

ERP-SYSTEM ANALYSIS, SOFTWARE SELECTION  
AND IMPLEMENTATION

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ESİN KURTULUŞ

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## Approval of the Graduate School of Social Sciences

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Prof.Dr. Tunçdan BALTACIOĞLU  
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science of Philosophy.

-----  
Prof. Dr. Alev KATRİNLİ  
Director  
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for a degree of Master of Science of Philosophy.

-----  
Prof.Dr. Erhan ADA  
Supervisor

Examining Committee Members  
(Title and Name in alphabetical order of last name)

Prof.Dr. Erhan ADA

-----

Doc. Dr. Ayla DEDEOĞLU

-----

Yrd. Doc. Dr. Deniz ELİİYİ

-----

**ABSTRACT****ERP-SYSTEM ANALYSIS, SOFTWARE SELECTION  
AND IMPLEMENTATION**

Kurtuluş, Esin

MBA, Department of Business Administrator

Supervisor: Prof. Dr. ERHAN ADA

SEPTEMBER 2007

The different way of handling the process of ERP implementation brings about many success and failure stories. This thesis shows a different approach in ERP implementation which is applied to three packaging companies of a company group. It also reflects the experience gained by system consultant team in these projects.

This thesis consists of four parts; First part recommends an ordering of initial steps and all of the implementation process steps, that directly affects the final success of the implementation. Second part is about system analysis; the methodology of system analysis and critical success factors are explained. In third part ERP software selection, based on the results of system analysis steps, is discussed. Lastly, fourth part shows critical factors of success during implementation step.

Keywords: ERP, SYSTEM ANALYSIS, ERP  
IMPLEMENTATION

## ÖZET

### ERP-SİSTEM ANALİZİ, YAZILIM SEÇİMİ VE UYGULANMASI

Kurtuluş, Esin

İşletme Yüksek Lisans, İşletme Yönetimi Bölümü

Tez Yöneticisi: Prof. Dr. ERHAN ADA

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ERP uygulaması sürecinde takip edilen yol başarıyı yada başarısızlığı belirler. Bu tez, ERP uygulamasında takip edilen süreçle ilgili farklı bir yaklaşımı göstermektedir. Söz konusu yaklaşım ambalaj sektöründeki bir şirketler grubunun üç şirketinde uygulanmıştır. Tez aynı zamanda, bu projelerde sistem danışmanları tarafından kazanılan deneyimi yansıtmaktadır.

Tez, dört temel bölümden oluşmaktadır. Öncelikle ERP uygulamasının başarısını doğrudan etkileyen başlangıç ve uygulama adımlarının sıralaması ile ilgili öneride bulunmaktadır. Daha sonra sistem analizinden bahsedilirken sistem analizi metodolojisi ve kritik başarı faktörleri ele alınmaktadır. Ardından, sistem analizi aşamasındaki sonuçlardan yola çıkarak ERP yazılım seçiminden bahsedilmektedir. Son olarak uygulama aşamasındaki kritik başarı faktörleri tartışılmaktadır.

Anahtar Kelimeler : ERP, Sistem Analizi, ERP Uygulaması

To My Parents

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## **I. INTRODUCTION**

Enterprise Resource Planning (ERP) systems are powerful software systems that make possible companies to integrate different functionalities. ERP systems provide many benefits to companies. They integrate departments like sales, logistics, production etc. in such a way that data produced in a department becomes immediately available to other departments. A business activity is entered only once in its according department and its status is changed in other departments according to the workflow. There is no need to enter same information twice.

ERP system gives a chance to enable organizational standardization. It enables a company to have a single image to its customers and vendors. Documents and data produced in different departments, plants and locations can have a common structure and view. ERP systems come with a number of best practices that can help companies in improving the way of doing business. Implementing an ERP includes the process of selecting appropriate best practices among the ones provided by ERP system used.

However, the process of ERP implementation is a very difficult one. Many ERP implementation projects fail due to inadequate planning, inexperience in project team or missing risk analysis. This

thesis discusses the importance and ordering of ERP lifecycle steps and planning required for the ERP implementation process.

## **II. ERP DEFINITION AND FUNDAMENTALS**

### **II.1 Definition**

“The enterprise resource planning (ERP) system is an integrated set of programs that provides support for core organizational activities such as manufacturing and logistics, finance and accounting, sales and marketing and human resources. An ERP system helps the different parts of the organization share data and knowledge, reduce costs, and improve management of business processes” (Stratman, J. and Roth, A., 1999). Enterprise Resource Planning system is a tightly integrated software package that consists of modules that helps the company to automate and integrate its business processes and provides an easily accessible environment to share common data.

ERP systems affect big corporations in the world and are used by many of the multinational firms. And also ERP affects small and medium companies, such like ERP consultants generated half of their revenues from small and medium companies. ERP systems became a competitive advantage because of creating value by successfully implementations. Implementing ERP systems makes firms need more information. Those firms can better use information and integrate it into their business processes and decision making. As a result, those firm’s vendors and customers need to adapt to the changes that will occur in ERP organizations.

## **II.2 History**

ERP is the last step in evolution of earlier Material Requirements Planning (MRP) systems which is used for manufacturing processes. “MRP were the first off-the-shelf business application to support the creation and maintenance of material master data and bill-of-materials (demand-based planning) across all products and plants in one or more plants. These early packages were able to process mass data but only with limited processing depth” (Klaus, 2000). MRP uses the master schedules, the bill of material and inventory data to determine requirements.

The second step in evolution is closed – loop MRP. Closed-loop MRP contains tools to give priority and capacity, and to support planning and execution.

The third step in evolution is called Manufacturing Resources Planning (MRPII). “During the 1970’s, MRP packages were extended with further applications in order to offer complete support for the entire production planning and control cycle. MRP II involves additional parts; sales & operations planning, financial interface and simulation. MRP II was initiated with long-term sales forecast to encompass new functionality such as sales planning, capacity management and scheduling” (Klaus, 2000).

The latest step in the evolution is ERP in the 1980's. "MRP II was extended towards the more technical areas that cover the product development and production process. Computer Integrated Manufacturing (CIM) supplied the entire conceptual framework for the integration of all business-administrative and technical functions of a company (Klaus, 2000)."

### **II.3 Benefits**

The main reason for using ERP systems is to make possible online information sharing and flow efficiently throughout all departments, plants and other units of a company. The practical benefits are divided into five aspects by Seddon (Seddon, Shanks and Willcocks, 2003): operational, managerial, strategic, IT infrastructure, and organizational.

Operational benefits are gained by "automating business processes and enabling process changes, they can offer benefits in terms of cost reduction, cycle term reduction, productivity improvement, quality improvement, and improved customer service." Managerial benefits are gained by "with centralized database and built-in data analysis capabilities; they can help an organization achieve better resource management, improved decision making and planning, and performance improvement." Strategic benefits come with "large-scale business involvement and internal/external integration

capabilities; they can assist in business growth, alliance, innovation, cost, differentiation, and external linkages.” IT infrastructure benefits come with “integrated and standard application architecture, they support business flexibility, reduced IT cost and marginal cost of business units’ IT, and increased capability for quick implementation of new applications.” Lastly, organizational benefits can “affect the growth of organizational capabilities by supporting organization structure change, facilitating employee learning, empowering workers, and building common visions” (Seddon et al., 2003).

#### **II.4 Advantages**

One of the main advantages of ERP is that it provides an integrated environment and frees the company from using software “islands” that do not effectively interface with each other. Without ERP, a company must use isolated software for handling customer orders, one for managing product engineering and bill of materials, one for inventory tracking, one for finance management etc.

Another advantage is that an event is entered only once and is available to all departments by related modules and transactions immediately. It eliminates the data redundancy problem. Management of data can be done more easily. Additionally, ERP provides a chance for a company to renew and develop its business processes.

From customer interaction point of view, “ERP includes the concepts of front office (how the company interacts with customers}, which include Customer Relationship Management (CRM), back end (internal workings of the company to fulfill customer needs), which includes quality control, to make sure there are no problems not fixed, in the end products, supply chain management (interacting with suppliers and transportation infrastructure), all of which are generally integrated in an ERP. Without an ERP that integrates this stuff, it can be a nightmare for a manufacturer to manage. (Koch, 2007)”

## **II.5 Disadvantages**

ERP systems are inherently very expensive. In addition to initial costs, support costs can also be very high. Cost disadvantage is stated by (Koch, 2007) as “Although different companies will find different land mines in the budgeting process, those who have implemented ERP packages agree that certain costs are more commonly overlooked or underestimated than others. Armed with insights from across the business, ERP pros vote the following areas as most likely to result in budget overrun.

**Training**—Training is the near-unanimous choice of experienced ERP implementers as the most underestimated budget item.

**Integration and testing**—Testing the links between ERP packages and other corporate software links that have to be built on a case-by-case basis is another often-underestimated cost.

**Customization**—Add-ons are only the beginning of the integration costs of ERP. Much more costly, and something to be avoided if at all possible, is actual customization of the core ERP software itself.

