Applied Technology Research Center
SMERP™ ERP Solution

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SMERP™

Small and Medium Enterprise Resource Planning.™

The most advanced ERP systems in the world for SMEs.
A product of Applied Technology Research Center™ (ATRC™)
If you do not have an ERP already then we have some great news for you. Our SMERP™ solution will help your organization to utilize its resources effectively, make automation affordable, especially if your organization is an SME, and increase profitability and economies of scale.
It will also shorten the activity life cycle in time-sensitive, export-oriented industries.

The ERP solution will integrate the processes and procedures in the industry in HR and Payroll, Finance, Production, Sales and Inventory management.

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The solution will provide and improve:

- **Security** - Application access available based on rights
- **Efficiency** - Quick access to information; all data is entered once only; integration of information between different modules.
- **Data Consistency** - All users in the application see the same information
- **Order Tracking** - Faster product/service look-up and ordering, saving time and money

- **Automated ordering** and payment, lowering payment processing and paper costs
- **Remove Redundancy** - Any data will be entered only once
- Generate **invoices and vouchers**
- Generate needed **reports**
- **Fast access** to detailed account histories, providing more abundant information and improved planning and analysis.

For details of how ATRC can provide you the benefits of our SMERP solution.
Please feel free to contact us anytime.

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Time to implement and deploy.
If your company is large then we can do an analysis and see which ERP shall fit your requirements better along with best of breed (BoB) applications which need to be integrated or created to optimize the integration of a large ERP. The analysis itself is a project which needs to be done so the benefits can be calculated of implementing the solution. Without such an analysis a large company runs a high risk of having a low or even negative ROI on the complete ERP investment over the ownership period of 5 to 15 years.

The estimated time to implement an ERP ranges from 6 months to 1 year for small organizations to 1 to 2 years for medium organizations and up to 3 years for large organizations. Depending heavily on the initiative of the internal IT people and the support of the investors.

Procedures for implemtation.

In-depth Study

In this phase the existing systems and procedures are studied by us in detail to have the first-hand knowledge of the problems. Interviews are held with concerned officers to gather their views about the possible improvements. At the of this exercise both ATRC and the client are clear about what is required.

Architecture & Overall Design

After the in-depth study is completed, we proceed with development of the system to be followed. Computer outputs are designed and computer master file layouts are prepared. In this process the tools and technologies to be used are also identified.

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Discussion & Finalization

Our findings, conclusions and suggestions are discussed with such persons as may be nominated by the client. The views of these officials will be accommodated in the final system. On one hand this ensures that the detailed development work (the next phase) will be in the right direction and on the other hand it gives a sense of participation to key officials in the client organisation. They also take pride in implementing the system as a result.

Detailed Development

Normally detailed development and coding is the longest phase in any computerization project but our experts through their knowledge, experience and developed software already available, are able to complete it at an amazingly fast speed. The work is carried out in logical order and systems are tested on carefully prepared dummy data and transactions.

Training

The systems developed by ATRC are always menu-driven and user-friendly so that the can be implemented with minimal training. The persons who have to operate the systems are trained for their specific areas of responsibilities.

Implementation

The implementation of systems involves actual allotment of codes, creation of master data files, transaction data management, real time on line processing and integration of systems to eliminate duplication of data entry effort. ATRC experts are always confident about the perfection of systems developed by them and in most cases implementation is completed much earlier than client's expectation. ATRC experts remain associated with the project till and system comes into absolutely smooth operation to the entire satisfaction of client organisation.

Backup Maintenance Service

Proper Backup maintenance services are provided for smooth running and upgradation

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of systems for years to come.
Benefis of ERP systems by Applied Technology Research Center.

What is ERP?

An ERP system is an integrated solution, sharing a centralized database, with all 'users'…. Human Resources/Payroll/Benefits, E-procurement, Accounting, Budgets, etc …. being served by the same database through one point of entry.

Data need only be entered or updated once, reducing errors, time and labor for reports, analysis, planning and program management.
Ultimately, time and resources are shifted to innovating,problem solving and direct service to customers rather than inputting, processing, organizing, verifying and related "busy work" that burns through time and money.

Enterprise resource planning software attempts to integrate all departments and functions across a company onto a single computer system that can serve all those departments' particular needs.

1. Real time information throughout all entire company
2. Better visibility into the performance of operational areas
3. Data standardization and accuracy across the enterprise. Single version of "The Truth!"
4. Best-practices or proven methodologies are included in the applications
5. Creates organizational efficiencies.
6. Allows for analysis and reporting for long-term planning

Significant Features on an ERP System

1. Information entered once into system
2. Can allow for the use of the best practices
3. Can be further developed
4. Based on reliable file structure
5. Provides functionality to interact with other elements in the process
6. Provides report writers and other tools for data inquiries

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ROI and Cost Savings
Here are some areas to look for possible ROI:

1. Reduce Inventory through better visibility and efficiency
2. Savings through the reduction in duplicated efforts
3. More efficient operations allowing for increase in ability to process transactions (added capacity)
4. Reduction in non-value added activities (lean processing)
5. Higher utilization of employees (less transactional, more analytical)
6. Improvement in decision making through more accurate and real-time data

General Services/E-Procurement
Benefits of an ERP system:

- Can reach more vendors, producing more competitive bids and widening participation in government contracts, lowering the cost of products and services purchased
- Potential of $10-$15 million in total yearly savings
- Significant paper and postage cost reductions as part of the yearly savings
- Faster product/service look-up and ordering, saving time and money
- Automated ordering and payment, lowering payment processing and paper costs
- Fast access to detailed account histories, providing more abundant information and improved planning and analysis
- Ability to distribute, receive and award contracts out for bid much faster
- Wider participation by city and county purchasing entities, multiplying cost savings and management improvements, and offsetting system operation costs

Management/Budget

An ERP system in the Department of Management would:
! Save enormous time and effort in data entry and report production for budgets
! Allow more innovative and extensive budget report content and analysis
! Through Web access, allow lawmakers, directors, managers, even taxpayers to view real-time budget information.

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! Link the budget system to payroll, accounting, Legislative Fiscal Bureau, personnel and other
departments, allowing nearly instant data exchange and ensuring such information is consistent
and uniform across the board
! Provide easy access to trend data—financial information from years past is quickly combined into
an up-to-date long-term view
! Empower departments to more closely measure program performance and results

Building a single software program that serves the needs of people in finance and human resoures is a large task.

Each department has its own computer system optimized for the particular ways that the department does its work.

But ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other.

That integrated approach can have a tremendous payback if companies install the software correctly.

For example : Take a customer order.

When a customer places an order, that order begins a mostly paper-based journey from inbox to inbox throughout the company, often being keyed and rekeyed into different departments' computer systems along the way.

All that time wasted in the inbox causes delays and lost orders, and all the keying into different computer systems invites errors.

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Meanwhile, no one in the company truly knows what the status of the order is at any given point because there is no way for the finance department, for example, to get into the warehouse's computer system to see whether the item has been shipped. "You will have to call the warehouse" is the familiar statement heard by frustrated customers.

ERP eliminates the old standalone computer systems in finance, HR, manufacturing and the warehouse, and replaces them with a single unified software program divided into software modules that roughly approximate the old standalone systems.

Finance, manufacturing and the warehouse all still get their own software, except now the software is linked together so that someone in finance can look into the warehouse software to see if an order has been shipped.

Early in the 1990s ERP was developed as a tightly integrated monolith, but most vendors' software has since become flexible enough that you can install some modules without installing the whole package.

How can ERP improve a company's business performance?

ERP's best hope for demonstrating value is as a sort of battering ram for improving the way your company takes a customer order and processes that into an invoice and revenue—otherwise known as the order fulfillment process.

ERP is often referred to as back-office software. It doesn't handle the up-front selling process (although most ERP vendors have recently developed CRM software to do this); rather, ERP takes a customer order and provides a software road map for automating the different steps along the path to fulfilling the order.

When a customer service representative enters a customer order into an ERP system, he has all the information necessary to complete the order (the customer's credit rating and order history from the finance module, the company's inventory levels from the warehouse module and the shipping dock's trucking schedule from the logistics module, for example).

People in these different departments all see the same information and can update it.

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When one department finishes with the order it is automatically routed via the ERP system to the next department. To find out where the order is at any point, you need only log in to the ERP system to track it down. The order process moves like a bolt of lightning through the organization, and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting.

Let's go back to those inboxes for a minute. That process may not have been efficient, but it was simple. Finance did its job, the warehouse did its job, and if anything went wrong outside of the department's walls, it was somebody else's problem. Not anymore. With ERP, the customer service representatives are no longer just typists entering someone's name into a computer and hitting the return key. The ERP screen makes them businesspeople. It flickers with the customer's credit rating from the finance department and the product inventory levels from the warehouse. Did the customer pay for the last order yet? Will we be able to ship the new order on time? These are decisions that customer service representatives have never had to make before, and the answers affect the customer and every other department in the company. But it's not just the customer service representatives who have to wake up. People in the warehouse who used to keep inventory in their heads or on scraps of paper now need to put that information online. If they don't, customer service reps' screens will show low inventory levels and reps will tell customers that the requested item is not in stock. Accountability, responsibility and communication have never been tested like this before.

People don't like to change, and ERP asks them to change how they do their jobs. That is why the value of ERP is so hard to pin down. The software is less important than the changes companies make in the ways they do business. If you use ERP to improve the ways your people take orders and manufacture, ship and bill for goods, you will see value from the software. If you simply install the software without trying to improve the ways people do their jobs, you may not see any value at all—indeed, the new software could slow you down by simply replacing the old software that everyone knew with new software that no one does.

How long will an ERP project take?

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Companies that install ERP do not have an easy time of it. Don't be fooled when ERP vendors tell you about a three- or six-month average implementation time. Those short (that's right, six months is short) implementations all have a catch of one kind or another: The company was small, or the implementation was limited to a small area of the company, or the company used only the financial pieces of the ERP system (in which case the ERP system is nothing more than a very expensive accounting system). To do ERP right, the ways you do business will need to change and the ways people do their jobs will need to change too. And that kind of change doesn't come without pain. Unless, of course, your ways of doing business are working extremely well (orders all shipped on time, productivity higher than all your competitors, customers completely satisfied), in which case there is no reason to even consider ERP.

The important thing is not to focus on how long it will take—real transformational ERP efforts usually run between one and three years, on average—but rather to understand why you need it and how you will use it to improve your business.
Will ERP fix my integration problems?

No. It seems almost quaint to think of it today, but back in the days before Y2K, enterprise software vendors, and, more forcefully, the management consultants who installed the stuff, sold ERP as a magic bullet that companies could use to escape the coming Y2K apocalypse, create seamless technology integration across the company and force your silos of isolated, sociopathic bureaucrats to start working together. It was an irresistible sell to businesspeople.

It's true that ERP was designed to solve integration problems, but it worked only in the theoretical environment of the vendors' development labs. Developers who believe they are modeling an entire business in software don't spend much time thinking about how that system will connect with other systems. Who needs other systems when we're creating the whole thing right here?

Of course, as soon as companies began buying these products, it became clear that

enterprise software was another chunk—a much larger and better integrated chunk to be sure, but still a chunk—of software in a complex architecture of IT systems that desperately needed to talk to one another and exchange information. The vendors created clunky, proprietary methods of connecting their systems with others, which have improved over the years, but that misses the point. The architecture of these systems, in a broad sense, was just like the ones that they were intended to save you from—monolithic, highly integrated and difficult to change.

No problem, said the vendors. Some of your maintenance and support fees are going to future R&D. As we develop new pieces to add in to our highly integrated suites, we'll let you upgrade to the next version for free and you can gradually get rid of all those other troublesome chunks. Again, it sounded great to the people buying the stuff—businesspeople.

But who could afford to install enterprise software as it was envisioned in the vendors' R&D labs? Very few. CIOs built complex integration links from enterprise software to other systems to keep the business running. Or they chunked up the installation, building dozens or even hundreds of unique installations of the same enterprise software to meet the needs of individual departments or businesses that all had to be linked together. The high degree of integration envisioned in the R&D lab was tenuous at best inside most organizations.

Gradually, enterprise software vendors came to realize that to serve customers better, they needed to break up their suites into application components and create complex ways to link to them over the Internet so that customers would not have to rewrite connections to pieces of the suite such as financials, which didn't change much.

