



DESSERTATION REPORT

On

ERP Implementation at HINDUSTAN CONSTRUCTION
CORPORATION

HCC



Submitted by

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REFERENCE COPY



UNIVERSITY OF PETROLEUM & ENERGY STUDIES

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CERTIFICATE

This is to certify that Mr. Ankit Panwar, Roll No. 500015635/R750211004 student of MBA ISM 2011-13 has done his dissertation on the topic "ERP Implementation at Hindustan Construction Corporation Ltd." for the partial fulfillment of the award of the degree of post graduation under my guidance.

This Report is the result of his own work and to the best of my knowledge no part of it has earlier comprised of any other report, monograph, dissertation or book. This project was carried out under my overall supervision.

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Internal Faculty Guide

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Introduction

Construction business have lot of opportunities abound – but more challenging is not capitalizing on them. Today, successes are determined by what you know about the projects and when you knew it. Then in the field with your crew, you may have all the high-tech tools and equipment needed – but when information determines success, your management team should be equipped similarly. Unfortunately, most of the construction companies struggle with nonintegrated, multiple-vendor legacy systems that provide inaccurate, unknown timely, information and make it difficult to adapt the changing business requirements.

Companies are using various stand-alone systems that maintain the all business process & operation by loosely and scatter coupled application. These legacy and scattered applications are not fully integrated with each other and it is not easy way to integrate them to maintain easily in a better way to get a high level output. High manpower and cost is required to maintain this application. To integrate different department, branches, business vertical and process in a wide area network required an integrated application. ERP – provides the backbone for an enterprise-wide information system. At the core of this enterprise software is a central database which draws data from and feeds data into modular applications that operate on a common computing platform. MNC like HINDUSTAN CONSTRUCTION CORPORATION it is required to implement an application that allows integrating their all business process which improve their operation, resource report, procurement, accounting.

HINDUSTAN CONSTRUCTION CORPORATION previously uses various small applications to manage their business and operation like procurement system, attendance system, payroll system, tender system, accounting system, MIS system. The application used is not integrated with all different branches, every worksite offices have their own application and to get output and reports (error free) in a central location require large time.

HINDUSTAN CONSTRUCTION CORPORATION decided to implement ERP system, so that they can overcome the above problem and reduce the operation time to control their business operation in better way and get competitive age over their competitor. Firstly HINDUSTAN CONSTRUCTION CORPORATION studies different ERP vendor to decide and Implement ERP system for their construction business. They compare various ERP vendors and select SAP for their track record and their times tested solution for Construction & Operations, Engineering.

HINDUSTAN CONSTRUCTION CORPORATION decided to implement ERP SAP for Engineering, Construction & Operations (SAP for EC&O) solution portfolio to help and ensure their business success in J&K site.

Abstract

HINDUSTAN CONSTRUCTION CORPORATION has decided to go with SAP EC&O solution. SAP is world's leader in ERP solution of most successful ERP implementation. The SAP for Engineering, Construction & Operations (SAP EC&O) solution portfolio provides a comprehensive set of integrated applications that encompassing all key processes of the construction industry. SAP for EC&O solutions help to increase profitability that enables you to deliver more projects on time and within budget with few resources.

Business Challenges

- Improve project execution.
- Mitigate risk growing in operational and financial process.
- Address more complex customer demands.
- Increase transparency within and across construction projects.
- IT solution landscape Key Features helps to improve integration.
- Complete process integration – That supports all aspects of the construction business with tightly integrated single-source solutions.
- Cost and quotation management – That utilize historical performance data to improve accuracy and speed of bids and quotations.
- Procurement – Reduce the costs of materials and services acquired during project execution
- Equipment management – Control tools and equipment assets with unmatched visibility into relevant data
- Talent management – Which maintains key in-house talent, Identify pending labor shortages and empower employees to master new skill sets rapidly.
- Opportunity expansion – That strengthen core competencies and develop downstream and upstream expansion

Business Benefits

- Maximize your profitability by enabling efficient project execution.
- Helps to manage more projects with fewer resources by integrating and automating key business processes.
- Lower the TCO by implementing a fully integrated set of solutions.