**Data conversion**—It costs money to move corporate information, such as customer and supplier records, product design data and the like, from old systems to new ERP homes. “

Implementation and support requires the company to find skilled and educated personnel in order to achieve a successful implementation and use the software effectively.

Customization needs can also be problematic. Resources must be attached in order to customize the software. Moreover, heavy customization brings nightmares during upgrades to new versions of the ERP package.



### **III. PROJECT MANAGEMENT AND SYSTEM ANALYSIS**

Project management consists of planning, monitoring and controlling the project staff and processes within an ERP project.

“Project failures are all too common - some make the headlines, the vast majority are quickly forgotten. The reasons for failure are wide and varied. Some common causes are:

- lack of co-ordination of resources and activities,
  
- lack of communication with interested parties, leading to products being delivered which are not what the customer wanted,
  
- poor estimation of duration and costs, leading to projects taking more time and costing more money than expected,
  
- insufficient measurable,
  
- inadequate planning of resources, activities, and scheduling,
  
- lack of control over progress so that projects do not reveal their exact status until too late,
  
- lack of quality control, resulting in the delivery of products that are unacceptable or unusable. (Office of Government Commerce, 2005)”

### **III.1 Project Management in ERP Lifecycle**

ERP projects are long lasting projects requiring huge amount of human and technical resources. It's often very difficult to control and follow the cost, budget and time set at the beginning. This is one of the biggest failure factors of ERP projects. Because of this, project management activities needs to be planned carefully from the beginning. Activities related to controlling, monitoring and tracking the progress of the ERP project, and updating the plans has to be planned. Project plans must include quality plans, in addition to timing plans, resource plans, and cost plans.

An issue often neglected or missed during project management is risk management. Both internal and external risks have to be controlled and monitored during the whole lifecycle.

### **III.2 System Analysis and Methods**

System analysis is about analyzing current system and determining requirements before the ERP project implementation. Results obtained from the analysis process become the input of implementation. However, analysis results sometimes uncover problems of the current business processes. It is important to avoid making changes in ERP implementation just to fit those problems.

Instead, problems in business processes should be solved before the implementation.

### **III.3 Models as System Analysis Tools**

To understand the system, different types of models are used. Models provide abstractions of the system from different perspectives and help to understand the system and communicate within project staff, users and customers.

Models used in the system analysis in a packaging company which will be discussed in last chapter of this work are: context model, data flow diagram, process flow diagram, and functional decomposition diagram. Following paragraphs give brief definition of these models.

#### **III.3.1.1 Context models**

“At an early stage in the requirements analysis you should decide on the boundaries of the systems. Context models are used to illustrate the operational context of a system - they show what lies outside the system boundaries. Social and organisational concerns may affect the decision on where to position system boundaries” (Sommerville, 2001). Context model diagrams show the system within its environment and it draws the system boundaries. It provides the higher view of the system and shows the interactions between system and other units in the same environment.

### **III.3.1.2 Data flow models**

Data flow diagrams show the flow of data between processes of the system. It also shows the data store locations. It can be used to analyse and compare the current system behaviour and the new system which will be implemented with the ERP. “Data flow diagrams, model the system from a functional perspective. Tracking and documenting how the data associated with a process is helpful to develop an overall understanding of the system. Data flow diagrams may also be used in showing the data exchange between a system and other systems in its environment. Data flow diagrams are used to show how data flows through a sequence of processing steps” (Sommerville, 2001).

### **III.3.1.3 Process flow models**

Process flow diagram or a flowchart shows the schematic structure of an algorithm or a process. It helps to understand how processes work and aids in communication with others. “Process models show the overall process and the processes that are supported by the system. Data flow models may be used to show the processes and the flow of information from one process to another” (Sommerville, 2001).

#### **III.3.1.4 The functional decomposition diagram**

Functional decomposition diagram shows higher-level functions in a hierarchical structure broken-down to its components and subcomponents. It can help to understand and analyze a complex system's functionality by dividing the functionality into understandable pieces. "The functional decomposition diagram (FDD) shows the business functions within an organization and the main processes needed to perform each function. The FDD is a business planning tool that depicts the hierarchy of business functions, processes, and sub processes within an organization that are later described in detail using process models" (McIntire School of Commerce via SAD web site, 2007)

## **IV. SELECTING SOFTWARE AND IMPLEMENTATION**

### **IV.1 Business Case in ERP Selection**

System analysis phase reveals the requirements of the company. These requirements can be business process related, technological, strategic, or they can result from competition. This set of requirements makes the business case of the ERP project. This business case needs to be correct and clear because the business case is the reason for the existence of the project. In all milestones during the project, the validity of the business case is checked. If it is found that the requirements contained in business case lost their validity then the project may have to be canceled. Business case also provides the input to software selection phase.

Technological requirements can be summarized as: difficulty in management of isolated software “islands” that do not interact with each other; shortcomings in legacy software in terms of adaptability to new business processes and technological advances.

Requirements like productivity improvement and increase in customer quality expectations are process related requirements of the business case. Merging of companies can be an example of strategic requirement. Often there will be competitive reasons such as ERP use of competitors or business partners.

## **IV.2 Decision Making Process**

This process is about explanation of the business case and benefit goals of the project to top management in order to get investment confirmation for the project. Cost-benefit balance is presented as the result of the feasibility study. Initial budget decided after cost-benefit analysis is controlled throughout project lifecycle. At the end of the project, whether the project costs are within the bounds of the initial budget is an important success factor for the project.

## **IV.3 Choosing an ERP Package**

The weaknesses and opportunities of the company are shown with the system analysis phase. These results can lead to decision to buy an ERP system. These results also provide a basis in comparison of the alternative ERP packages. The most important selection criteria are how well an ERP package solves the business problems of the company. Second most important factor is costs of the potential ERP software packages. Another important criterion is whether the ERP package supports modification. Another very important selection criterion is the reputation of the software package, especially in selection making company's sector. User friendliness and power and experience of the support team are important point in ERP selection.

#### **IV.4 Software Implementation**

ERP software is one of the largest types of software ever written in terms of complexity and code base size. It is due to its application to almost every department within an organization. ERP implementation involves large number of members with different roles such as analysts, programmers, users, and consultants for installing updates and patches. Without getting professional help from specialized companies, ERP implementation projects can be very costly and time consuming, especially in bigger organizations. By consulting to and getting support from a company offering ERP services, an ERP implementation project can be completed in a relatively shorter time period, including testing.

ERP implementation project within a firm is often done with getting help from an ERP vendor or a firm specializing in that particular ERP package. Typically, there are two types of services offered by ERP consulting companies:

1. Business consulting services. Business consulting is about analyzing business processes and matching them to ERP software by making customized configuration within the bounds of parameterization offered by ERP software.
2. Technical consulting/development services. Technical consulting is about modifying and/or extending source code



of the ERP software in order to meet the special needs of the company. It often makes sense when ERP software lacks the functionality needed by the company or when it's impossible to achieve it by configuration changes (i.e. by business consulting services).

Customization is not always easy; it often brings problems because not all ERP systems support customization very well. It can often be desirable to implement common best practices included in the ERP package itself in order to get rid of the risks and complications involved in modification. Some functionality can be too generic to be directly usable. In that case a firm can consider buying a third party tool that integrates well with that particular ERP software or its database system.

#### **IV.5 Process Modeling in ERP Implementation**

ERP implementation brings an important decision to the company, whether to change its business processes to match the ERP system or change the ERP software to match the current business processes, or both. During the analysis phase of the ERP implementation a company can model the current business processes if it chooses not to change existing processes. This type of modeling is sometimes called "as is" modeling. A company can choose to improve its current processes by modeling the processes that it needs, instead of

modeling current business processes. This kind of modeling is sometimes called “to be” modeling.

#### **IV.5.1 Modeling Current Processes**

If a company chooses not to renew existing processes, current process modeling can be used to show whether the chosen ERP software fits the company needs. There is a tendency in companies that are implementing ERP systems to improve existing processes by utilizing the change opportunity that comes with the implementation of the ERP, so in these cases this kind of modeling does not bring important benefits.

#### **IV.5.2 Modeling New Processes**

If a company chooses and plans to modify and continue to develop chosen ERP software then new process analysis leads to new process developments. But if a company does not plan to modify ERP software than this type of modeling and analysis can be used as an ERP choosing process - choosing which processes to use from the set of processes provided by ERP package.

### **IV.6 Types of Changes in Implementation**

From a change perspective, a company implementing ERP can walk a path from four possible alternatives:

#### **IV.6.1 Minimal Change**

Completing the implementation with minimal changes both in software and current business processes requires the chosen ERP software to be strong enough to support existing processes and also requires processes to be relatively flexible to match the ones provided by ERP software.

Main advantage of this alternative is that its cost is relatively low and the implementation process can be completed faster because there is no need to modify ERP software and business processes.

However, by not changing processes, company misses the opportunity to reduce the number of people by changing business processes with ERP implementation. Often, reducing the number of people involved in business processes can be one of the goals of ERP project. In this case, not having the opportunity to reduce people can be thought as a disadvantage of this alternative.