The final death knell for the original enterprise software architecture model came in 2004 when the major enterprise software vendors all announced that they were offering packages of integration middleware—tacitly acknowledging the reality that had been clear since middleware was first invented decades ago: Integration happens best outside of specific software applications, not inside them. The enterprise software vendors have been conspicuously absent from the Web services standards movement, looking ever more like the Dark Princes of Lock-In while the originators of the lock-in concept, IBM and Microsoft, looked like white knights for doing the lion's share of work to create free (so far, anyway) standards for integration in Web services. And it's great

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stuff. How ironic that those companies that were going to save your CEO from integration in 1999 have been the laggards in developing truly useful enterprise integration.

This is not to say that ERP is a boondoggle, or even that the software isn't valuable to the companies that bought it. Even though most vendors have had some big bumps in the road, most of their products work well. The happiest customers are those who used enterprise software to create new capabilities and processes that they could not express in software with their old systems. But back in 1999, many CIOs talked about ERP as an integration strategy, about replacing systems that had more and better functionality than the enterprise software they were installing in order to be more integrated, more efficient when the new software was installed. For the few companies that could afford to install enterprise software in the manner envisioned in the vendors' R&D labs, they may have gotten there. Many are still maintaining the custom code they had to write for outraged business users who lost capabilities they had in the old software.

ERP Benefits - Operational Control, Management Control and Strategic Planning

Organizational processes fall into three levels - strategic planning, management control and operational control.

ERP systems facilitating operational coordination across functional departments. ERP systems also benefit strategic planning and manegment control one way or other.

Help reduce operating costs

ERP software attempts to integrate business processes across departments onto a single enterprise-wide information system.

The major benefits of ERP are improved coordination across functinal departments and increased efficiencies of doing business.

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The immediate benefit from implementing ERP systems we can expect is reduced operating costs, such as lower inventory control cost, lower production costs, lower marketing costs and lower help desk support costs.

Facilitate Day-to-Day Management

ERP systems facilitate day-to-day management.

The implementations of ERP systems nurture the establishment of backbone data warehouses.

ERP systems offer better accessibility to data so that management can have up-to-the-minute access to information for decision making and managerial control.

ERP software helps track actual costs of activities and perform activity based costing.

Support Strategic Planning

Strategic Planning is "a deliberate set of steps that assess needs and resources; define a target audience and a set of goals and objectives; plan and design coordinated strategies with evidence of success; logically connect these strategies to needs, assets, and desired outcomes; and measure and evaluate the process and outcomes."

Part of ERP software systems is designed to support resource planning portion of strategic planning.

Open Source ERP Comparison

ERP (Enterprise Resource Planning):

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What is an ERP?

1st Definition:

Enterprise Resource Planning systems (ERP's) integrate (or attempt to integrate) all data and processes of an organization into a unified system. A typical ERP system will use multiple components of computer software and hardware to achieve the integration. A key ingredient of most ERP systems is the use of a unified database to store data for the various system modules. The term ERP originally implied systems designed to plan the utilization of enterprise-wide resources. Although the acronym ERP originated in the manufacturing environment, today's use of the term ERP systems has much broader scope. ERP systems typically attempt to cover all basic functions of an organization, regardless of the organization's business or charter. Business, non-profit organizations, non governmental organizations, governments, and other large entities utilize ERP systems.

Additionally, it may be noted that to be considered an ERP system, a software package generally would only need to provide functionality in a single package that would normally be covered by two or more systems. Technically, a software package that provides both Payroll and Accounting functions (such as QuickBooks) would be considered an ERP software package.

However, the term is typically reserved for larger, more broadly based applications. The introduction of an ERP system to replace two or more independent applications eliminates the need for external interfaces previously required between systems, and provides additional benefits that range from standardization and lower maintenance (one system instead of two or more) to easier and/or greater reporting capabilities (as all data is typically kept in one database).

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2nd Definition:

Enterprise resource planning software, or ERP, doesn't live up to its acronym. Forget about planning—it doesn't do much of that—and forget about resource, a throwaway term. But remember the enterprise part. This is ERP's true ambition. The software attempts to integrate all departments and functions across a company onto a single computer system that can serve all those departments' particular needs.

Building a single software program that serves the needs of people in finance as well as it does the people in human resources and in the warehouse is a tall order. Each of those departments typically has its own computer system optimized for the particular ways that the department does its work. But ERP combines them all together into a single, integrated software program that runs off a single database so that the various departments can more easily share information and communicate with each other.

That integrated approach can have a tremendous payback if companies install the software correctly.

Take a customer order, for example. Typically, when a customer places an order, that order begins a mostly paper-based journey from inbox to inbox throughout the company, often being keyed and rekeyed into different departments' computer systems along the way. All that lounging around in inbox causes delays and lost orders, and all the keying into different computer systems invites errors. Meanwhile, no one in the company truly knows what the status of the order is at any given point because there is no way for the finance department, for example, to get into the warehouse's computer system to see whether the item has been shipped. "You'll have to call the warehouse" is the familiar refrain heard by frustrated customers.

ERP vanquishes the old standalone computer systems in finance, HR, manufacturing and the warehouse, and replaces them with a single unified software program divided into software modules that roughly approximate the old standalone systems. Finance, manufacturing and the warehouse all still

get their own software, except now the software is linked together so that someone in finance can look into the warehouse software to see if an order has been shipped. Back in the '90s ERP was developed as a tightly integrated monolith, but most vendors' software has since become flexible enough that you can install some modules without buying the whole package. Many companies, for example, will install only an ERP finance or HR module and leave the rest of the functions for another day.
How can ERP improve a company's business performance?

ERP's best hope for demonstrating value is as a sort of battering ram for improving the way your company takes a customer order and processes that into an invoice and revenue—otherwise known as the order fulfillment process. That is why ERP is often referred to as back-office software. It doesn't handle the up-front selling process (although most ERP vendors have recently developed CRM software to do this); rather, ERP takes a customer order and provides a software road map for automating the different steps along the path to fulfilling the order. When a customer service representative enters a customer order into an ERP system, he has all the information necessary to complete the order (the customer's credit rating and order history from the finance module, the company's inventory levels from the warehouse module and the shipping dock's trucking schedule from the logistics module, for example).

People in these different departments all see the same information and can update it. When one department finishes with the order it is automatically routed via the ERP system to the next department. To find out where the order is at any point, you need only log in to the ERP system to track it down. With luck, the order process moves like a bolt of lightning through the organization, and customers get their orders faster and with fewer errors than before. ERP can apply that same magic to the other major business processes, such as employee benefits or financial reporting.

That, at least, is the dream of ERP. The reality is not so rosy.

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job, and if anything went wrong outside of the department's walls, it was somebody else's problem. Not anymore. With ERP, the customer service representatives are no longer just typists entering someone's name into a computer and hitting the return key. The ERP screen makes them businesspeople. It flickers with the customer's credit rating from the finance department and the product inventory levels from the warehouse. Did the customer pay for the last order yet? Will we be able to ship the new order on time? These are decisions that customer service representatives have never had to make before, and the answers affect the customer and every other department in the company. But it's not just the customer service representatives who have to wake up. People in the warehouse who used to keep inventory in their heads or on scraps of paper now need to put that information online. If they don't, customer service reps' screens will show low inventory levels and reps will tell customers that the requested item is not in stock. Accountability, responsibility and communication have never been tested like this before.

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Of course, as soon as companies began buying these products, it became clear that enterprise software was another chunk—a much larger and better integrated chunk to be sure, but still a chunk—of software in a complex architecture of IT systems that desperately needed to talk to one another and exchange information. The vendors created clunky, proprietary methods of connecting their systems with others, which have improved over the years, but that misses the point. The architecture of these systems, in a broad sense, was just like the ones that they were intended to save you from—monolithic, highly integrated and difficult to change.

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What does ERP *really* cost?

There aren't any good numbers to predict ERP costs because the software installation has so many variables, such as: the number of divisions it will serve, the number of modules installed, the amount of integration that will be required with existing systems, the readiness of the company to change and the ambition of the project—if the project is truly meant to be a battering ram for reengineering how the company does its most important work, the project will cost much more and take much longer than one in which ERP is simply replacing an old transaction system. There is a sketchy rule of thumb that experts have used for years to predict ERP installation costs, which is that the installation will cost about six times as much as the software license. But this has become increasingly less relevant as the market for ERP has slowed over time and vendors have offered deep discounts on the software up front.

Research companies don't even bother trying to predict costs anymore. A few years ago, the dearly departed Meta Group did a study looking at the total cost of ownership (TCO) of ERP, including hardware, software, professional services and internal staff costs. The TCO numbers include getting the software installed and the two years afterward, which is when the real costs of maintaining, upgrading and optimizing the system for your business are felt. Among the 63 companies surveyed—including small, midsize and large

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companies in a range of industries—the average TCO was $15 million (the highest was $300 million and the lowest was $400,000). While it's hard to draw a solid number from that kind of range of companies and ERP efforts, Meta came up with one statistic that proves that ERP is expensive no matter what kind of company is using it: The TCO for someone who uses the system a lot over that period was a staggering $53,320.
When will I get payback from ERP—and how much will it be?

Don't expect to revolutionize your business with ERP. Its contribution is optimizing the way things are done internally rather than with customers, suppliers or partners. Again, value depends on ambition. If ERP is the focus of an effort to bring dramatic improvements to the way a company does business, it will bring more value than if the project is treated as a simple systems replacement. And even if ERP does bring dramatic change, because it affects mostly existing "back office" processes such as order management rather than creating new revenue opportunities, the bottom-line value may not be much. Veterans say ERP is more a cost of doing business to make the company operate more efficiently than something that offers dramatic payback. And most veterans say it takes six months or more to get the new systems and processes running up to snuff. A Meta Group study of 63 companies a few years ago found that it took eight months after the new system was in (31 months total) to see any benefits. The median annual savings from the new ERP system were $1.6 million—pretty modest, considering that ERP projects at big companies can cost $50 million or more.
What will ERP fix in my business?

There are five major reasons why companies undertake ERP.

1. *Integrate financial information*—;As the CEO tries to understand the company's overall performance, he may find many different versions of the truth. Finance has its own set of revenue numbers, sales has another version, and the different business units may each have their own version of how much they contributed to revenue. ERP creates a single version of the truth that cannot be questioned because everyone is using the same system.
2. *Integrate customer order information*—;ERP systems can become the place where the customer order lives from the time a customer service

representative receives it until the loading dock ships the merchandise and finance sends an invoice. By having this information in one software system, rather than scattered among many different systems that can't communicate with one another, companies can keep track of orders more easily, and coordinate manufacturing, inventory and shipping among many different locations simultaneously.
3. *Standardize and speed up manufacturing processes*—;Manufacturing companies—especially those with an appetite for mergers and acquisitions—often find that multiple business units across the company make the same widget using different methods and computer systems. ERP systems come with standard methods for automating some of the steps of a manufacturing process. Standardizing those processes and using a single, integrated computer system can save time, increase productivity and reduce headcount.
4. *Reduce inventory*—;ERP helps the manufacturing process flow more smoothly, and it improves visibility of the order fulfillment process inside the company. That can lead to reduced inventories of the materials used to make products (work-in-progress inventory), and it can help users better plan deliveries to customers, reducing the finished good inventory at the warehouses and shipping docks. To really improve the flow of your supply chain, you need supply chain software, but ERP helps too.
5. *Standardize HR information*—;Especially in companies with multiple business units, HR may not have a unified, simple method for tracking employees' time and communicating with them about benefits and services. ERP can fix that.

In the race to fix these problems, companies often lose sight of the fact that ERP packages are nothing more than generic representations of the ways a typical company does business. While most packages are exhaustively comprehensive, each industry has quirks that make it unique. Most ERP systems were designed to be used by discrete manufacturing companies (that make physical things that can be counted), which immediately left all the process manufacturers (oil, chemical and utility companies that measure their products by flow rather than individual units) out in the cold. Each of these industries has struggled with the different ERP vendors to modify core ERP programs to their needs.

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Will ERP fit the ways I do business?