- Reduce your financial and operational risk by implementing tight project controls.
- Improve the resource management by increasing your utilization of equipment, material, labor and subcontractors.
- Minimize the risk by helping ensure high scalability and eliminating third-party add-on solutions.

Opportunities & Challenges

Problems faced by construction industry are not new but probably thousands of years old. What are different now the tools and techniques that can be utilized to get the best usage of its resources, equipment's and materials. The nature of construction business introduces challenges typically not encountered in other industries. For example, construction industries differs widely from other industries more as

- Every project is unique in itself.
- They involve remote sites with various access problems.
- Process is not as predictable.
- It is difficult to apply automation.
- Costs can vary according to conditions.
- Difficult to manage resources and other supply utilities.
- Technical innovations are adopted slower.
- Quality of people derives the success.
- Custom-oriented.
- Product can be of mind-boggling cost, size, and complexity.
- Work is not performed in controlled conditions i.e. highly impacted by weather and other environmental conditions.

All this poses a unique set of challenges as illustrated below.

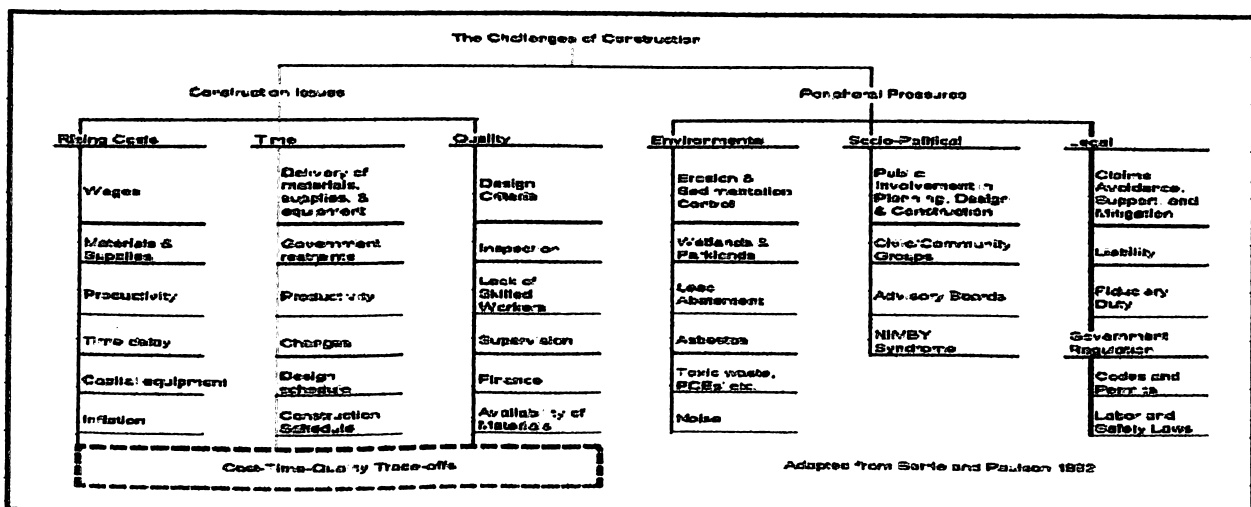


Figure shows it is a herculean task to co-ordinate and integrates all these challenges into one solution. Some of the major problems in construction industries which do not have partial IT infrastructure.

1. No e-tracking of tasks. The project manager needs to produce daily production report manually.
2. Controls and Budget are done by using legacy spreadsheets and this is very time consuming task and the employee is overloaded.
3. Every project has its own independent method of encoding.
4. Off-Site locations are not as organized as desired.
5. Equipment and Material usage are hard to track; writing on site is very little.
6. The project managers provide status reports but it contain lack of critical information such as
 - a. Inventory information and budgetary information
8. No process for
 - Payment follow ups.
 - Evaluating the performance of the project manager.
 - Reminders of issues like raising invoices.
 - Beneficial weekly status report.
9. Ineffective system to incorporate fixed assets into the company books.
10. There is no clear process to accurately track inventory at multiple sites.
11. Invoices are not raised frequently enough thus contributing to a cash flow problem.