#### **IV.6.2 Business Process Changes**

ERP implementation provides an opportunity to rethink and change existing processes, but some companies see it as a limitation in ERP package. They think that if the software were able to support a wider range of business processes, then there would be no need to make process changes.

First advantage of this alternative is that implementation of new versions of the ERP software would be very easy because ERP software would not be changed.

In an ERP package all modules are integrated. Making changes in one of them may require a change in another one. By not making changes in software, company gets rid of the risks and costs associated with these propagating changes. This can be thought as second advantage of this alternative.

Not making software changes brings another important advantage: not requiring change maintenance. If a company makes software changes then it requires continuing maintaining of the changes and extra expertise to support this process.

Matching business processes to those available in ERP software helps a company to standardize its processes. But sometimes matching a business process to a generic process provided by ERP can be a disadvantage. If the existing process created a value then replacing it to the closest one in ERP may lead to unpredicted and strange behavior.

### **IV.6.3 Software Changes**

Instead of changing business processes to match the software, companies may chose to change the software to match their existing

business processes or to implement some best practices not provided by ERP software. Disadvantage of this kind of change is that changing the software makes it very difficult to maintain the software and upgrade to new versions. Making modifications, maintaining them, and redoing modifications when upgrading to new versions brings costs in terms of both money and time. “Customization of ERP software is an unavoidable in any implementation, though the extent of customization may vary. But it is advisable to exercise discretion in the customization process to balance the benefits and the challenges involved in the process. While customization promises a better fit ERP software solution for the company, it directly affects the budget and timelines. Finding a middle way is a delicate process that needs proper evaluation of options available.” (iSummation Technologies, 2007)

#### **IV.6.4 Business Process Changes and Software Changes**

A company implementing ERP may choose to make software changes and make changes in company’s business processes. Successful implementation of this alternative makes company get the ERP software and business processes it desired. ERP provider or ERP consulting company or vendor may share some of the costs of this alternative, because the processes are implemented first time.

However, changing the software can be very costly. Generally, big companies may have courage to use this alternative. Alternatively,

the more ERP software is customized to meet specific business needs, the less it is likely to meet other business needs. As a result, making major changes in software or implementing specific best practices may actually limit ERP sales to other firms.

#### **IV.7 Improvement in ERP Package Functionality**

Sometimes, the ERP vendor cooperates with the ERP implementing company expanding the product capabilities of its ERP package by making widespread software changes. In this case ERP vendor can increase the set of available best practices and modules in ERP package. Thus, widespread software changes lead to industry-specific versions of the ERP software. Cooperating with ERP implementing companies gives a chance to share some of the development costs with implementing companies. Extending process set by partnering with an ERP implementing company in its ERP package, makes an ERP vendor able to sell its new processes to other companies.

#### **IV.8 Effect of Changes in Success and Failure**

Often, making only minimal changes both in ERP software and in business processes carries the lower risk of failure in ERP implementation projects. In other words, the lesser the change the more the project is likely to be successful. Failure would probably come

when a company makes extensive business process changes and adaptations are problematic, when it chooses wrong best practices and when it encounters big resistance to change.

In the other side, if the company makes extensive software changes, failure can come from not having enough experience to implement large software projects. In general, making large changes in business processes and in the ERP software often can lead to failure due to reasons stated above.

## **IV.9 Implementation Strategies of ERP Systems**

An ERP implementation can be done as “all at once” implementation all modules at all locations at the same time; or, it can be done staged. These are the two main strategies used to implement ERP systems. There are other implementation strategies like location based and parallel.

### **IV.9.1 All at Once Implementation**

All at once implementation means that all of the modules of ERP package are implemented at the same time at all company locations. In an all at once implementation, test system is converted to productive system in a short time period. All modules are implemented at the same time. All a once implementation requires large amount of up front testing before going to productive system.

All business processes are chosen or developed in ERP software at the same time. Modules are tested separately as a single unit. After that, module integration and interfaces between them are tested. Testing often produces feedback to fix and change the corresponding modules.

Legacy system is closed and new system is started. There can be changes that are required to be made after the implementation, but ideally major ones had to be seen and fixed at the step number two.

#### **IV.9.1.1 Advantages of All at Once Implementation**

Because legacy system is canceled completely there is no need to build and maintain interfaces to them, thus reducing the resources that had to be used otherwise. Also, there is no need to spend time and resources for maintaining and changing the legacy system because there will be no legacy system running. Another advantage is that, risks can be lower because the project is attacked with all the IT resources. The chance of losing employees during an all at once implementation might be lower due to the fact that their experience would not be complete until the implementation is completed.

Moreover, implementation of some business processes may require the cooperation of more than one module. In this case, those functionalities can be in use more swiftly because all modules are implemented at once. There is also lower risk for canceling the new



system and return to legacy system. Because legacy system is cancelled as a whole, there would be no old system to return to immediately. This issue may help people concentrate on the new system even if there are some problems during the implementation. This concentration can lead to find solutions more rapidly. In addition, whole project time can be shorter. The more the project time gets longer the more the requirements and business processes will change. Implementing all modules in parallel generally leads to shorter project time. Cost is also expected to be lower because there would be no legacy system to support and maintain temporary interfaces between the old system and new system.

#### **IV.9.1.2 Disadvantages of All at Once Implementation**

All at once strategy needs huge amount of resources to support multiple module implementations in parallel. Additionally, a module has fewer resources assigned to it because resources are shared between multiple modules. Another disadvantage is that there is a risk of total system failure because all modules are implemented at once and legacy system is cancelled as a whole. Besides that, there is no easy way for legacy system fallback in case of problems because there is no legacy system running. And lastly, in order to demonstrate a working part of the system one has to wait entire project to complete.

## **IV.9.2 Staged Implementation**

In staged implementation strategy, modules are implemented one by one or in groups at a time sequentially. If there are multiple implementation locations, often implementation is done one location at a time. Coordination with legacy system is very important because legacy systems functionality will be used for unimplemented modules thus far. Staged implementation strategy has smaller iterations of design development, testing, and implementation.

### **IV.9.2.1 Advantages of Staged Implementation**

Amount of resources used at a given moment is far less than all at once implementation. So if a company has limited resources than it may consider staged implementation instead of all at once implementation. Another advantage of staged implementation is that whole project team and all resources can be concentrated on one particular stage. If a company has fewer resources than staged strategy may help it to achieve implementation goals with limited resources.

Some companies think that staged implementation strategy has lower risks because there is no probability of total system failure. In contrast, all at once implementation strategy has the drawback that total system failure is sometimes probable because it is implemented in all or nothing fashion. In case of problems in staged implementation strategy,

temporary fallback to legacy system is possible because legacy system is not cancelled as a whole. Additionally, staff involved in implementation gains experience in one stage and uses it in the following stages.

A working system can be demonstrated earlier in a staged implementation strategy. If a module is successfully implemented then it can be shown that the system is working. This can help convincing management that the new modules will be implemented successfully and it also helps to get support from management. Best utilization of this advantage is when the easiest modules are implemented first. And lastly, implementation time per module will be shorter. In contrast, with all at once implementation strategy duration between implementation and going into production will be longer. Longer duration may lead participants to lose the link between development and usage.

#### **IV.9.2.2 Disadvantages of Staged Implementation**

Temporary interfaces between old system and new system have to be built and maintained; legacy applications need to be maintained and changed; Risk of losing personnel is greater because a single module is completed in relatively shorter time, therefore personnel will gain experience faster; some functionality requires cooperation of more than one module, so it cannot be used until whole set is completed; not closing down legacy system may lead to tendency to fallback to legacy

system in case of even small problems; and total installation duration is longer and total cost is higher.

### **IV.9.3 Location Based Implementation**

If a company implementing ERP has multiple locations it can choose to implement the system location by location. Single location is finished in each iteration and project continues in next location.

#### **IV.9.3.1 Advantages of Location Based Implementation**

Implementation in each location, individually provide feedback to implementation in following locations about progress and problems of implementation. If an implementation in one location is completed successfully then it will provide confidence to team members during following implementations.

### **IV.9.4 Parallel Implementation**

While implementing an ERP system, often companies don't want to immediately close legacy system either partially or as a whole because they want to ensure that new system is running as expected. In that case both systems run in parallel for some period of time.

#### **IV.9.4.1 Advantages of Parallel Implementation**

Advantages of this implementation strategy are that, workings and outputs of new system can be compared to the legacy one, and legacy system provides a backup in case new system does not behave as expected.

#### **IV.9.4.2 Disadvantages of Parallel Implementation**

Resource requirement will be higher because two separate systems will be run and maintained. In addition, because people know that old system will be closed after some period of time, they will no longer give enough attention to old system. This can lead to errors when comparing new system's outputs with the old one. And finally, having the legacy system available for a long period of time may have negative impact on acceptance of the new system, because people may have greater confidence to old system.