Before the checks are signed and the implementation begins, it's critical for companies to figure out if their ways of doing business will fit within a standard ERP package. The most common reason that companies walk away from multimillion-dollar ERP projects is that they discover the software does not support one of their important business processes. At that point there are two things they can do: They can change the business process to accommodate the software, which will mean deep changes in long-established ways of doing business (that often provide competitive advantage) and shake up important people's roles and responsibilities (something that few companies have the stomach for). Or they can modify the software to fit the process, which will slow down the project, introduce dangerous bugs into the system and make upgrading the software to the ERP vendor's next release excruciatingly difficult because the customizations will need to be torn apart and rewritten to fit with the new version.

Needless to say, the move to ERP is a project of breathtaking scope, and the price tags on the front end are enough to make the most placid CFO a little twitchy. In addition to budgeting for software costs, financial executives should plan to write checks to cover consulting, process rework, integration testing and a long laundry list of other expenses before the benefits of ERP start to manifest themselves. Underestimating the price of teaching users their new job processes can lead to a rude shock down the line, and so can failure to consider data warehouse integration requirements and the cost of extra software to duplicate the old report formats. A few oversights in the budgeting and planning stage can send ERP costs spiraling out of control faster than oversights in planning almost any other information system undertaking.

What are the hidden costs of ERP?

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.

1. *Training*—Training is the near-unanimous choice of experienced ERP implementers as the most underestimated budget item. Training expenses are high because workers almost invariably have to learn a new set of processes, not just a new software interface. Worse, outside training companies may not be able to help you. They are focused on telling people how to use software, not on educating people about the particular ways you do business. Prepare to develop a curriculum yourself that identifies and explains the different business processes that will be affected by the ERP system. One enterprising CIO hired staff from a local business school to help him develop and teach the ERP business-training course to employees. Remember that with ERP, finance people will be using the same software as warehouse people and they will both be entering information that affects the other. To do this accurately, they have to have a much broader understanding of how others in the company do their jobs than they did before ERP came along. Ultimately, it will be up to your IT and businesspeople to provide that training. So take whatever you have budgeted for ERP training and double or triple it up front. It will be the best ERP investment you ever make.
2. *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. A typical manufacturing company may have add-on applications from the major—e-commerce and supply chain—to the minor—sales tax computation and bar coding. All require integration links to ERP. You're better off if you can buy add-ons from the ERP vendors that are pre-integrated. If you need to build the links yourself, expect things to get ugly. As with training, testing ERP integration has to be done from a process-oriented perspective. Veterans recommend that instead of plugging in dummy data and moving it from one application to the next, you should run a real purchase order through the system, from order entry through shipping and receipt of payment—the whole order-to-cash banana—preferably with the participation of the employees who will eventually do those jobs.
3. *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. This

happens when the ERP software can't handle one of your business processes and you decide to mess with the software to make it do what you want. You're playing with fire. The customizations can affect every module of the ERP system because they are all so tightly linked together. Upgrading the ERP package—no walk in the park under the best of circumstances—becomes a nightmare because you'll have to do the customization all over again in the new version. Maybe it will work, maybe it won't. No matter what, the vendor will not be there to support you. You will have to hire extra staffers to do the customization work, and keep them on for good to maintain it.
4. *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. Although few CIOs will admit it, most data in most legacy systems is of little use. Companies often deny their data is dirty until they actually have to move it to the new client/server setups that popular ERP packages require. Consequently, those companies are more likely to underestimate the cost of the move. But even clean data may demand some overhaul to match process modifications necessitated—or inspired—by the ERP implementation.
5. *Data analysis*—Often, the data from the ERP system must be combined with data from external systems for analysis purposes. Users with heavy analysis needs should include the cost of a data warehouse in the ERP budget—and they should expect to do quite a bit of work to make it run smoothly. Users are in a pickle here: Refreshing all the ERP data every day in a big corporate data warehouse is difficult, and ERP systems do a poor job of indicating which information has changed from day to day, making selective warehouse updates tough. One expensive solution is custom programming. The upshot is that the wise will check all their data analysis needs before signing off on the budget.
6. *Consultants ad infinitum*—When users fail to plan for disengagement, consulting fees run wild. To avoid this, companies should identify objectives for which its consulting partners must aim when training internal staff. Include metrics in the consultants' contract; for example, a specific number of the user company's staff should be able to pass a project-management leadership test—similar to what the consultants have to pass to lead an ERP engagement.
7. *Replacing your best and brightest*—It is accepted wisdom that ERP

success depends on staffing the project with the best and brightest from the business and IS divisions. The software is too complex and the business changes too dramatic to trust the project to just anyone. The bad news is a company must be prepared to replace many of those people when the project is over. Though the ERP market is not as hot as it once was, consultancies and other companies that have lost their best people will be hounding yours with higher salaries and bonus offers than you can afford—or that your HR policies permit. Huddle with HR early on to develop a retention bonus program and create new salary strata for ERP veterans. If you let them go, you'll wind up hiring them—or someone like them—back as consultants for twice what you paid them in salaries.

8. *Implementation teams can never stop*—Most companies intend to treat their ERP implementation as they would any other software project. Once the software is installed, they figure the team will be scuttled, and everyone will go back to his or her day job. But after ERP, you can't go home again. The implementers are too valuable. Because the implementers have worked so closely with ERP, they know more about the sales process than the salespeople and more about the manufacturing process than the manufacturing people. Companies can't afford to send their project people back into the business because there's so much to do after the ERP software is installed. Just writing reports to pull information out of the new ERP system will keep the project team busy for a year at least. And it is in analysis—and, one hopes, insight—that companies make their money back on an ERP implementation. Unfortunately, few IS departments plan for the frenzy of post-ERP installation activity, and fewer still build it into their budgets when they start their ERP projects. Many are forced to beg for more money and staff immediately after the go-live date, long before the ERP project has demonstrated any benefit.

9. *Waiting for ROI*—One of the most misleading legacies of traditional software project management is that the company expects to gain value from the application as soon as it is installed, while the project team expects a break and maybe a pat on the back. Neither expectation applies to ERP. Most of the systems don't reveal their value until after companies have had them running for some time and can concentrate on making improvements in the business processes that are affected by the system. And the project team is not going to be rewarded until their efforts pay off.

10. *Post-ERP depression*—ERP systems often wreak cause havoc in the companies that install them. In a recent Deloitte Consulting survey of 64 Fortune 500 companies, one in four admitted that they suffered a drop in performance when their ERP system went live. The true percentage is undoubtedly much higher. The most common reason for the performance problems is that everything looks and works differently from the way it did before. When people can't do their jobs in the familiar way and haven't yet mastered the new way, they panic, and the business goes into spasms.

Why do ERP projects fail so often?

At its simplest level, ERP is a set of best practices for performing the various duties in the departments of your company, including in finance, manufacturing and the warehouse. To get the most from the software, you have to get people inside your company to adopt the work methods outlined in the software. If the people in the different departments that will use ERP don't agree that the work methods embedded in the software are better than the ones they currently use, they will resist using the software or will want IT to change the software to match the ways they currently do things. This is where ERP projects break down.

Political fights erupt over how—or even whether—the software will be installed. IT gets bogged down in long, expensive customization efforts to modify the ERP software to fit with powerful business barons' wishes. Customizations make the software more unstable and harder to maintain when it finally does come to life. The horror stories you hear in the press about ERP can usually be traced to the changes the company made in the core ERP software to fit its own work methods. Because ERP covers so much of what a business does, a failure in the software can bring a company to a halt, literally.

But IT can fix the bugs pretty quickly in most cases, and besides, few big companies can avoid customizing ERP in some fashion—every business is different and is bound to have unique work methods that a vendor cannot account for when developing its software. The mistake companies make is assuming that changing people's habits will be easier than customizing the

software. It's not. Getting people inside your company to use the software to improve the ways they do their jobs is by far the harder challenge. If your company is resistant to change, then your ERP project is more likely to fail.
Is a "single instance" of ERP better?

An "instance" refers to the number of discreet versions of ERP software you have in your company. The original vision of ERP was that companies should have a single instance—that is, a single implementation of the software running on a single database—that serves the entire company. It would mean no duplication of information in different departments or in different geographic divisions and thus better integration and information quality across the company. Upgrading the software would also be easier than with multiple customized instances of ERP across the company.

But few companies installed ERP that way. First, there were the technology limitations: databases, networks and storage systems couldn't handle the load, and bandwidth was still expensive enough that linking globally based divisions together on a single database was expensive. Worse, different business units often had unique processes or resisted the ones that came in the ERP box. All these factors combined caused many big, global corporations to install dozens—even hundreds—of instances of software from a single ERP vendor.

Today, many of those early barriers have come down. So does it make sense to create a single (or a significantly reduced number) of instances—while also getting rid of outdated or feature-poor systems from other vendors? Like most complex technology issues, it depends.

There are some compelling reasons to undertake such a project now. For starters, the Sarbanes-Oxley Act, the government's post-Enron accounting legislation requires that financial reports have a verifiable audit trail.
With a single instance, all of a company's financial data will live in one application and will originate from one source, eliminating consolidation errors and greatly reducing the time it takes to close the books. Having a single data source could also create new revenue opportunities and cut

costs. Companies would be able to run reports that show cross-promotion opportunities, places where they could reuse equipment or leverage purchasing power. Also, AMR estimates that companies should budget $4.3 million for a single-instance order management module versus $7.1 million for multiple instances.

But despite these benefits, rip-and-replace is a difficult pill for CIOs to swallow, many of whom are just shaking off the multiyear, multimillion-dollar hangover of their first ERP project. And they're wondering if there isn't another cure for their integration headaches: Web services and the promise of service-oriented architecture (SOA). Web services could—with the emphasis on could—allow CIOs who have invested in best-of-breed solutions to integrate their standalone systems without either shelling out millions for single instance or tying their company's future to a single vendor. Trouble is, Web services and SOA are still immature and require complex planning and a long list of programming and architectural talents inside the IT department—and don't forget implementation time and cost.

Most pundits believe some form of standard, simple, vendor-independent integration will emerge over the long term, but that doesn't help CIOs today. Most experts recommend waiting for better integration standards if the costs of operating your systems as-is don't outweigh the costs and benefits of ripping and replacing with a single instance and the business is not missing out on important revenue opportunities because of problems with the current system.

Essentially, single instance and Web services/SOA are two ways to get to the same place, and CIOs will need to choose which path to lead their company down. For much more detail on this choice, see Ben Worthen's piece "Extreme ERP Makeover" www.cio.com/archive/111503/erp.html Here are some very basic guidelines:

You should consider single instance if you...

- Have fairly commonplace business processes that extend across all

divisions
- Have older systems that need to be replaced
- Have multiple ERP instances from a single vendor

You should consider an integration layer if you...

- Have divisions with unique business processes that can't be changed
- Consider an existing investment in best-of-breed solutions a competitive advantage
- Want an environment in which it is easy to integrate new applications

How difficult is it to upgrade ERP software?

It's extremely difficult, unless you are one of the rare companies that did not tinker with the system while installing it. In the early days of ERP, vendors pursued a vision that has since been disproven: Business processes built into the software should be adopted by every customer. Change your business to fit the system. CEOs like the sound of reengineering, but take that logic to the departmental head who won't be able to serve her customers as well with the process in the software box and suddenly reengineering sounds less compelling. CIOs were forced (or acquiesced) to tinker with the innards of these packages to avoid losing valuable chunks of business processes, and it made their lives hell. Vendors ignored this reality for years. They thought changing the system to fit your own processes meant you were a weak girly man who couldn't stand up to your business people. Those processes couldn't be any good anyway if they hadn't made it into the vendors' best practice pool when they developed the stuff. Modifying the core code of ERP was like turning your Pinto into a low rider. You just voided the warranty, dude. Tough luck. ERP vendors would not support customized versions of their software.

When a new version of the highly integrated suite arrived with cool new features, customers sometimes could not afford to install them because they had made so many changes to the previous version. CIOs had built so many different links to the enterprise systems to get them working with other

systems in the company that an upgrade was akin to starting over. Many of the old links had to be torn apart and rewritten to fit with the new version. And many of those rewrites were completely pointless. The new suite might have one new piece and nine others that had changed little since the last version. But it was all so integrated together that every custom link had to be redone, even to the pieces that didn't change.