### **IV.10 Effect of Company Characteristics to ERP Implementation Strategy**

Besides the issues like resources, management support and risk there are factors that arise from company characteristics that can influence implementation methodology decision. Those factors include company size, complexity, structure and controls.

Company size and complexity are important factors in determination of the ERP implementation strategy to be used. Generally, big and more complex companies tend to use staged strategies, while small and less complex companies tend to use all at once strategies. Company size is determined by its customers, products, product line, characteristics of its customers, number of locations, number of plants etc.

Companies with greater number of customers or products are generally more complex than companies with less number of customers and products. Companies that work with powerful customers tend to be more complex because powerful customers may have impact on company's business processes.

Companies with more than one locations and plants are more complex than others. All at once strategy naturally fits to small companies very well because small companies are less complex. They have fewer products and customers, their business processes are less complex, hence their implementation will be easier. There will also be less risk of failure. Also, due to its lower cost and fast total completion time all at once implementation strategy nicely fits to small companies.

At the other side, staged implementation strategy more naturally fits to complex and bigger companies. In contrast, all at once strategy can make progress difficult and failure potential very high.

If a company has strong hierarchical structure and strong controls it is more able to use staged implementation strategy. But if a company is flat in its structure and has looser controls generally, all at once strategy would be better because otherwise it would be too difficult to maintain commitment during long period of staged implementation.

Implementation size in terms of number of modules to be implemented and/or changed, affects the decision of the implementation strategy to be used. If the number of modules to be implemented is very high then staged implementation strategy of the ERP will be better because all at once implementation strategy will require huge amount of effort just for coordination among the modules and resource requirements would be far greater.

Sometimes, amount of software changes affect the strategy of the implementation. The more the modules are changed the more the staged strategy will fit better. If changes are minimal then interaction problems between them will be minimal, hence all at once implementation strategy will fit well. Making software changes increases the potential of problems and bugs. This increases need for

testing modules individually and need for testing interactions between them. If there will be large amount of changes to be done then following a staged implementation strategy will be better.

#### **IV.11 Importance of Implementation Standarts**

In an ERP implementation, ERP implementing company has to set some standards in its models, processes and master data design. Standards are important because they affect success of the implementation.

Prior to ERP systems, legacy systems tended to be isolated. Those systems were developed, designed and configured separately even between different locations of the same company mainly due to technology limitations. Those conditions aren't suitable for strong standardization. Having different models and processes and making different choices when designing master data like customer codes, product codes, account charts etc. makes it difficult to coordinate and integrate multiple locations.

Because ERP software is integrated; it allows cooperation among departments, plants and locations within a company, for a successful implementation, ERP software requires that standardized processes, models and master data be used among all departments and locations of a company.



Integrating multiple departments and plants makes possible for all users to access same data. In order to provide a common view and structure of the data standardized models and master data design are required. Besides, standardization helps to reduce costs and creates value.

Sometimes, standardization does not fit well for some divisions or plants. In these cases there would be a trade off between maximizing global benefits of the company and minimizing departmental or location based costs.

#### **IV.12 Key Roles and Issues in ERP Implementation**

Among the people involved in ERP project, management, project team, external consultants and users play key roles and have great impact on ERP implementation. Relationships between ERP provider and ERP implementing company, support and tools provided by vendor also has great influence in ERP implementation project's success.

##### **IV.12.1 Management Support**

Management support is one of the most important factors in ERP implementation success. Support should come throughout the ERP project life cycle. In order to have a successful ERP implementation project, top management should regularly monitor the progress of the project. It also has to provide guidance to project team, help to set

strategic business goals for the project and approve them. Among the most important factors for the success of ERP project is the top management commitment and support. “The role of top management includes, developing an understanding of the capabilities and limitation of the proposed system, setting goals, and communicating the corporate IT Strategy to all employees”, (Somers T.M., and Nelson K., 2001).

#### **IV.12.2 Project Team**

Successful ERP implementation requires that project team have business skills besides technological skills. Ideally, members of project team should focus only on the ERP project; they should not be messed with unrelated work during the implementation. Information sharing among project team members also plays important role in success.

#### **IV.12.3 External ERP Consultants**

When implementing an ERP, a company should consider using external ERP consultants to gain more experience, expertise and knowledge of ERP system. External consultants often make requirement analysis and provide solutions to problems and requirements within the ERP system. External consultants also can bring detailed knowledge of the different modules in ERP package.

### **IV.13 Post-Implementation Process**

There are still jobs to be done after the system goes live. Implementation decisions, bottlenecks, data conversions etc. need to be checked whether they continue to meet the needs of the company. Plans should be checked against what actually happened. Future plans should be made, considering upgrades to new versions.

## **V. APPLICATION IN A PACKAGING COMPANY**

### **V.1 About B Firm<sup>1</sup>**

B Firm was founded in 1973 as a company producing printed and non-printed paper bags, operating out of a 2,000 m<sup>2</sup> facility. Within three years, B Firm expanded its equipment plant and started servicing packaged pasta industry. It continued its expansion by acquiring clients in the bulk and snack foods, chocolate, confectionery, frozen deserts, beverage, frozen foods, baked goods and fresh produce markets. It also caters to the needs of the hygiene and chemical products customers. B Firm, with its professional team, is customer focused, and monitors the changing needs of the marketplace, providing fast, reliable and high quality goods and services.

The company maintains its position by employing leading edge technology and continually improving its assets. B Firm provides its customers with flexible packaging solutions for food and hygiene products that are ready for use in automated packaging equipment, packaged as rolls and bags.

B Firm has made quality management and continuous improvement parts of its corporate culture. With its flexible production structure, horizontal and vertical integration with its sister companies,

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<sup>1</sup> Facts about the B firm are taken from the company's web site.

experienced and expert staff, and an annual production volume exceeding 15,000 metric tons, B Firm services such diverse markets as food, hygiene, beverage and audio and video magnetic tape packaging. Its client reference list exceeds 200 companies in domestic and international markets.

B Firm is attaining its vision of becoming a world leader in the flexible packaging goods industry through its competitive advantages and focuses on high standards of quality, and is continuously improving itself based on its foundation of values.

Although the B Firm's technology and quality is superior to competitors in the market, the B Firm can't reach the desired profit and cost balance. Main reason for this is that it is unable to calculate the real costs from separate software systems. This was the forcing reason in deciding to adopt the ERP system. After the decision, the B firm started the journey with the system analysis step.

## V.2 System Analysis Results of B Firm

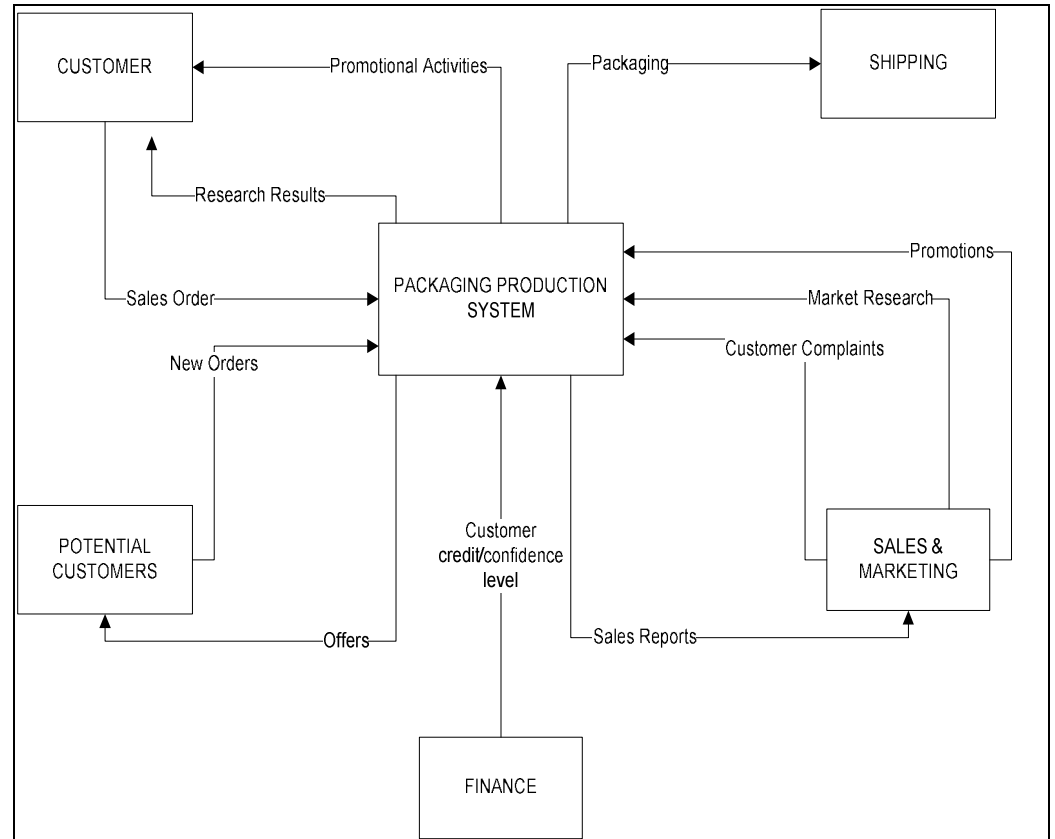


Figure 9. Context Diagram of B Firm's Packaging Production System

It's a common idea that, ERP systems are usually more appropriate for mass production industries and for customer ordered industries ERP systems are impractical. In the packaging business, companies are not selling the brand names whose packaging they produce. There is a lot of technical information needing to produce an order for a specific customer. Because of these needs, these industries need very flexible ERP software to adapt to companies effectively.

B firm was using specific software for individual processes and specific tasks. For example, Netsis for accounting, Lotus for production, specific software for graphics, intranet reports for financial analyzing, intranet applications for importing and exporting applications, and MS Office applications for all departments reporting and daily needs. Because of this B firm had a large IS and IT organization that wrote software and support this current applications. This structure was very hard to control and manage, and also costly for company.

The other huge problem for organization was absence of data-flow between departments. Each department entering same data to their own system (that can be a software or excel or just hard copy). This causes extra loosing working power, loosing time, high personal mistakes and finally loosing integration of departments.

In B firm, organization was running with personal strives. When a person was not in company, organization was limping. This is a very important risk for firm's organizational future.

Different units could not communicate with each other except through written specific reports in intranet environment. Because of this communication problem, people force to enter same data to three or more system (like Excel, Netsis and intranet, etc.)

The production parameters, such as the types and amounts of raw materials to be used, and the production steps are entering a software system prior to converting to ERP, but the concept of a product tree did not exist within the enterprise. B firm instead had a list of material inputs. And because of this, they did not know the right amount of raw material used for specific order. This enterprise was giving only used quantity of material, not expected quantity.

B firm decided on the project metrics and set performance goals. B firm's foreign competitors in the packaging business calculate production costs all the way down to the weight of the glue used. In order to report on efficiency results, we needed a report which would take too long to be prepared manually.

This in turn affected performance. To give an example: let's say you have to use a special proof film in certain production run. Configuring that proof film requires special knowledge and its own equipment. A job order may not have been specified for it. Not, the unit operator demands a job order as it affects his or her performance.

They did not know the right amount of inventory the maintenance warehouse contained and where it was located. B firm have about 650 job orders processed per month. On average about 25 to 30 job orders are placed daily. Behind these numbers there is a process: Each proof



film has associated layers. If you are producing packaging for a bag, it calls for 4 layers. This means that you need to specify 4 different proof films on the job order. These are glued together and printed to form a single package. This calls for glue, ink, and proof film, which all need to be handled individually. The warehouse currently handles this work load with two or three personnel.

Businesses can only make healthy forecasts by knowing their costs. B firm lacked technology and had a lot of data. The staffs were basing their production decisions on the law of averages: Based on the past usage of materials and the resulting product. One person worked on all job orders for 15 days, and came up with the cost data. In the past, a form called 'unit cost' was used. It was completed by the sales department where they specified costs for such data as expenses and the proof films to be used, based on what they believed were to be the costs. Since the company did not track monthly purchases and periodic increases, the end of period cost analysis made absolutely no sense. It wasn't clear what costs were being tracked and how.

Problems stated above are general problems of the B firm that are drawn from system analysis phase. Every department (sales & marketing, logistics, production, finance and shipping) shown in decomposition diagram (Figure 10) (sales & marketing, logistics,

production, finance and shipping) is analyzed in detail, but only sales and marketing department is discussed in following paragraphs.

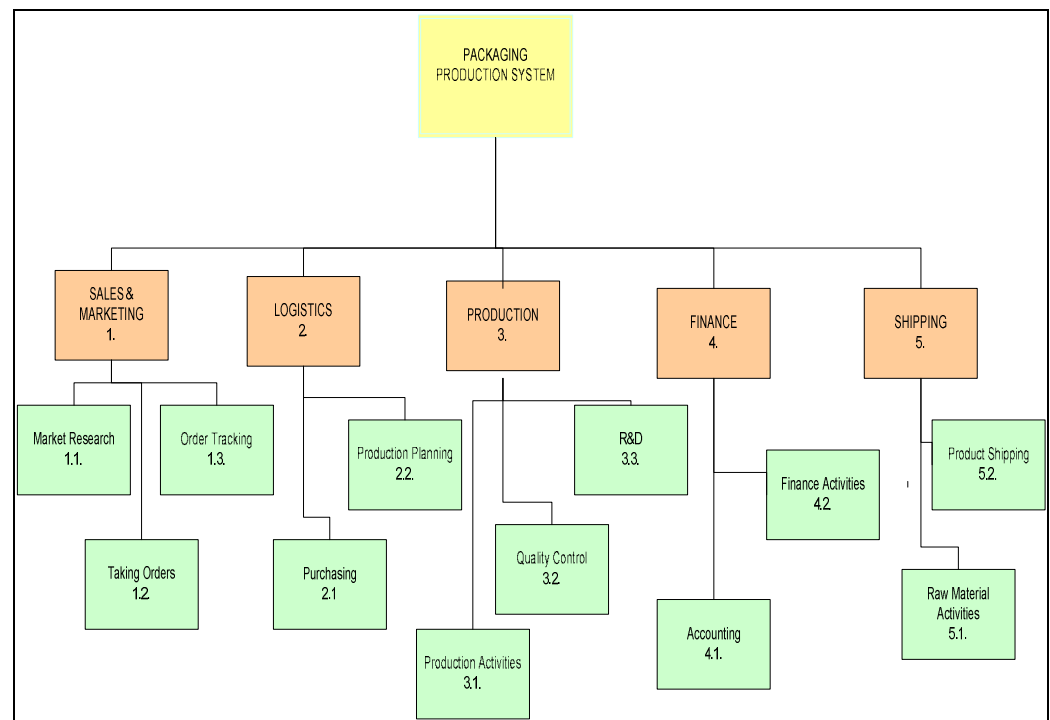


Figure 11. The Functional Decomposition Diagram of B Firm's Sales Organization

### V.3 System Analysis of Sales and Marketing Department of B Firm

Sales and Marketing Department communicates with the customer, takes and tracks customer orders, and informs the customer periodically until the final product is shipped. Its role is among the most important roles of the system. It consists of three main activities: Market Research, Taking Orders, and Order Tracking and Reporting.

### V.3.1 Market Research

These kind of researches are aim to reach potential customers and meet the new needs of old customers. Because the large part of the target market consists of foreign markets, research activities have an important role in company's business. Research is not only about potential customers, but also new technologies are subject to research. Let's see the market research in detail.

Table 2. Market research input/output table.

New/Old Customer Research	
Input	Output
Area Representative Information	New Customer/New Markets
Internet Research	
Market/Segment Research Results	
Exposition Attendance	

Sales and Marketing Department is divided to two sub departments; Internal Marketing and External Marketing. Internal Marketing focuses on sales and marketing activities within Turkey, whereas External Marketing focuses on companies in foreign countries. External Marketing is also divided by regions. Each region has its representation which has the duty of bringing customers and providing

market information to company. Representatives take commissions from each customer order and act as guarantors for customers who do not know the company yet. Main representations are UK, Russia, Germany, Middle East, and France. In order for these orders to be met, needs and conditions of these customers need to be met. For that reason laws, packaging technologies, and quality standards need to be followed. Representations are information resources for these issues. In addition, by attending to expositions, advertising, and gaining rewards they aim to reach target customers. Another information resource is Internet. Mails and price conditions sent to new customers often help to achieve objectives.

### **V.3.2 Taking Orders**

Sales and Marketing personnel working in this phase is called Sales Representative. As its name implies, when an agreement is made between company and the customer, sales representative starts to track the order and provides information to customer. They are responsible to customer for every problem and latency. They are supposed to explain customer needs perfectly to the company. Only sales representatives are in contact with customers.

Table 3. Order taking input/output table (1)

Taking of Main Specifications	
<b>Input</b>	<b>Output</b>
Order Info	Product Specifications
	Cost Analysis Request

Initial order request from customer is taken by e-mail, mail or fax. First task after taking the order is to determine whether the order includes all required information. If there are some missing information, customer is contacted back and asked for missing info. This information includes for example: order quantity, film type and thickness, number of colors, payment type, etc. Cost Analysis Request Form is prepared with this information and sent to logistics department. Incoming orders are separated to three categories: regularly produced products (repeat product), products requiring small changes that do not affect the price (product requiring change), and products that are to be produced first time (new product). Task explained above is only performed for new products. For regularly produced products or products requiring small changes that do not affect the price, the cost analysis is not prepared.

Table 4. Order taking input/output table.(2)

Agreeing on Price with Customer	
<b>Input</b>	<b>Output</b>
Product Specification	Customer Confirmation
Standard Unit Cost Form	Sample Request

Logistics department provides feedback with Standard Unit Cost Form. Total raw material cost including scrap is computed. Profit and shipping charges are added to this cost. Firstly, price agreement is attempted to be made with customer. If price agreement cannot be made, then the order is reported and negotiation terminates. But if the customer confirms the price, for new products, a sample request is sent to Research and Development department. It provides the answer to whether it is possible to meet the customer requests. This step is skipped in regularly produced products.