When vendors began breaking up and componentizing their suites to make them easier to integrate with each other and with legacy systems inside the company, they also broke up one of the value propositions that had been so enticing in the first place: "free" upgrades. Freed of the suite model, enterprise software vendors started charging fresh license fees for the new components they developed. Many early ERP suites had their development "frozen." Customers could continue to get support, but newer features cost extra and worked much better—or sometimes only—with the newer version of the vendor's software. And CIOs stuck with the old suites began wondering where all their maintenance fees had gone. They couldn't afford to upgrade to the newer, componentized version of the vendors' software models and if they could, they'd pay a new license fee for their trouble.

In theory, early users of ERP paid for those new versions of the software through yearly maintenance fees to the vendor that every ERP vendor charges. The largest percentage of those fees went to R&D rather than to support and maintenance of existing software. But the economics became untenable for vendors. When the ERP boom crashed after 2000, sales of new software slowed to a crawl and vendors said they were forced to charge for new components. It may be true, but it ended the short era of "free" upgrades.
Will service-oriented architecture (SOA) replace ERP?

No. Every company needs a core transactional system that records the information from its most important business processes. But companies are realizing that ERP is shifting from being the sum total of their software architecture strategy to being a component of a larger strategy based on expressing technology as specific business services that business people can easily understand—such as "customer record" or "get credit rating," for example—rather than arcane software applications like ERP.

The services strategy entails building an integration layer that is separate and distinct from any of the software applications—including ERP—in a company's portfolio. The foundational piece—known as the messaging infrastructure—is like a good executive assistant—translating, routing and monitoring information from different systems without these systems needing to connect directly. Adding, changing or removing a system becomes a matter of modifying a single link, rather than ripping apart connections to all the different systems it may need to communicate with.

But while the messaging infrastructure makes connecting systems easier, it doesn't free business processes from their mainframe prisons, or eliminate redundancies in applications, or provide any impetus to create a useful architecture. Indeed, a good messaging infrastructure can perpetuate the chaos by making it easier to deal with.

Messaging has long lacked a higher purpose, a strategy. Service objects (or just plain "services") are that strategy, and it is the second core piece of the integration layer. This is an old concept, based on object-oriented programming from the '80s. Services extract pieces of data and business logic from systems and databases around the company and bundle them together into chunks that are expressed in business terms.

At telecom company Verizon, for example, the service called "get CSR" (get customer service record) is a complex jumble of software actions and data and business logic extractions that uses Verizon's messaging infrastructure to access more than 25 systems in as many as four data centers across the country. Before building the "get CSR" service, Verizon developers wanting to get at that critical lump of data would have to build links to all 25 systems—adding their own links on top of the web of links already hanging off the popular systems.

But with the "get CSR" service sitting in a central repository on Verizon's intranet, those developers can now build a single link to the carefully crafted interface that wraps around the service using the Web services standard simple object access protocol (SOAP). Those 25 systems immediately

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line up and march, sending customer information to the new application and saving developers months, even years, of development time each time the service is used.

The most interesting new "feature" being developed by the ERP vendors today is the extent to which they will make their software part of a service SOA using their own homegrown integration software, known as middleware, and Web services so that customers can more easily link ERP with other types of software in the architecture. Each vendor has claimed fealty to the concept and each has its own vision of how to create an integration layer independent of its own software that is capable of linking to any other piece of software in the universe. But view their pronouncements skeptically because if they do it well they will eliminate an important piece of their competitive differentiation: dominance over the software acquisition process of their customers.

When CIOs call themselves a "SAP shop" or an "Oracle shop," it's because software from those companies dominates their architecture and new software from those providers works better with their existing code base than does code from other vendors. Vendors who make integration with their software truly universal eliminate the built-in advantage they have with existing customers. Some ways that vendors use their new middleware strategies to keep customers: The middleware is offered only to customers who upgrade to the latest version of ERP, or customers are charged a fee for using the middleware to link with software from another vendor.
How does ERP fit with e-commerce?

ERP vendors were not prepared for the onslaught of e-commerce. ERP is complex and not intended for public consumption. It assumes that the only people handling order information will be your employees, who are highly trained and comfortable with the tech jargon embedded in the software. But now customers and suppliers are demanding access to the same information your employees get through the ERP system—things such as order status, inventory levels and invoice reconciliation—except they want to get all this information simply, without all the ERP software jargon, through your website.

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E-commerce means IT departments need to build two new channels of access into ERP systems—one for customers (otherwise known as business-to-consumer) and one for suppliers and partners (business-to-business). These two audiences want two different types of information from your ERP system. Consumers want order status and billing information, and suppliers and partners want just about everything else.

Traditional ERP vendors are having a hard time building the links between the Web and their software, though they certainly all realize that they must do it and have been working hard for years to develop it. The bottom line, however, is that company with e-commerce ambitions face a lot of hard integration works to make their ERP systems available over the Web. For those companies that were smart—or lucky—enough to have bought their ERP systems from a vendor experienced in developing e-commerce wares, adding easily integrated applications from that same vendor can be a money-saving option. For those companies whose ERP systems came from vendors that are less experienced with e-commerce development, the best—and possibly only—option might be to have a combination of internal staff and consultants hack through a custom integration.

But no matter what the details are, solving the difficult problem of integrating ERP and e-commerce requires careful planning, which is key to getting integration off on the right track.
Can I use ERP to manage a network of foreign suppliers?

ERP was designed at a time when process management was an internal affair. The systems have lagged behind the explosive growth of globalization and offshore outsourcing of manufacturing. When most U.S. manufacturing was still mostly local, companies could link their ERP systems through expensive electronic data interchange (EDI) connections. But EDI links (and ERP systems themselves) never penetrated much beyond a manufacturer's top tier (read biggest, richest) of suppliers, due to the cost of installing and managing the links at the supplier. In third-world manufacturing destinations, even an Internet connection is often a luxury. The market for managing the core ERP information (orders, inventory, etc.) of the "extended

supply chain," is only now beginning to emerge.

Ideal ERP's:

Ideally, ERP delivers a single database that contains all data for the software modules, which would include:

*Manufacturing *

Engineering, Bills of Material, Scheduling, Capacity, Workflow Management, Quality Control, Cost Management, Manufacturing Process, Manufacturing Projects, Manufacturing Flow

Manufacturing, a branch of industry, is the application of tools and a processing medium to the transformation of raw materials into finished goods for sale. This effort includes all intermediate processes required for the production and integration of a product's components. Some industries, such as semiconductor and steel manufacturers use the term fabrication instead. The manufacturing sector is closely connected with engineering. Manufacturing accounts for about one-quarter of the world's economic activity According to some unorthodox economists, manufacturing is a wealth producing sector of an economy, whereas a service sector tends to be wealth consuming Emerging technologies have provided some new growth in advanced manufacturing employment opportunities in the Manufacturing Belt in the United States. Manufacturing provides important material support for national infrastructure and for national defense.

On the other hand, some manufacturing may involve significant social and environmental costs. The clean-up costs of hazardous waste, for example, may outweigh the benefits. Hazardous materials may expose workers to health risks. Developed countries regulate manufacturing activity with labor laws and environmental laws. In the United States, manufacturers are subject to regulations by the Occupational Safety and Health Administration and the Environmental Protection Agency. In Europe, pollution taxes to offset environmental costs are another form of regulation on manufacturing

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activity. Labor Unions and craft guilds have played a historic role negotiation of worker rights and wages. Environment laws and labor protections that are available in developed nations may not be available in the third world. Tort law and product liability impose additional costs on manufacturing.

*Supply Chain Management *

Inventory, Order Entry, Purchasing, Product Configurator, Supply Chain Planning, Supplier Scheduling, Inspection of goods, Claim Processing, Commission Calculation

Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption. The term supply chain management was coined by The definition one Americaprofessional association put forward is that Supply Chain Management
encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies.

Supply chain event management (abbreviated as SCEM) is a consideration of all possible occurring events and factors that can cause a disruption in a supply chain. With SCEM possible scenarios can be created and solutions can be planned.

Some experts distinguish supply chain management and logistics, while others consider the terms to be interchangeable.

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Supply chain management is also a category of software products.

Consultant Keith Oliver, of strategy consulting firm Booz Allen Hamilton in 1982.
Supply chain management problems

Supply chain management must address the following problems:

- Distribution Network Configuration: Number and location of suppliers, production facilities, distribution centers, warehouses and customers.
- Distribution Strategy: Centralized versus decentralized, direct shipment, Cross docking, pull or push strategies, third party logistics.
- Information: Integrate systems and processes through the supply chain to share valuable information, including demand signals, forecasts, inventory and transportation.
- Inventory Management: Quantity and location of inventory including raw materials, work-in-process and finished goods.

Activities/Functions

Supply chain management is a cross-functional approach to managing the movement of raw materials into an organization and the movement of finished goods out of the organization toward the end-consumer. As corporations strive to focus on core competencies and become more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other corporations that can perform the activities better or more cost effectively. The effect has been to increase the number of companies involved in satisfying consumer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts. The purpose of supply chain management is to improve trust and collaboration among supply chain partners, thus improving inventory visibility and improving inventory velocity.

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Several models have been proposed for understanding the activities required to manage material movements across organizational and functional boundaries. SCOR is a supply chain management model promoted by the Supply-Chain Management Council. Another model is the SCM Model proposed by the Global Supply Chain Forum (GSCF). Supply chain activities can be grouped into strategic, tactical, and operational levels of activities.
Strategic

- Strategic network optimization, including the number, location, and size of warehouses, distribution centers and facilities.
- Strategic partnership with suppliers, distributors, and customers, creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics.
- Product design coordination, so that new and existing products can be optimally integrated into the supply chain, load management
- Information Technology infrastructure, to support supply chain operations.
- Where to make and what to make or buy decisions
- Align Overall Organizational Strategy with supply strategy

Tactical

- Sourcing contracts and other purchasing decisions.
- Production decisions, including contracting, locations, scheduling, and planning process definition.
- Inventory decisions, including quantity, location, and quality of inventory.
- Transportation strategy, including frequency, routes, and contracting.
- Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.
- Milestone Payments

Operational

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- Daily production and distribution planning, including all nodes in the supply chain.
- Production scheduling for each manufacturing facility in the supply chain (minute by minute).
- Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers.
- Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.
- Inbound operations, including transportation from suppliers and receiving inventory.
- Production operations, including the consumption of materials and flow of finished goods.
- Outbound operations, including all fulfillment activities and transportation to customers.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.
- Performance tracking of all activities

Supply Chain Management

Nowadays, one of the few outcomes in the constantly changing business world is that organizations can no longer compete solely as individual entities. Increasingly, they must rely on effective supply chains, or networks, to successfully compete in the global market and networked economy (Baziotopoulos, 2004). Peter Drucker's (1998) management's new paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

During the past decades, globalization, outsourcing and information technology have enabled many organizations such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities (Scott, 1993). This inter-organizational supply network can be acknowledged as a new form of organization. However, with the complicated interactions

among the players, the network structure fits neither "market" nor "hierarchy" categories (Powell, 1990). It is not clear what kind of performance impacts different supply network structures could have on firms, and little is known about the coordination conditions trade-offs that may exist among the players. From a system's point of view, a complex network structure can be decomposed into individual component firms (Zhang and Dilts, 2004). Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players. Therefore, the choice of internal management control structure is known to impact local firm performance (Mintzberg, 1979).

In the 21st century, there have been few changes in business environment that have contributed to the development of supply chain networks. First, as an outcome of globalization and proliferation of multi-national companies, joint ventures, strategic alliances and business partnerships were found to be significant success factors, following the earlier "Just-In-Time", "Lean Management" and "Agile Manufacturing" practices (McDuffie and Helper, 1997; Monden, 1993; Womack and Jones, 1996; Gunasegaram, 1999). Second, technological changes, particularly the dramatic fall in information communication costs, a paramount component of transaction costs, has led to changes in coordination among the members of the supply chain network (Coase, 1998).

Many researchers have recognized these kinds of supply network structure as a new organization form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", Global Production Network", and "Next Generation Manufacturing System" (Drucker, 1998; Tap Scott, 1996; Dilts, 1999). In general, such structures can be defined as "a group of semi-independent organizations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration" (Ackerman's, 2001).
Supply Chain Business Process Integration

Successful SCM requires a change from managing individual functions to

integrating activities into key supply chain processes. An example scenario: the purchasing department places orders as requirements become appropriate. Marketing, responding to customer demand, communicates with several distributors and retailers, and attempts to satisfy this demand. Shared information between supply chain partners can only be fully leveraged through process integration.