Table 5. Order taking input/output table. (3)

Creating the Product Information Form	
<b>Input</b>	<b>Output</b>
Customer Confirmation	Product Information Form (PIF)
Sample Request Form	
Order Catalog & CD	

Customer order catalog and CD are sent after the price agreement. Product information is extracted from Sample Request Form taken from R&D, order catalog, and CD. PIF is created from this information. PIF is prepared for all orders. For regularly produced products only the PIF number is changed. For products that require change, PIF number is changed and changes are stated. PIF specifies detailed attributes of the product and acts as an information source for following steps of production. PIF and catalog and CD taken from customer are sent to graphics department. Graphics department prepares the Color Printout similar to Ready to be Pressed Form. This shows the attributes of the product that can be produced.

Table 6. Order taking input/output table. (4)

Feasibility Decision	
<b>Input</b>	<b>Output</b>
Product Information Form	Feasibility Form
Color Printout	PIF Confirmation

Sales representatives enter into the feasibility meeting taking PIF and color printout. This meeting is done only for new products. Technical Expert, Quality Control Engineer, Graphics Expert, Production Chief, Logistics Chief also attend this meeting along with Sales Representatives. At this meeting, decisions are made about how

much of the customer needs can be met, how and in what conditions the product is going to be produced and when it can be delivered. Sometimes these meetings end with a decision not to produce the order. This is often seen when orders are beyond the capacity or when products can't be done technically. At the end of the feasibility meeting a Feasibility Form is prepared. Feasibility decision is shared with customer. If the meeting result is negative, communication with customer is over. Feasibility decision and conditions are discussed with customer. A new feasibility meeting is held if the customer does not accept these conditions. This is how the agreement is made. If there are changes, they are written down on PIF. Thus the PIF is confirmed. After the PIF confirmation, information is entered to computer system. This allows everybody to see the order details on PIF. In other words, finally the order is entered to the system.

Table 7. Order taking input/output table. (5)

Order Confirmation and Acceptance	
Input	Output
PIF Confirmation	Order Confirmation and Acceptance Form
	Digital Print Report



After the PIF confirmation, the order is taken. Order Confirmation and Acceptance Form is prepared. This is sort of a contract. It consists of product information, packaging information, customer information, delivery date, payment information, price information, etc. If the customer confirms it, this order confirmation and acceptance form is finalized. After confirmation, it is entered into the system similar to PIF. Thus, related departments can see the orders and make their preparations.

### **V.3.3 Order Tracking and Reporting**

Sales Representatives are responsible to inform both their customers and managers. As already stated before, they start to work in behalf of their customers after they take the order. For that reason they are continuously in contact with customer. They work to meet delivery date; they track supplies, customer payment plan, and shipping regularly. In addition, they report their managers regularly. They report at weekly coordination meetings and meetings which are held monthly/yearly. How close planned objectives are met is determined at these meetings.

Table 8. Order tracking and reporting input/output table (1)

Order Tracking	
Input	Output
Logistics Info	Customer Info
Production Info	Order Tracking Info
Shipment Info	
Financial Info	
Digital Print Report	

After the order is taken, Sales Representatives give order information to Logistics Department, and they start to track the job. They are informed that the digital print is sent to B GRAPHICS COMPANY; they are informed by the Logistics Department whether the job can be done until requested date. They inform the customer about unexpected latencies. If there is no tolerance, they try to make sure that the order is scheduled to be started as soon as possible. After the material supply, they participate in sample preparation phase and check whether the sample satisfies required attributes. They control the production stages of the order and track the delays. Their work continues after the shipment. They track customer payments and get customer complaints.

Table 9. Order tracking and reporting input/output table (2)

Reporting	
<b>Input</b>	<b>Output</b>
Order Tracking Info	Weekly/Monthly Reports
Order Confirmation and Approval Form	
New Customer/Market Information	

At coordination meetings which are held weekly, Sales Representatives inform Sales and Marketing Manager about customer, new order, production phase of the order, and financial position. Sales representatives prepare SPM presentation reports before these meetings. This report shows monthly planned objectives and actual performance. Next month's objectives are set during these meetings. Besides this, reports about payments are given to Finance Manager weekly/monthly. Customer complaints are given to related departments in report form. Data Flow in Sales and Marketing Department is shown with Figure-4: Data Flow in Sales and Marketing Department.

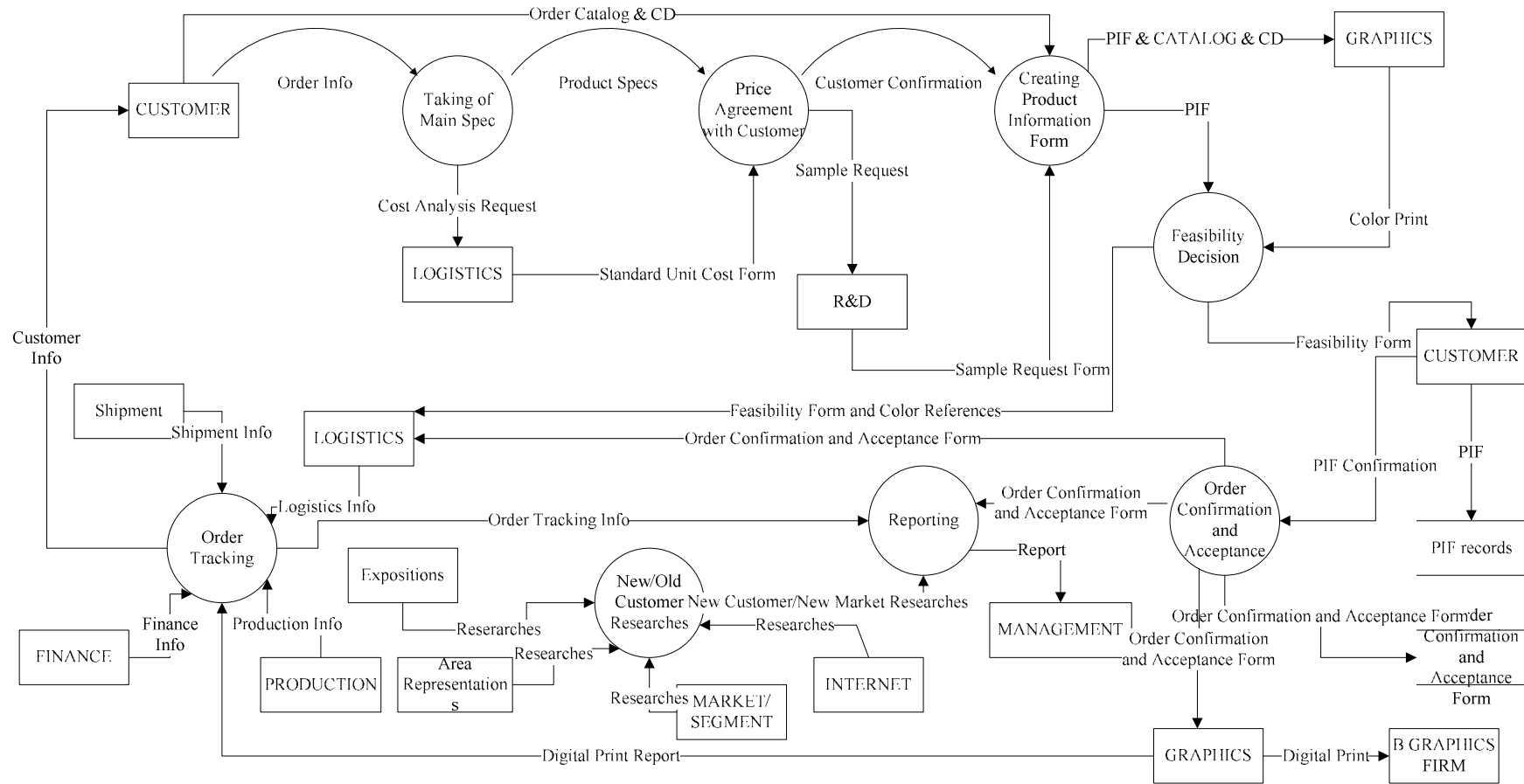


Figure 11. Data Flow Diagram of B Firm's Sales Organization

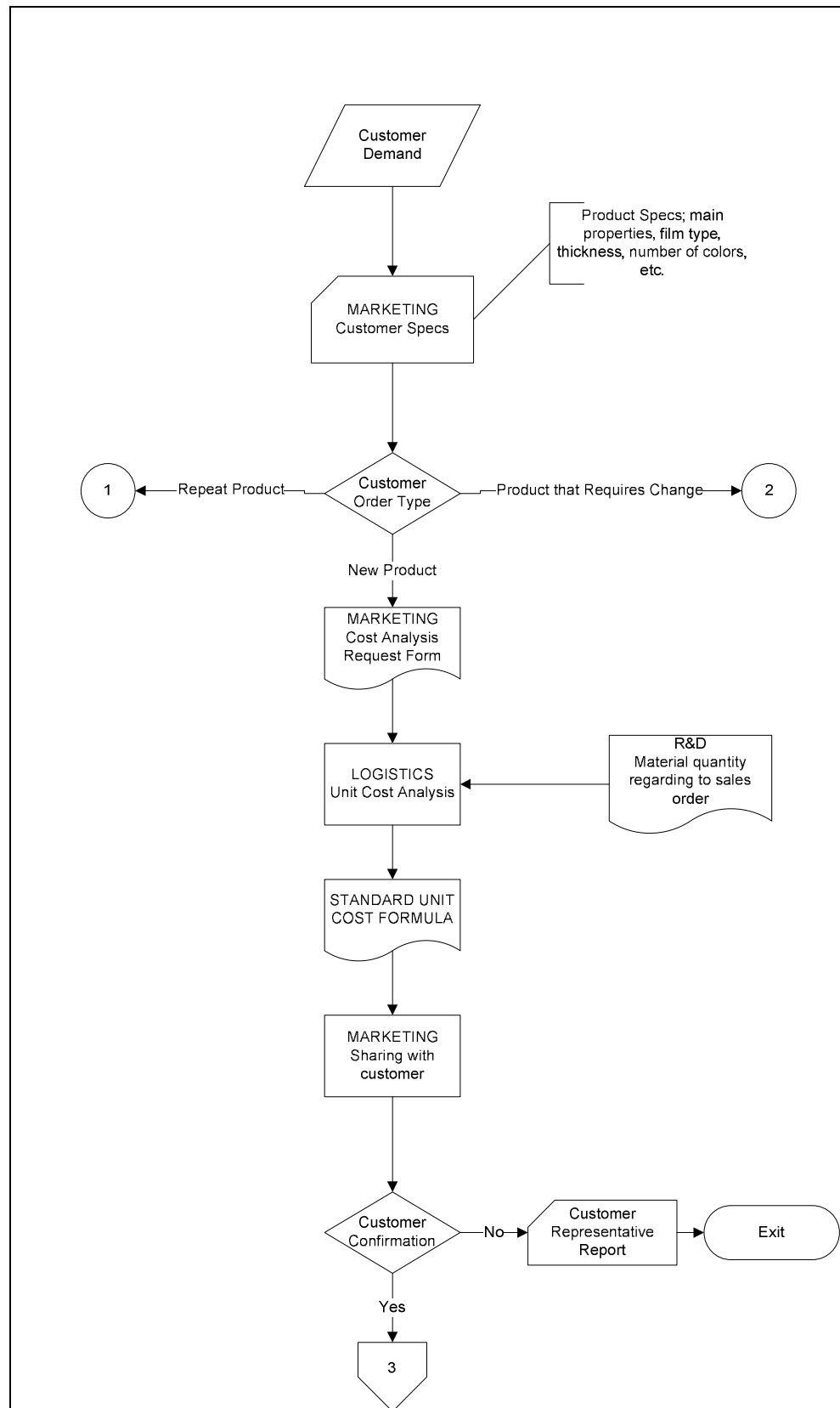


Figure 12. Flowchart of B Firm's Sales Organization -1

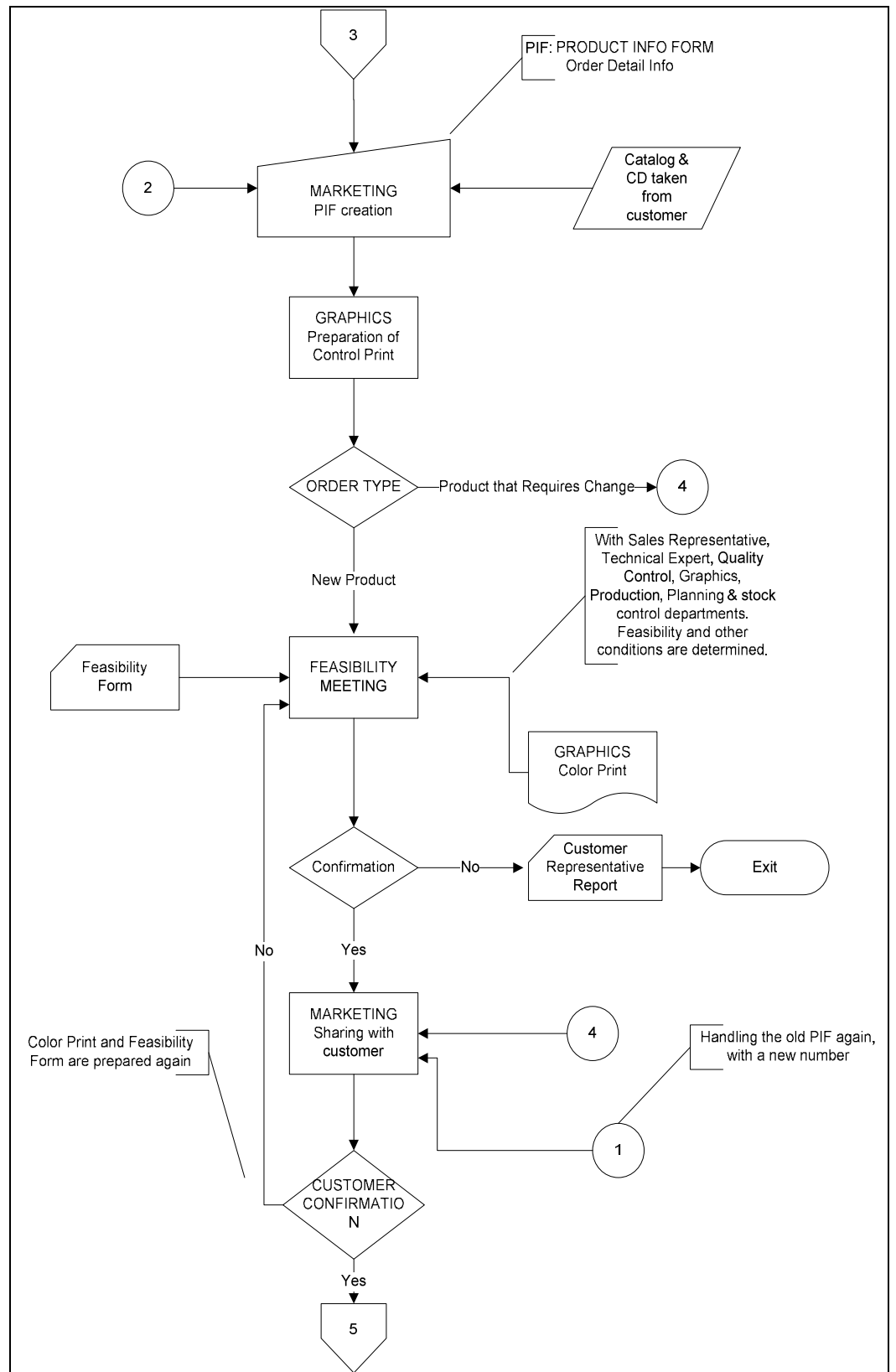


Figure 12. Flowchart of B Firm's Sales Organization -2

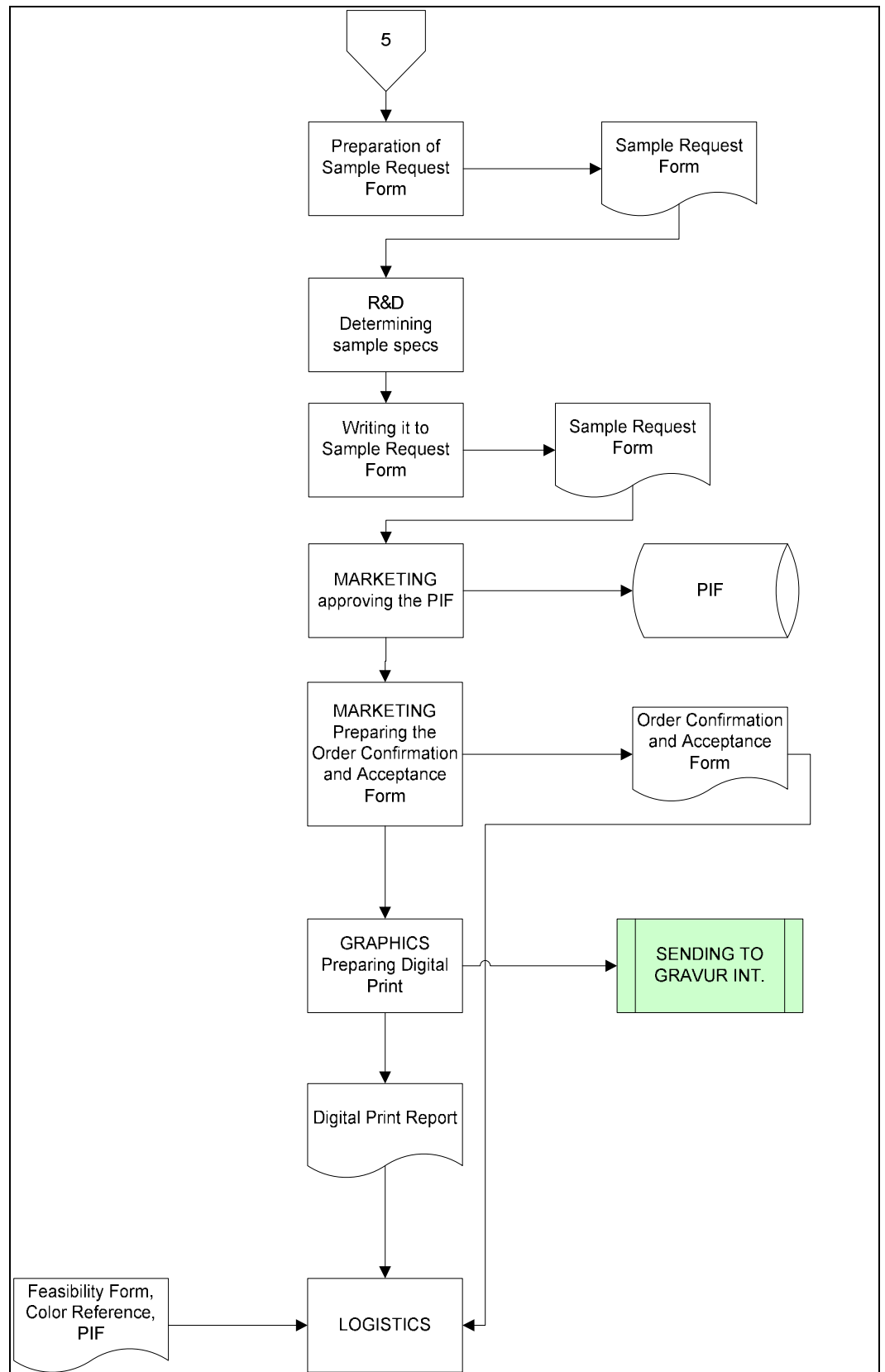


Figure 12. Flowchart of B Firm's Sales Organization -3

As can be seen from the diagrams above, data flow diagram shows the flow of data between and within departments. Where as, flowchart shows the process flow of the department. These artefacts act as guides in planning and implementation steps.



## **VI.CONCLUSION**

Not all ERP implementations lead to success. It is not realistic to assume that buying an ERP solves all company problems. ERP is no silver bullet. This thesis showed that strong project planning plays a very important role in implementation of Enterprise Resource Planning systems. Lack of a strong plan may result in project failure. System analysis should be started before searching and deciding to buy a particular ERP package. Because system analysis outputs the requirements of the company and shows the parts of the processes that go wrong. Wrong going processes should be addressed before stepping to ERP selection phase.

Besides the points stated above, quality of the project team, synchronization of project plan with jobs being done, top management's support to project, support from ERP vendor are among the most important success factors of ERP implementation.

And lastly, end users should be included in the implementation process. They have to feel that they own the project. If all these conditions are satisfied, ERP implementation process can be done successfully.

## REFERENCES

- Al-Mashari, M. (2002). Enterprise Resource Planning (ERP) Systems: a research agenda. *Industrial Management and Data Systems*, 102(3), 165-170.
- Al-Mashari, M., Al-Mudimigh, A., & Zairi M. (2003). Enterprise resource planning: A taxonomy of critical factors. *European Journal of Operational Research*, 146(2), 352-364.
- Appleton, E. (1999). How to survive ERP. *Datamation*, Marc
- Arnold, V., Hunton, J. E., and Sutton, S. G. (2000) On the Death and Dying of Originality in the Workplace: A Critical View of Enterprise Resource Planning Systems' Impact on Workers and the Work Environment. Working Paper, University of South Florida.
- ASAP (WORLD CONSULTANCY) (1996). Using SAP R/3. Indianapolis, IN
- Bailey, J. (1999). "Trash Haulers Are Taking Fancy Software to the Dump." *Wall Street Journal*, June 9.
- Bingi, P., Sharma, M. K., & Godla, J. K. (1999). Critical issues affecting an ERP implementation. *Information Systems Management*, 16(3), 7-14
- Busse, T. (1998). "Boeing Takes Off with BAAN." *InfoWorld*, July 6.
- Bylinsky, G. (1999). "The Challengers Move In on ERP". *Fortune*
- Crow, B. (1998). "Integrating Lean Manufacturing Principles into BAAN ERP." Unpublished presentation, April 23.

- Davenport, T. H. (1996). *Holistic Management of Mega-Package Chance: The Case of SAP*. Boston: Center of Business Innovation, Ernst & Young LLP.
- Davenport, T. H. (1998). Living with ERP. *CIO Magazine*, 12(5), 30–31.
- Davis, A. (2005). “ERP Customization Impacts on Strategic Alignment and System Agility” Proceedings of the 2005 Southern Association of Information System Conference, 249-259
- Freeman, E. (1997). “ERP Recipe?” *Datamation*, August, pg.61
- Glover, S. M., Prawitt, D., and Romney, M. (1999). Implementing ERP. *Internal Auditor*, 40-47.