Supply chain business process integration involves collaborative work between buyers and suppliers, joint product development, common systems and shared information. According to Lambert and Cooper (2000) operating an integrated supply chain requires continuous information flows, which in turn assist to achieve the best product flows. However, in many companies, management has reached the conclusion that optimizing the product flows cannot be accomplished without implementing a process approach to the business. The key supply chain processes stated by Lambert (2004) are:

- Customer relationship management
- Customer service management
- Demand management
- Order fulfillment
- Manufacturing flow management
- Supplier relationship management
- Product development and commercialization
- Returns management

One could suggest other key critical supply business processes combining these processes stated by Lambert such as:

1. Customer service Management
2. Procurement
3. Product development and Commercialization
4. Manufacturing flow management/support
5. Physical Distribution
6. Outsourcing/ Partnerships
7. Performance Measurement

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a) *Customer service management process*

Customer service provides the source of customer information. It also provides the customer with real-time information on promising dates and product availability through interfaces with the company's production and distribution operations.

b) *Procurement process*

Strategic plans are developed with suppliers to support the manufacturing flow management process and development of new products. In firms where operations extend globally, sourcing should be managed on a global basis. The desired outcome is a win-win relationship, where both parties benefit, and reduction times in the design cycle and product development is achieved. Also, the purchasing function develops rapid communication systems, such as electronic data interchange (EDI) and Internet linkages to transfer possible requirements more rapidly. Activities related to obtaining products and materials from outside suppliers. This requires performing resource planning, supply sourcing, negotiation, order placement, inbound transportation, storage and handling and quality assurance. Also, includes the responsibility to coordinate with suppliers in scheduling, supply continuity, hedging, and research to new sources or programmes.

c) *Product development and commercialization*

Here, customers and suppliers must be united into the product development process, thus to reduce time to market. As product life cycles shorten, the appropriate products must be developed and successfully launched in ever shorter time-schedules to remain competitive. According to Lambert and Cooper (2000), managers of the product development and commercialization process must:

1. coordinate with customer relationship management to identify customer-articulated needs;
2. select materials and suppliers in conjunction with procurement, and

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3. develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow for the product/market combination.

d) Manufacturing flow management process

The manufacturing process is produced and supplies products to the distribution channels based on past forecasts. Manufacturing processes must be flexible to respond to market changes, and must accommodate mass customization. Orders are processes operating on a just-in-time (JIT) basis in minimum lot sizes. Also, changes in the manufacturing flow process lead to shorter cycle times, meaning improved responsiveness and efficiency of demand to customers. Activities related to planning, scheduling and supporting manufacturing operations, such as work-in-process storage, handling, transportation, and time phasing of components, inventory at manufacturing sites and maximum flexibility in the coordination of geographic and final assemblies postponement of physical distribution operations.

e) *Physical Distribution*

This concerns movement of a finished product/service to customers. In physical distribution, the customer is the final destination of a marketing channel, and the availability of the product/service is a vital part of each channel participant's marketing effort. It is also through the physical distribution process that the time and space of customer service become an integral part of marketing, thus it links a marketing channel with its customers (e.g. links manufacturers, wholesalers, retailers).

f) *Outsourcing/Partnerships*

This is not just outsourcing the procurement of materials and components, but also outsourcing of services that traditionally have been provided in-house. The logic of this trend is that the company will increasingly focus on those activities in the value chain where it has a distinctive advantage and everything else it will outsource. This movement has been

particularly evident in logistics where the provision of transport, warehousing and inventory control is increasingly subcontracted to specialists or logistics partners. Also, to manage and control this network of partners and suppliers requires a blend of both central and local involvement. Hence, strategic decisions need to be taken centrally with the monitoring and control of supplier performance and day-to-day liaison with logistics partners being best managed at a local level.

g) *Performance Measurement*

Experts found a strong relationship from the largest arcs of supplier and customer integration to market share and profitability. By taking advantage of supplier capabilities and emphasizing a long-term supply chain perspective in customer relationships can be both correlated with firm performance. As logistics competency becomes a more critical factor in creating and maintaining competitive advantage, logistics measurement becomes increasingly important because the difference between profitable and unprofitable operations becomes narrower. A.T. Kearney Consultants (1985) noted that firms engaging in comprehensive performance measurement realized improvements in overall productivity. According to experts internal measures are generally collected and analyzed by the firm including

1. Cost
2. Customer Service
3. Productivity measures
4. Asset measurement, and
5. Quality.

External performance measurement is examined through customer perception measures and "best practice" benchmarking, and includes 1) Customer perception measurement, and 2) Best practice benchmarking.

Components of Supply Chain Management are 1. Standardisation 2. Postponement 3. Customisation
* *Supply Chain Management Components Integration

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The management components of SCM

The SCM management components are the third element of the four-square circulation framework. The level of integration and management of a business process link is a function of the number and level, ranging from low to high, of components added to the link (Ellram and Cooper, 1990; Houlihan, 1985). Consequently, adding more management components or increasing the level of each component can increase the level of integration of the business process link. The literature on business process reengineering (McNeill, 1975; Williamson, 1974; Hewitt, 1994), buyer-supplier relationships (Stevens, 1989; Ellram and Cooper, 1993; Ellram and Cooper, 1990; Houlihan, 1985), and SCM (Cooper *et al.*, 1997; Lambert *et al.*, 1996; Turnbull, 1990) suggests various possible components that must receive managerial attention when managing supply relationships. Lambert and Cooper (2000) identified the following components which are:

- Planning and control
- Work structure
- Organization structure
- Product flow facility structure
- Information flow facility structure
- Management methods
- Power and leadership structure
- Risk and reward structure
- Culture and attitude

However, a more careful examination of the existing literature (Zhang and Dilts, 2004 ;Vickery *et al.*, 2003; Hemila, 2002; Christopher, 1998; Joyce *et al.*, 1997; Bowersox and Closs, 1996; Williamson, 1991; Courtright *et al.*, 1989; Hofstede, 1978) will lead us to a more comprehensive structure of what should be the key critical supply chain components, the "branches" of the previous identified supply chain business processes, that is what kind of relationship the components may have that are related with suppliers and customers accordingly. Bowersox and Closs states that the emphasis on cooperation represents the synergism leading to the highest level of joint achievement (Bowersox and Closs, 1996). A primary level channel participant

is a business that is willing to participate in the inventory ownership responsibility or assume other aspects financial risk, thus including primary level components (Bowersox and Closs, 1996). A secondary level participant (specialized), is a business that participates in channel relationships by performing essential services for primary participants, thus including secondary level components, which are supporting the primary ones. Also, third level channel participants and components may be included, that will support the primary level channel participants, and which are the fundamental branches of the secondary level components.

Consequently, Lambert and Cooper's framework of supply chain components, does not lead us to the conclusion about what are the primary or secondary (specialized) level supply chain components (see Bowersox and Closs, 1996, p.g. 93), that is what supply chain components should be viewed as primary or secondary, and how should these components be structured in order to have a more comprehensive supply chain structure and to examine the supply chain as an integrative one (See above sections 2.1 and 3.1).

Baziotopoulos reviewed the literature to identify supply chain components (Stevens, 1989; Ellram and Cooper, 1993; Mills *et al.*, 2004; Lewis and Talalayevsky, 2004; Hedberg and Olhager, 2002; Hemila, 2002; Vickery et.al., 2003; Yusuf *et al.*, 2003; Handfield and Bechtel, 2001; Prater *et al.*, 2001; Kern and Willcocks, 2000; Bowersox and Closs, 1996; Christopher, 1992; Bowersox, 1989). Based on this study, Baziotopoulos (2004) suggests the following supply chain components (Fig.8):

1. For *Customer Service Management*: Includes the primary level component of customer relationship management, and secondary level components such as benchmarking and order fulfillment.
2. For *Product Development and Commercialization*: Includes the primary level component of Product Data Management (PDM), and secondary level components such as market share, customer satisfaction, profit margins, and returns to stakeholders.
3. For *Physical Distribution, Manufacturing support and Procurement*: Includes the primary level component of Enterprise Resource Planning (ERP), with secondary level components such as warehouse management, material

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management, manufacturing planning, personnel management, and postponement (order management).
4. For *Performance Measurement*: This includes the primary level component of logistics performance measurement, which is correlated with the information flow facility structure within the organization. Secondary level components may include four types of measurement such as: variation, direction, decision and policy measurements. More specifically, in accordance with these secondary level components total cost analysis (TCA), customer profitability analysis (CPA), and Asset management could be concerned as well. In general, information flow facility structure is regarded by two important requirements, which are a) planning and Coordination flows, and b)operational requirements.
5. For *Outsourcing*: This includes the primary level component of management methods and the company's cutting-edge strategy and its vital strategic objectives that the company will identify and adopt for particular strategic initiatives in key the areas of technology information, operations, manufacturing capabilities, and logistics (secondary level components).

*Financials *

General Ledger, Cash Management, Accounts Payable, Accounts Receivable, Fixed Assets

Finance studies and addresses the ways in which individuals, businesses, and organizations raise, allocate, and use monetary resources over time, taking into account the risks entailed in their projects. The term finance may thus incorporate any of the following:

The study of money and other assets

The management and control of those assets

Profiling and managing project risks

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As a verb, "to finance" is to provide funds for business

The activity of finance is the application of a set of techniques that individuals and organizations (entities) use to manage their financial affairs, particularly the differences between income and expenditure and the risks of their investments.

An entity whose income exceeds its expenditure can lend or invest the excess income. On the other hand, an entity whose income is less than its expenditure can raise capital by borrowing or selling equity claims, decreasing its expenses, or increasing its income. The lender can find a borrower, a financial intermediary, such as a bank or buy notes or bonds in the bond market. The lender receives interest, the borrower pays a higher interest than the lender receives, and the financial intermediary pockets the difference.

A bank aggregates the activities of many borrowers and lenders. A bank accepts deposits from lenders, on which it pays the interest. The bank then lends these deposits to borrowers. Banks allow borrowers and lenders of different sizes to coordinate their activity. Banks are thus compensators of money flows in space since they allow different lenders and borrowers to meet, and in time, since every borrower, in theory, will eventually pay back.

A specific example of corporate finance is the sale of stock by a company to institutional investors like investment banks, who in turn generally sell it to the public. The stock gives whoever owns it part ownership in that company. If you buy one share of XYZ Inc, and they have 100 shares available, you are 1/100 owner of that company. You own 1/100 of the net difference between assets and liabilities on the balance sheet. Of course, in return for the stock, the company receives cash, which it uses to expand its business in a process called "equity financing". Equity financing mixed with the sale of bonds (or any other debt financing) is called the company's capital structure.

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Finance is used by individuals (personal finance), by governments (public finance), by businesses (corporate finance), etc., as well as by a wide variety of organizations including schools and non-profit organizations. In general, the goals of each of the above activities are achieved through the use of appropriate financial instruments, with consideration to their institutional setting.

Personal finance

Questions in personal finance revolve around

How much money will be needed by an individual (or by a family) at various points in the future?

Where will this money come from (e.g. savings or borrowing)?

How can people protect themselves against unforeseen events in their lives, and risk in financial markets?

How can family assets be best transferred across generations (bequests and inheritance)?

How do taxes (tax subsidies or penalties) affect personal financial decisions?

Personal financial decisions may involve paying for education, financing durable goods such as real estate and cars, buying insurance, e.g. health and property insurance, investing and saving for retirement.

Business finance

In the case of a company, managerial finance or corporate finance is the task of providing the funds for the corporations' activities. It generally involves balancing risk and profitability. Long term funds would be provided by ownership equity and long-term credit, often in the form of bonds. These decisions lead to the company's capital structure. Short term funding or

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working capital is mostly provided by banks extending a line of credit.

On the bond market, borrowers package their debt in the form of bonds. The borrower receives the money it borrows by selling the bond, which includes a promise to repay the value of the bond with interest. The purchaser of a bond can resell the bond, so the actual recipient of interest payments can change over time. Bonds allow lenders to recoup the value of their loan by simply selling the bond.

Another business decision concerning finance is investment, or fund management. An investment is an acquisition of an asset in the hopes that it will maintain or increase its value. In investment management - in choosing a portfolio - one has to decide what, how much and when to invest. In doing so, one needs to

Identify relevant objectives and constraints: institution or individual - goals - time horizon - risk aversion - tax considerations

Identify the appropriate strategy: active vs passive - hedging strategy

*Measure the portfolio performance *

Financial management is duplicate with the financial function of the Accounting profession. However, Financial Accounting is more concerned with the reporting of historical financial information, while the financial decision is directed toward the future of the firm.

Shared Services

There is currently a move towards converging and consolidating Finance provisions into shared services within an organization. Rather than an organization having a number of separate Finance departments performing the same tasks from different locations a more centralized version can be created.

Finance of states

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Country, state, county, city or municipality finance is called public finance. It is concerned with

Identification of required expenditure of a public sector entity

Source(s) of that entity's revenue

*The budgeting process *

Debt issuance (municipal bonds) for public works projects

Financial economics

Financial economics is the branch of economics studying the interrelation of financial variables, s.a. prices, interest rates and shares as opposed to those concerning the real economy. Financial economics concentrates on influences of real economic variables on financial ones, in contrast to pure finance.

It studies:

Valuation - Determination of the fair value of an asset

How risky is the asset? (identification of the asset appropriate discount rate)

What cash flows will it produce? (discounting of relevant cash flows)

How does the market price compare to similar assets? (relative valuation)

Are the cash flows dependent on some other asset or event? (derivatives, contingent claim valuation)

*Financial markets and instruments *

Commodities

Stocks

Bonds

Money market instruments

Derivatives Financial institutions and regulation

Financial mathematics

Financial mathematics is the main branch of applied mathematics concerned with the financial markets. Financial mathematics is the study of financial data with the tools of mathematics, mainly statistics. Such data can be movements of securities - stocks and bonds etc. - and their relations. Another large subfield is insurance mathematics.

Experimental finance

The goals of experimental finance are to establish different market settings and environments to observe experimentally and analyze agents' behavior and the resulting characteristics of trading flows, information diffusion and aggregation, price setting mechanisms, and returns processes. Researchers in experimental finance can study to what extent existing financial economics theory makes valid predictions, and attempt to discover new principles on which such theory can be extended. Research may proceed by conducting trading simulations or by establishing and studying the behaviour of people in artificial competitive market-like settings.

*Projects *

Costing, Billing, Time and Expense, Activity Management

A project is a temporary endeavor undertaken to create a unique product<http://en.wikipedia.org/w/index.php?title=Product_%28project_management%29&action=edit>or service <http://en.wikipedia.org/wiki/Service>.

In the above definition "temporary" means any project will have a start date and end date, doesn't mean short in duration. Unique means the product or service at the end of the project should be some thing different than the existing (Can be an invention or an innovation.)

It can also comprise an ambitious plan <http://en.wikipedia.org/wiki/Plan>to define and constrain <http://en.wikipedia.org/wiki/Constrain> a future by limiting it to set goals and parameters. The planning, execution and monitoring of major projects sometimes involves setting up a special temporary organization<http://en.wikipedia.org/wiki/Organization>, consisting of a project team <http://en.wikipedia.org/wiki/Project_team> and one or more work teams<http://en.wikipedia.org/w/index.php?title=Work_team&action=edit>. A *project* usually needs resources<http://en.wikipedia.org/wiki/Factors_of_production> .

The word *project* comes from the Latin <http://en.wikipedia.org/wiki/Latin>word *projectum* from *projicere*, "to throw something forwards" which in turn comes from *pro-*, which denotes something that precedes the action of the next part of the word in time (paralleling the Greek<http://en.wikipedia.org/wiki/Greek_language>πρό) and *jacere*, "to throw". The word "project" thus actually originally meant "something that comes before anything else is done". When the word was initially adopted, it referred to a plan of something, not to the act of actually carrying this plan out. Something performed in accordance with a project was called an object<http://en.wikipedia.org/wiki/Object_%28task%29>. This use of "project" changed in the 1950s<http://en.wikipedia.org/wiki/1950s>when several techniques for

project
management <http://en.wikipedia.org/wiki/Project_management> were
introduced: with this advent the word slightly changed meaning to cover both
projects and objects. However in certain projects there may still exist so
called *objects* and *object leaders<http://en.wikipedia.org/wiki/Leadership>
*, reflecting the older use of the words.

One may also think in terms of
platonism<http://en.wikipedia.org/wiki/Platonism>,
where *ideas <http://en.wikipedia.org/wiki/Idea>* from the realm of ideals
are *projected* onto the physical world<http://en.wikipedia.org/wiki/Physics>.
(See: Plato's allegory of the
cave<http://en.wikipedia.org/wiki/Plato%27s_allegory_of_the_cave>
.)

Particularly liked by Western business<http://en.wikipedia.org/wiki/Business>,
projects can subdivide into sub-projects and spawn an industrial sub-culture
of project planning <http://en.wikipedia.org/wiki/Project_planning> and project
management <http://en.wikipedia.org/wiki/Project_management>, all oblivious
to more holistic developments.

Some feel this habit of short-termism has permeated
economic<http://en.wikipedia.org/wiki/Economics>planning and personal
growth<http://en.wikipedia.org/w/index.php?title=Personal_growth&action=edit>to
the detriment of cyclical and
multi-cultural <http://en.wikipedia.org/wiki/Multiculturalism> world views.
Alternatives to project-centric planning include trend-oriented
goal-setting<http://en.wikipedia.org/w/index.php?title=Trend-oriented_goal-
setting&action=edit>and
directional
planning<http://en.wikipedia.org/w/index.php?title=Directional_planning&action=edit>
.

*Human Resources *

Human Resources, Payroll, Training, Time & Attendance, Benefits

Modern analysis emphasizes that human beings are not predictable commodity "resources" with definitions totally controlled by contract, but are creative and social beings that make contributions beyond "labor" to a society and to civilization <http://en.wikipedia.org/wiki/Civilization>. The broad term human capital <http://en.wikipedia.org/wiki/Human_capital> has evolved to contain the complexity of this term, and in macro-economics<http://en.wikipedia.org/wiki/Macro-economics>the term "firm-specific human capital" has evolved to represent the original meaning of term "human resources".

Advocating the central role of "human resources" or human capital in enterprises and societies has been a traditional role of socialist parties<http://en.wikipedia.org/wiki/Socialism>, who claim that value is primarily created by their activity, and accordingly justify a larger claim of profits or relief from these enterprises or societies. Critics say this is just a bargaining tactic which grew out of various practices of medieval European guilds<http://en.wikipedia.org/wiki/Guild>into the modern trade union <http://en.wikipedia.org/wiki/Trade_union> and collective bargaining unit <http://en.wikipedia.org/wiki/Collective_bargaining_unit>.

A contrary view, common to capitalist parties<http://en.wikipedia.org/wiki/Capitalism>, is that it is the infrastructural capital<http://en.wikipedia.org/wiki/Infrastructural_capital>and (what they call) intellectual capital <http://en.wikipedia.org/wiki/Intellectual_capital> owned and fused by "management" that provides most value in financial capital<http://en.wikipedia.org/wiki/Financial_capital>terms. This likewise justifies a bargaining position and a general view that "human resources" are interchangeable.

A significant sign of consensus on this latter point is the ISO 9000<http://en.wikipedia.org/wiki/ISO_9000>series of standards which requires a "job description" of every participant

in a productive enterprise. In general, heavily unionized nations such as France <http://en.wikipedia.org/wiki/France> and Germany<http://en.wikipedia.org/wiki/Germany>have adopted and encouraged such descriptions especially within trade unions. One view of this trend is that a strong social consensus on political economy <http://en.wikipedia.org/wiki/Political_economy> and a good social welfare system <http://en.wikipedia.org/wiki/Social_welfare_system>facilitates labor mobility <http://en.wikipedia.org/wiki/Labor_mobility> and tends to make the entire economy more productive, as labor can move from one enterprise to another with little controversy or difficulty in adapting.

An important controversy regarding labor mobility illustrates the broader philosophical issue with usage of the phrase "human resources": governments of developing nations often regard developed nations that encourage immigration or "guest workers" as appropriating human capital that is rightfully part of the developing nation and required to further its growth as a civilization <http://en.wikipedia.org/wiki/Civilization>. They argue that this appropriation is similar to colonial commodity fiat<http://en.wikipedia.org/wiki/Colonial_commodity_fiat>wherein a colonizing European power would define an arbitrary price for natural resources <http://en.wikipedia.org/wiki/Natural_resources>, extracting which diminished national natural capital<http://en.wikipedia.org/wiki/Natural_capital>
.

The debate regarding "human resources" versus human capital thus in many ways echoes the debate regarding natural resources versus natural capital. Over time the United Nations <http://en.wikipedia.org/wiki/United_Nations>have come to more generally support the developing nations' point of view, and have requested significant offsetting "foreign aid" contributions so that a developing nation losing human capital does not lose the capacity to continue to train new people in trades, professions, and the arts.

An extreme version of this view is that historical inequities such as African

slavery <http://en.wikipedia.org/wiki/African_slavery> must be compensated by current developed nations, which benefitted from stolen "human resources" as they were developing. This is an extremely controversial view, but it echoes the general theme of converting human capital to "human resources" and thus greatly diminishing its value to the host society, i.e. "Africa", as it is put to narrow imitative use as "labor" in the using society.

In the very narrow context of corporate "human resources", there is a contrasting pull to reflect and require workplace diversity<http://en.wikipedia.org/wiki/Workplace_diversity>that echoes the diversity of a global customer base. Foreign language and culture skills, ingenuity, humor, and careful listening, are examples of traits that such programs typically require. It would appear that these evidence a general shift to the human capital point of view, and an acknowledgement that human beings do contribute much more to a productive enterprise than "work": they bring their character, their ethics, their creativity, their social connections, and in some cases even their pets and children, and alter the character of a workplace. The term corporate culture<http://en.wikipedia.org/wiki/Corporate_culture>is used to characterize such processes.

The traditional but extremely narrow context of hiring, firing, and job description is considered a 20th century anachronism. Most corporate organizations that compete in the modern global economy have adopted a view of human capital that mirrors the modern consensus as above. Some of these, in turn, deprecate the term "human resources" as useless.

As the term refers to predictable exploitations of human capital in one context or another, it can still be said to apply to manual labor<http://en.wikipedia.org/wiki/Manual_labour>, mass agriculture <http://en.wikipedia.org/wiki/Agriculture>, low skill " McJobs <http://en.wikipedia.org/wiki/McJob>" in service industries, military and other work that has clear job descriptions, and which generally do not encourage creative or social contributions.

In general the abstractions of macro-economics treat it this way - as it

characterizes no mechanisms to represent choice or ingenuity. So one interpretation is that "firm-specific human capital" as defined in macro-economics is the modern and correct definition of "human resources" - and that this is inadequate to represent the contributions of "human resources" in any modern theory of political economy<http://en.wikipedia.org/wiki/Political_economy>
.
Human resource development in relation to recruitment and selection

In terms of recruitment and selection it is important to consider carrying out a thorough job analysis <http://en.wikipedia.org/wiki/Job_analysis> to determine the level of skills/technical abilities, competencies, flexibility of the employee required etc. At this point it is important to consider both the internal and external factors that can have an impact on the recruitment of employees. The external factors are those out-with the powers of the organization and include issues such as current and future trends of the labor market e.g. skills, education level, government investment into industries etc. On the other hand internal influences are easier to control, predict and monitor, for example management styles or even the organizational culture <http://en.wikipedia.org/wiki/Organizational_culture>.

In order to know the business environment in which any organization operates, three major trends should be considered:

- Demographics – the characteristics of a population/workforce, for example, age, gender or social class. This type of trend may have an effect in relation to pension offerings, insurance packages etc.
- Diversity <http://en.wikipedia.org/wiki/Diversity> – the variation within the population/workplace. Changes in society now mean that a larger proportion of organizations are made up of female employees in comparison to thirty years ago. Also over recent years organizations have become more culturally diverse and have increased the number of working patterns (part-time, casual, seasonal positions) to cope with the changes in both society and the global market. It is important to note here that an organisation must consider the ethic and legal implications of their decisions in relation to the HRM policies they enact to protect employees.