- Grabski, S. V., Leech, S. A., and Lu, B. (2000). *Successful implementation of ERP systems: risks and complementary Factors*. Working Paper, Eli Broad College of Business, Michigan State University, East Lansing.
- Greenberg, I.(1997a). “Oracle, Peoplesoft Target C/S Apps Vertically.” *Infoworld*, pg10.
- Hammer, M. (1990). “Reengineering Work: Don’t automate, Obliterate” *Harvard Business Review*, pg 104-120
- Hirt, S., and Swanson, E. B. (1998). “Adopting SAP at Siemens Power Company.” Paper presented at the International Conference on Information Systems (Helsinki), December.
- Holland, P. H., and Light, B. (1999). A Critical Success Factors Model for ERP Implementation. *IEEE Software*, 16(3), 30-36
- Holt, S. (1998). “People Soft Hops on Front Office Band Wagon”, *InfoWorld*, pg.16

- iSummation Technologies, 2007, [http://www.isummation.com/it-services/enterprise-architecture/erp\\_customization.cfm](http://www.isummation.com/it-services/enterprise-architecture/erp_customization.cfm)
- Keeling, D. (1996). "A Buyers Guide to High End Accounting Systems". *Journal Of Accounting*, pg43-52.
- Kersnar, K., and May, M. (1999). "Plug and Pray." *CFO*, pg 40-50
- Klaus, H., Rosemann, M. and Gable, G. G. 2000. 'What is ERP?' *Information Systems Frontiers*,2(2): 141-162.
- Koch, 2007, ABC: An Introduction to ERP, <http://www.cio.com/article/40323>
- Lamonica, M. (1998). "Customizing ERP Falls from Favor." *InfoWorld*, November 23, pp. 1, 57, 58.
- Light, C. B., Holland, C. P., and Wills, K. (2001). ERP and best of breed: a comparative analysis. *Business Process Management Journal*, 7(3), 216-224.
- Lundqvist, H. (2003). *ERP Systems*, CIO, Sweden, 32-37
- McIntire School of Commerce via SAD, 2007, [www2.sims.berkeley.edu/courses/is208/s01/Decomposition.doc](http://www2.sims.berkeley.edu/courses/is208/s01/Decomposition.doc)
- Office of Government Commerce, 2005, *Managing Successful Projects with Prince2*
- Parr, A., and Shanks, G. (2000). A model of ERP project implementation. *Journal of Information Technology*, 15(4), 289-303.
- Radosevich, L. (1997). "Quantum's Leap." *CIO Magazine*, February
- Rosario, J. G. (2000, May 17). On the leading edge: critical success factors in ERP implementation projects, *BusinessWorld (Philippines)*, p. 1.

- Seddon, P. B., Shanks, G., and Willcocks, L. (Eds.). (2003). *Second-wave enterprise resource planning systems*. New York: Cambridge University.
- Somers T.M., and Nelson K. (2001), The Impact of Critical Success Factors across the Stages of Enterprise Resource Planning Implementations, published in 34th Hawaii International Conference on System Sciences 2001, Hawaii
- Stedman, C. (1998). “Big Retail SAP Project Put on Ice.” *Computerworld*, November 2, pp. 1, 104.
- Sumner, M. (1999). Critical success factors in enterprise wide information management systems projects. *Proceedings of the Americas Conference on Information Systems*, Milwaukee, 1999, 232-234.
- Umble, E. J, Haft, R. R., & Umble, M. M. (2003). Enterprise resource planning: Implementation procedures and critical success factors. *European Journal of Operational Research*, 146(2), 241–257.
- Wee, S. (2000). Juggling toward ERP success: keep key success factors high. In Nah et al. (2001)
- Westrup, C., and Knight, F. (2000). Consultants and enterprise resource planning (ERP) systems. *European Conference in Information systems, July 3.-5., Vienna*, 637 - 643.
- Willcocks, L. P., and Sykes, R. (2000). The role of the CIO and IT function in ERP. *Communications of the ACM*, 43(4), 33–38