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Employers have to be acutely aware of the rise in discrimination, unfair dismissal and sexual/racial harassment cases in recent years and the detrimental effects this can have on the employees and the organisation. Anti-discrimination legislation over the past 30 years has provided a foundation for an increasing interest in diversity at work which is "about creating a working culture that seeks respects and values difference."
- Skills and qualifications – as industries move from manual to a more managerial professions so does the need for more highly skilled graduates. If the market is 'tight' i.e. not enough staff for the jobs, employers will have to compete for employees by offering financial rewards, community investment etc.also the political issues

In regards to how individuals respond to the changes in a labour market the following should be understood:

- Geographical spread – how far is the job from the individual? The distance to travel to work should be in line with the pay offered by the organization and the transportation and infrastructure of the area will also be an influencing factor in deciding who will apply for a post.
- Occupational structure – the norms and values of the different careers within an organization. Mahoney 1989 developed 3 different types of occupational structure namely craft (loyalty to the profession), organization career (promotion through the firm) and unstructured (lower/unskilled workers who work when needed).
- Generational difference –different age categories of employees have certain characteristics, for example their behaviour and their expectations of the organisation.

Recruitment methods are wide and varied, it is important that the job is described correctly and any personal specifications stated. Job recruitment methods can be through job centres, employment agencies/consultants, headhunting, and local/national newspapers. It is important that the correct media is chosen to ensure an appropriate response to the advertised post. Human resources within firms

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Though human resources have been part of business and organizations since the first days of agriculture, the modern concept of human resources began in reaction to the efficiency focus of Taylorism<http://en.wikipedia.org/wiki/Taylorism>in the early 1900s. By 1920, psychologists and employment experts in the United States <http://en.wikipedia.org/wiki/United_States> started the human relations <http://en.wikipedia.org/wiki/Human_relations> movement, which viewed workers in terms of their psychology<http://en.wikipedia.org/wiki/Psychology>and fit with companies, rather than as interchangeable parts. This movement grew throughout the middle of the 20th century, placing emphasis on how leadership <http://en.wikipedia.org/wiki/Leadership>, cohesion, and loyalty played important roles in organizational success. Although this view was increasingly challenged by more quantitatively rigorous and less "soft" management techniques in the 1960s and beyond, human resources had gained a permanent role within the firm.

*Customer Relationship Management *

Sales and Marketing, Commissions, Service, Customer Contact and Call Centersupport

Customer relationship management (CRM) covers methods and technologies used by companies to manage their relationships with clients. Information stored on existing customers (and potential customers) is analyzed and used to this end. Automated CRM processes are often used to generate automatic personalized marketing based on the customer information stored in the system.
Implementing CRM

Customer relationship management is a corporate level strategy, focusing on creating and maintaining relationships with customers. Several commercial

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CRM software packages are available which vary in their approach to CRM. However, CRM is not a technology itself, but rather a holistic approach to an organization's philosophy, placing the emphasis firmly on the customer.

CRM governs an organization's philosophy at all levels, including policies and processes, front-of-house customer service, employee training, marketing, systems and information management. CRM systems are integrated end-to-end across marketing, sales, and customer service.

A CRM system should:

- Identify factors important to clients.
- Promote a customer-oriented philosophy
- Adopt customer-based measures
- Develop end-to-end processes to serve customers
- Provide successful customer support
- Handle customer complaints
- Track all aspects of sales
- Create a holistic view of customers' sales & services information

CRM Architecture

There are three fundamental components in CRM:

- Operational - automation of basic business processes (marketing, sales, service)
- Analytical - analysis of customer data and behavior using business intelligence
- Collaborative - communicating with clients

Operational CRM

Operational CRM provides automated support to "front office" business processes (sales, marketing and service). Each interaction with a customer is generally added to a customer's history, and staff can retrieve information on customers from the database as necessary

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Sales force automation (SFA) or Sales force management systems

These automate some of a company's critical sales and sales force management tasks, such as forecasting, sales administration, tracking customer preferences and demographics, performance management, lead management, account management, contact management and quote management.

Customer service and support (CSS)

CSS automates certain service requests, complaints, product returns and enquiries.

Enterprise marketing automation (EMA)

EMA provides information about the business environment, including information on competitors, industry trends, and macro environmental variables. EMA applications are used to improve marketing efficiency.

Integrated CRM software is often known as a "front office solution", as it deals directly with customers.

Many call centers use CRM software to store customer information. When a call is received, the system displays the associated customer information (determined from the number of the caller). During and following the call, the call center agent dealing with the customer can add further information.

Some customer services can be fully automated, such as allowing customers to access their bank account details online or via a WAP phone.
Analytical CRM

Analytical CRM analyses data (gathered as part of operational CRM, or from other sources) in an attempt to identify means to enhance a company's relationship with its clients. The results of an analysis can be used to design targeted marketing campaigns, for example:

- Acquisition: Cross-selling, Up-selling
- Retention: Retaining existing customers (antonym: customer attrition)
- Information: Providing timely and regular information to customers

Other examples of the applications of analyses include:

- Contact optimization
- Evaluating and improving customer satisfaction
- Optimizing sales coverage
- Fraud detection
- Financial forecasts
- Price optimization
- Product development
- Program evaluation
- Risk assessment and management
- Strategic Marketing
- Operational marketing

Data collection and analysis is viewed as a continuing and iterative process. Ideally, business decisions are refined over time, based on feedback from earlier analyses and decisions. Most analytical CRM projects use a data warehouse to manage data.
Collaborative CRM

Collaborative CRM focuses on the interaction with customers (personal interaction, letter, fax, phone, Internet, e-mail etc.)

Collaborative CRM includes:

- Providing efficient communication with customers across a variety of communications channels
- Providing online services to reduce customer service costs
- Providing access to customer information while interacting with customers

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Driven by authors from the Harvard Business School(Kracklauer/Mills/Seifert), Collaborative CRM also seems to be the new
paradigm to succeed the leading Efficient Consumer Response and Category Management concept in the industry/ trade relationship.
Uses of CRM

In its broadest sense, CRM covers all interaction and business with customers. A good CRM program allows a business to acquire customers, provide customer services and retain valued customers.

Customer services can be improved by:

- Providing online access to product information and technical assistance around the clock
- Identifying what customers value and devising appropriate service strategies for each customer
- Providing mechanisms for managing and scheduling follow-up sales calls
- Tracking all contacts with a customer
- Identifying potential problems before they occur
- Providing a user-friendly mechanism for registering customer complaints
- Providing a mechanism for handling problems and complaints
- Providing a mechanism for correcting service deficiencies
- Storing customer interests in order to target customers selectively
- Providing mechanisms for managing and scheduling maintenance, repair, and on-going support

Technical Considerations

The following factors need to be considered:

- Scalability: the system should be highly scalable, as the volume of data stored in the system grows over time
- Communication channels: CRM can interface with a variety of

different channels (phone, WAP, Internet etc.)
- Workflow - a company's business processes need to be represented by the system with the ability to track the individual stages and transfer information between steps
- Assignment - the ability to assign requests, such as service requests, to a person or group.
- Database - the means of storing customer data and histories (in a data warehouse)
- Customer privacy considerations, such as data encryption and legislation.

* *Improving Customer Relationships

CRM applications often track customer interests and requirements, as well as their buying habits. This information can be used to target customers selectively. Furthermore, the products a customer has purchased can be tracked throughout the product's life cycle, allowing customers to receive information concerning a product or to target customers with information on alternative products once a product begins to be phased out.

Repeat purchases rely on customer satisfaction, which in turn comes from a deeper understanding of each customer and their individual needs. CRM is an alternative to the "one size fits all" approach. In industrial markets, the technology can be used to coordinate the conflicting and changing purchase criteria of the sector
* *Privacy and Ethical Concerns

The data gathered as part of CRM raises concerns over customer privacy and enables persuasive sales techniques (see persuasion technology). However, CRM does not necessarily involve gathering new data, but also includes making better use of customer information gathered as a result of routine customer interaction.

The privacy debate generally focuses on the customer information stored in the centralized database itself, and fears over a company's handling of this information. For example, there is virtually no way a consumer can determine

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if the company shares private (personally identifiable) data with third parties. Furthermore, companies may not always accurately declare to the consumer the types of information collected by CRM systems and the specific purposes for which the information is used.
CRM for Non-profit Organizations

CRM is also important to non-profit organizations, which sometimes use the terms "*constituent* relationship management", "*contact* relationship management" or "*community* relationship management" to describe their information systems for managing donors, volunteers and other supporters. salesforce.com, a popular CRM service that is on demand, offers its products for free to nonprofit organizations.

*Data Warehouse *

And various Self-Service interfaces for Customers, Suppliers, and Employees

A data warehouse is a computer system for archiving and analyzing an organization's historical data, such as sales, salaries, or other information from day-to-day operations. Normally, an organization copies information from its operational systems (such as sales and human resources) to the data warehouse on a regular schedule, such as every night or every weekend; after that, management can perform complex queries and analysis (such as data mining <http://en.wikipedia.org/wiki/Data_mining>) on the information without slowing down the operational systems.

A data warehouse is the main repository of the organization's historical data, its corporate memory. For example, an organization would use the information that's stored in its data warehouse to find out what day of the week they sold the most widgets in May 1992, or how employee sick leave the week before Christmas differed between California and Quebec from 2001-2005. In other words, the data warehouse contains the raw material for management's decision support system<http://en.wikipedia.org/wiki/Decision_support_system>
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While operational systems are optimized for simplicity and speed of modification (online transaction processing<http://en.wikipedia.org/wiki/Online_transaction_processing>, or OLTP) through heavy use of database normalization<http://en.wikipedia.org/wiki/Database_normalization>and an entity-relationship model <http://en.wikipedia.org/wiki/Entity-relationship_model>, the data warehouse is optimized for reporting and analysis (online analytical processing <http://en.wikipedia.org/wiki/Online_Analytical_Processing>, or OLAP). Frequently data in Data Warehouses is heavily demoralized<http://en.wikipedia.org/wiki/Denormalization>, summarized and/or stored in a dimension-based model<http://en.wikipedia.org/wiki/Star_schema>but this is not always required to achieve acceptable query response times.

More formally, Bill Inman <http://en.wikipedia.org/wiki/Bill_Inmon> (one of the earliest and most influential practitioners) defined a data warehouse as follows:

- Subject-oriented, meaning that the data in the database is organized so that all the data elements relating to the same real-world event or object are linked together;

- Time-variant, meaning that the changes to the data in the database are tracked and recorded so that reports can be produced showing changes over time;

- Non-volatile, meaning that data in the database is never over-written or deleted, but retained for future reporting; and,

- Integrated, meaning that the database contains data from most or all of an organization's operational applications, and that this data is made consistent.

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History of data warehousing

Data Warehouses became a distinct type of computer<http://en.wikipedia.org/wiki/Computer> database <http://en.wikipedia.org/wiki/Database> during the late 1980s and early 1990s. They were developed to meet a growing demand for management information and analysis that could not be met by operational systems. Operational systems were unable to meet this need for a range of reasons:

- The processing load of reporting reduced the response time of the operational systems,
- The database designs of operational systems were not optimized for information analysis and reporting,
- Most organizations had more than one operational system, so company-wide reporting could not be supported from a single system, and
- Development of reports in operational systems often required writing specific computer programs which was slow and expensive

As a result, separate computer databases began to be built that were specifically designed to support management information and analysis purposes. These data warehouses were able to bring in data from a range of different data sources, such as mainframe computers<http://en.wikipedia.org/wiki/Mainframe_computer>, minicomputers <http://en.wikipedia.org/wiki/Minicomputer>, as well as personal computers <http://en.wikipedia.org/wiki/Personal_computer> and office automation software such as spreadsheet<http://en.wikipedia.org/wiki/Spreadsheet>, and integrate this information in a single place. This capability, coupled with user-friendly reporting tools and freedom from operational impacts, has led to a growth of this type of computer system.

As technology improved (lower cost for more performance) and user requirements increased (faster data load cycle times and more features), data warehouses have evolved through several fundamental stages:

- Offline Operational Databases - Data warehouses in this initial stage are developed by simply copying the database of an operational system to an off-line server where the processing load of reporting does not impact on the operational system's performance.
- Offline Data Warehouse - Data warehouses in this stage of evolution are updated on a regular time cycle (usually daily, weekly or monthly) from the operational systems and the data is stored in an integrated reporting-oriented data structure
- Real Time Data Warehouse - Data warehouses at this stage are updated on a transaction or event basis, every time an operational system performs a transaction (e.g. an order or a delivery or a booking etc.)
- Integrated Data Warehouse - Data warehouses at this stage are used to generate activity or transactions that are passed back into the operational systems for use in the daily activity of the organization.

Data Warehouse Architecture

The term Data Warehouse Architecture is primarily used to today to describe the overall structure of a Business Intelligence<http://en.wikipedia.org/wiki/Business_Intelligence>system. Other historical terms include Decision Support Systems <http://en.wikipedia.org/wiki/Decision_Support_Systems>(DSS), Management Information Systems<http://en.wikipedia.org/wiki/Management_Information_Systems>(MIS), and others.

The Data Warehouse Architecture describes the overall system from various perspectives such as Data, Process, and Infrastructure needed to communicate the structure, function and interrelationships of each component. The infrastructure or technology perspective details the various hardware and software products used to implement the distinct components of the overall system. The Data perspective typically diagrams the source and target data structures and aid the user in understanding what data assets are available and how they are related. The process perspective is primarily concerned

with communicating the process and flow of data from the originating source system through the process of loading the data warehouse, and often the process that client products use to access and extract data from the warehouse.
Components of a data warehouse

The primary components of the majority of data warehouses are shown in the attached diagram and described in more detail below:

<http://en.wikipedia.org/wiki/Image:Dwhlayersv3.png>
Data Sources

Data sources refers to any electronic repository of information that contains data of interest for management use or analytics. This definition covers mainframe <http://en.wikipedia.org/wiki/Mainframe_computer> databases (e.g. IBM DB2 <http://en.wikipedia.org/wiki/IBM_DB2>, ISAM<http://en.wikipedia.org/wiki/ISAM>, Adabas <http://en.wikipedia.org/wiki/Adabas>, Teradata<http://en.wikipedia.org/wiki/Teradata>, etc.), client-server <http://en.wikipedia.org/wiki/Client-server> databases (e.g. Teradata <http://en.wikipedia.org/wiki/Teradata>, IBM DB2<http://en.wikipedia.org/wiki/IBM_DB2>, Oracle database <http://en.wikipedia.org/wiki/Oracle_database>, Informix<http://en.wikipedia.org/wiki/Informix>, Microsoft SQL Server <http://en.wikipedia.org/wiki/Microsoft_SQL_Server>, etc.), PC databases (e.g. Microsoft Access<http://en.wikipedia.org/wiki/Microsoft_Access>, Alpha Five <http://en.wikipedia.org/wiki/Alpha_Five>), spreadsheets (e.g. Microsoft Excel <http://en.wikipedia.org/wiki/Microsoft_Excel>) and any other electronic store of data. Data needs to be passed from these systems to the data warehouse either on a transaction-by-transaction basis for real-time data warehouses or on a regular cycle (e.g.daily or weekly) for offline data warehouses.
Data Transformation Layer

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The data transformation layer (aka Extract, transform, load<http://en.wikipedia.org/wiki/Extract%2C_transform%2C_load>- ETL or some variant) is the subsystem concerned with extraction of data from the data sources (source systems), transformation from the source format and structure into the target(data warehouse) format and structure, and loading into the data warehouse.
Data Warehouse

The data warehouse is normally (but does not have to be) a relational database <http://en.wikipedia.org/wiki/Relational_database>. It must be organized to hold information in a structure that best supports not only query and reporting, but also advanced analysis techniques, like data mining. Most data warehouses hold information for at least 1 year and sometimes can reach half century, depending on the business/operations data retention requirement. As a result these databases can become very large.
Reporting

The data in the data warehouse must be available to the organization's staff if the data warehouse is to be useful. There are a very large number of software applications that perform this function, or reporting can be custom-developed. Examples of types of reporting tools include:

· Business intelligence tools<http://en.wikipedia.org/wiki/Business_intelligence_tools>: These are software applications that simplify the process of development and production of business reports based on data warehouse data.

· Executive information systems<http://en.wikipedia.org/wiki/Executive_information_system>(known more widely as Dashboard (business) <http://en.wikipedia.org/wiki/Dashboard_%28business%29>: These are software applications that are used to display complex business metrics and information in a graphical way to allow rapid understanding.

· OLAP <http://en.wikipedia.org/wiki/OLAP> Tools: OLAP tools form data into logical multi-dimensional structures and allow users to select

which dimensions to view data by.

· Data Mining <http://en.wikipedia.org/wiki/Data_Mining>: Data mining tools are software that allow users to perform detailed mathematical and statistical calculations on detailed data warehouse data to detect trends, identify patterns and analyze data.

Metadata

Metadata <http://en.wikipedia.org/wiki/Metadata>, or "data about data", is used not only to inform operators and users of the data warehouse about its status and the information held within the data warehouse, but also as a means of integration of incoming data and a tool to update and refine the underlying DW model.

Examples of data warehouse metadata include table and column names, their detailed descriptions, their connection to business meaningful names, the most recent data load date, the business meaning of a data item and the number of users that are logged in currently.

Operations

Data warehouse operations are comprised of the processes of loading, manipulating and extracting data from the data warehouse. Operations also cover user management, security, capacity management and related functions

Optional Components

In addition, the following components exist in some data warehouses:

1. Dependent Data Marts: A dependent data mart is a physical database (either on the same hardware as the data warehouse or on a separate hardware platform) that receives all its information from the data warehouse. The purpose of a Data Mart is to provide a sub-set of the data warehouse's data for a specific purpose or to a specific sub-group of the organization. A data mart <http://en.wikipedia.org/wiki/Data_mart> is exactly like a data warehouse technically, but it serves a different business purpose: it either holds information for only part of a company (such as a division), or it

holds a small selection of information for the entire company (to support extra analysis without slowing down the main system). In either case, however, it is not the organization's official repository, the way a data warehouse is.

2. Logical Data Marts: A logical data mart is a filtered view of the main data warehouse but does not physically exist as a separate data copy. This approach to data marts delivers the same benefits but has the additional advantages of not requiring additional (costly) disk space and it is always as current with data as the main data warehouse. The downside is that Logical Data Marts can have slower response times than physicalized ones.

3. Operational Data Store<http://en.wikipedia.org/wiki/Operational_Data_Store>:

An ODS is an integrated database of operational data. Its sources include legacy systems, and it contains current or near-term data. An ODS may contain 30 to 60 days of information, while a data warehouse typically contains years of data. ODSs are used in some data warehouse architectures to provide near-real-time reporting capability in the event that the Data Warehouse's loading time or architecture prevents it from being able to provide near-real-time reporting capability.

The Data Architecture - Different methods of storing data in a data warehouse

In OLTP <http://en.wikipedia.org/wiki/OLTP> - online transaction processing systems relational database design use the discipline of data modeling<http://en.wikipedia.org/wiki/Data_modeling>and generally follow the Codd <http://en.wikipedia.org/wiki/Codd> rules of data normalization in order to ensure absolute data integrity. Using these rules complex information is broken down into its most simple structures (a table) where all of the individual atomic level elements relate to each other and satisfy the normalization rules. Codd defines 5 increasing stringent rules of normalization and typically OLTP systems achieve a 3rd level normalization. Fully normalized OLTP database designs often result in having information from a business transaction stored in dozens to hundreds of tables.

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Relational database managers are efficient at managing the relationships between tables and result in very fast insert/update performance because only a little bit of data is affected in each relational transaction.

The business challenge arises when people need to reassemble all the atomic bits into a meaningful record for reporting and analysis. OLTP databases are efficient because they are typically only dealing with the information around a single transaction. In reporting and analysis, thousands to billions of transactions may need to be reassembled imposing a huge workload on the relational database. Given enough time the software can usually return the requested results, but because of the negative performance impact on the machine and all of its hosted applications, data warehousing professional recommend that reporting databases be physically separated from the OLTP database.

In addition, data warehousing suggests that data be restructured and reformatted to facilitate query and analysis by novice users. OLTP databases are designed to provide good performance by rigidly defined applications built by programmers fluent in the constraints and conventions of the technology. Add in frequent enhancements, and to many a database is just a collection of cryptic names, seemingly unrelated and obscure structures that store data using incomprehensible coding schemes. All factors that while improving performance, complicate use by untrained people.

Lastly, the data warehouse needs to support high volumes of data gathered over extended periods of time and are subject to complex queries and need to accommodate formats and definitions of inherited from independently designed package and legacy systems.

Designing the data warehouse data Architecture is the realm of Data Warehouse Architects.

The goal of a data warehouse is to bring data together from a variety of existing databases to support management and reporting needs. The generally accepted principle is that data should be stored at its most elemental level because this provides for the most useful and flexible basis for use in

reporting and information analysis.

However, because of different focus on specific requirements, there can be alternative methods for design and implementing data warehouses. There are two leading approaches to organizing the data in a data warehouse. The dimensional approach advocated by Ralph Kimball<http://en.wikipedia.org/wiki/Ralph_Kimball>and the normalized approach advocated by Bill Inmon <http://en.wikipedia.org/wiki/Bill_Inmon>.

In the "dimensional" approach, transaction data is partitioned into either a measured "facts" which are generally numeric data that captures specific values or "dimensions" which contain the reference information that gives each transaction its context. As an example, a sales transaction would be broken up into facts such as the number of products ordered, and the price paid, and dimensions such as date, customer, product, geographical location and salesperson. The main advantages of a dimensional approach is that the Data Warehouse is easy for business staff with limited information technology <http://en.wikipedia.org/wiki/Information_technology> experience to understand and use. Also, because the data is pre-joined into the dimensional form, the Data Warehouse tends to operate very quickly. The main disadvantage of the dimensional approach is that it is quite difficult to add or change later if the company changes the way in which it does business.

The "normalized" approach uses database normalization<http://en.wikipedia.org/wiki/Database_normalization>. In this method, the data in the data warehouse is stored in third normal form <http://en.wikipedia.org/wiki/Third_normal_form>. Tables are then grouped together by subject areas that reflect the general definition of the data (Customer, Product, Finance etc.). The main advantage of this approach is that it is quite straightforward to add new information into the database -- the primary disadvantage of this approach is that because of the number of tables involved, it can be rather slow to produce information and reports.

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Subject areas are just a method of organizing information and can be defined along any lines. The traditional approach has subjects defined as the subjects or nouns within an problem space. E.g in a Financial Services business area, you might have Customers, products, Contracts, etc. An alternative approach is to organize around the business transactions. E.gCustomer enrollment, Sales, Trades.
Advantages of using data warehouse

There are many advantages to using a data warehouse, some of them are:

- Enhances end-user access to a wide variety of data.
- Business decision makers can obtain various kinds of trend reports e.g. the item with the most sales in a particular area / country for the last two years.

Concerns in using data warehouse

- Extracting, cleaning and loading data could be time consuming.
- Data warehousing project scope might increase.
- Problems with compatibility with systems already in place.
- Providing training to end-users, who end up not using the data warehouse?
- Security could develop into a serious issue, especially if the data warehouse is web accessible.
- Reports and Data may not be trustworthy because anybody can generate reports.
- Data Storage controversy leaves it unclear how to structure my warehouse

ERP or MRP:

Enterprise Resource Planning is a term originally derived from manufacturing

resource planning (MRP II) that followed material requirements planning (MRP). MRP evolved into ERP when "routings" became major part of the software architecture and a company's capacity planning activity also became a part of the standard software activity. ERP systems typically handle the manufacturing, logistics, distribution, inventory, shipping, invoicing, and accounting for a company. Enterprise Resource Planning or ERP software can aid in the control of many business activities, like sales, marketing, delivery, billing, production, inventory management, quality management, and human resources management.

ERP's are often incorrectly called back office systems indicating that customers and the general public are not directly involved. This is contrasted with front office systems like customer relationship management (CRM) systems that deal directly with the customers, or the e-Business systems such as eCommerce, e-Government, e-Telecom, and e-Finance, or supplier relationship management (SRM) systems.

ERP's are cross-functional and enterprise wide. All functional departments that are involved in operations or production are integrated in one system. In addition to manufacturing, warehousing, logistics, and Information Technology, this would include accounting, human resources, marketing, and strategic management.

ERP II means open ERP architecture of components. The older, monolithic ERP systems became component oriented.

EAS - Enterprise Application Suite is a new name for formerly developed ERP systems which include (almost) all segments of business, using ordinary Internet browsers as thin clients