All these issues make construction projects highly complex to track and control. If we have to successfully manage these complex projects than it is more important that work progress and resources utilized are measurable. The success of project will be judge by meeting the criteria of safety, cost, time, quality and resource allocation, and quality as defined during the budgeting and planning of the project.

The purpose of the ERP will be to measure the progress continually at every step of the project so as to achieve goals and objectives through the planned usage of resources that meet the project's quality, cost, time, scope, and safety requirements. Through the ERP the Project Manager must be in a position to control, deflect, or mitigate the effects of any occurrence or situation that could affect project success.

Tailored ERP solution can lead to

1. Company resources are fully utilized.
2. Maximum productivity can be attained.
3. Communication between all departments becomes more effective.
4. Ability to analyze and track each task and operation

what these construction companies expect from a tailor made ERP solution is

1. Effective Processes

- That shows the progress, cash-flow, inventory by projects and amount of raised invoices.
 - Track project budgets, to track the individual project level and its summary level.
2. To be able to record major project tasks over the duration of the project.
 3. Accountability at each level of project progress
 4. A system with the least amount of human intervention is not limited to:
 - a. Tracking the project progress
 - b. Tracking the utilization and production of resources
 - c. To send alerts for delay or problems halting the project progress.
 5. Each Project phase must be divided into segments for the aiding accountability at every stage.
 6. Metrics and Dashboards to monitor each level of project progress.
 7. Alerts to remind and to indicate the project manager if the project is not on schedule
 8. Maintain log on project issues for resolution and record keeping.
 9. To build the work flow so that it is easy for the user to know what is to be done next for each task.

ERP solution helps in measuring the financials of the project. Any typical construction project is budgeted and planned. Using the ERP it will be possible to compare the actual value reporting and the planned analysis.

System tracks the actual utilization and planned budget of resources as per budget. This will represent a practical approach for measuring the progress of a project against the plans and it is based on variance analysis.

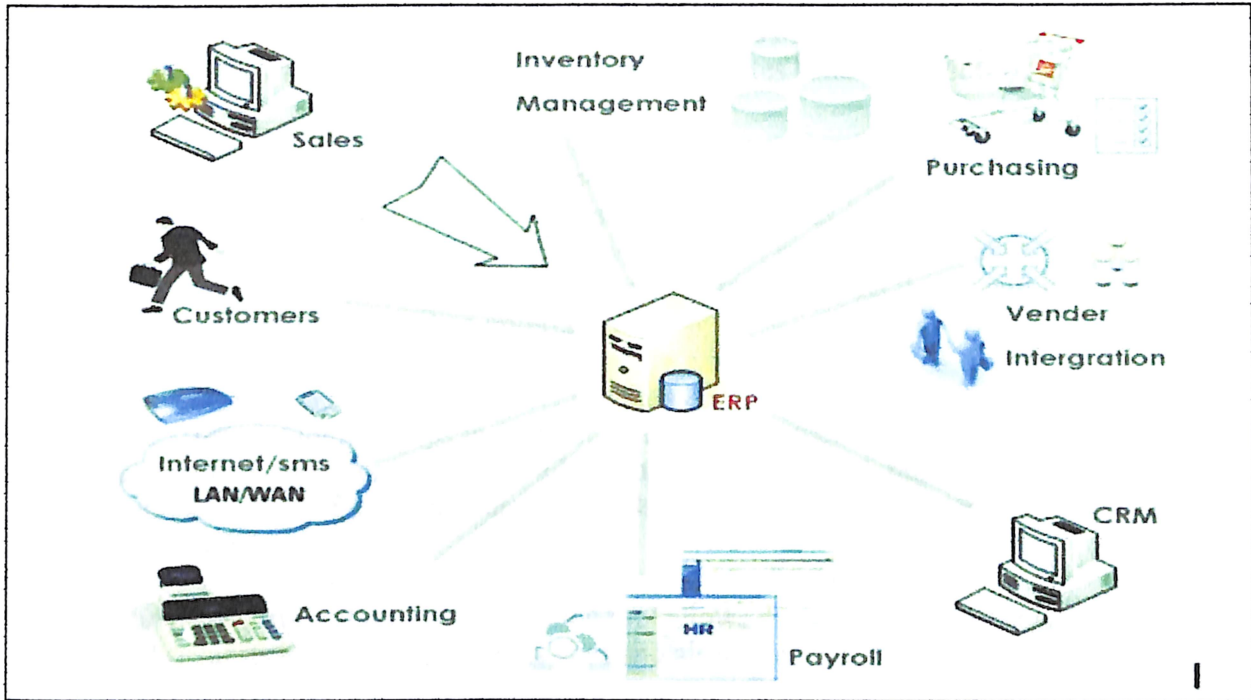
This is where the ERP can make a difference. The system will measure three dimensions of data to associate project progress with project expenditure. These dimensions provide a complete status, including:

- Planned value of the work that has been scheduled
- Actual value of the work that has been accomplished
- Actual costs incurred in accomplishing the work that has been scheduled

By calculating the cost of work actually performed, the expected cost of work that was performed, and the actual value of work performed, project managers, will have the means of cost performance

and linking schedule. It shows complete project progress as measured against project budgets in turn controlled and monitored by the top management.

This gives a complete method of controlling and measuring project performance, making it well worth of the ERP implementation.



It is clear that implementation of ERP solution can provide huge benefits for the construction industry, how do the companies make sure they choose the right ERP vendor?

The major problem with construction companies is to choose the best ERP solution which meets their needs. No two companies are same and forcing them to utilize software which is not engineered according to their environment there is a high potential for failure of the ERP solution and loss of profit. Companies should maintain their competitive edge and to do so they are lead to believe a best practices application will lead them in the right direction.

Now there are ERP vendors with understanding of each company needs and have been pioneering the art of tailored ERP solutions. They offer flexible, light weight, affordable and easily installable solutions. These are tailored software solutions according to industry needs. Tailored solutions are made according to the requirements of each organization without the long development periods and difficulty of upgrading. These solutions are agile software solutions for they are highly configurable and offer all the advantages of custom software solution along with the best characteristics of scanned software solution. These tailored solutions will have most success for your organization, they will have capability of growing and changing as the organization continues to do so in affordable budget compared to pre-packaged expensive ERP solutions.

Benefits of ERP

Waste Reduction: ERP implementation provides generation of information that always help to reduce waste. 6% waste of cement and 4% steel waste has been accepted by the industry. Since ERP provides material reconciliation process to be fully automated, organizations now easily reduce this waste by using various process and implement tools. Businesses, due to large amount of data involved but small value associated, doesn't focus on material across the board. ERP provides information to be processed quickly and for a large data set which facilitates business review of low value material as well.

Better Project Planning: In order to implement ERP, the organization will force to look at creating playbooks to mobilize projects. The integral part of these process is project planning. Traditional issues with project lacking or planning are many but lack of recorded information around it constitutes "mobilization". ERP allows the information to collate and thus it will be translated into a repeatable business process based on criteria.

Reduced inventory levels: Better visibility in to material lead time will reduce inventory levels for organization. Better planning helps in forecasting material demand and allows business to purchase material close to consumption time. ERP allow implementation with minimum reorder level process that helps address issue of material scarcity and also at times was used by organization to carry bloated inventories.

Better equipment utilization: The integrated tool allows more utilization of construction equipment. It document requests coming from various sites and allows management to get most out of the available equipment.

Easier project monitoring: Documented project planning is used for easier project monitoring. One can monitor projects easily and identify key dependencies. Issue and risk management becomes simple due to getting increase visibility of information related to project.

Scalability of operations: In order to scale up, one just need to be ensuring that the tool supported process is follow which reduces "on boarding" time for new resources. Processes can evolve once they are followed on regular basis and exceptions tend to be limited.

Improved quality of work: Recorded data, Repeatable processes and collated information allows organizations to measure key indicators and to improve quality across the business.

HINDUSTAN CONSTRUCTION CORPORATION Introduction

HCC is business group of global scale developing and building responsible infrastructure through next practices. With turnover of Rs.8,157 Cr, its businesses span the sectors of Engineering & Construction, Infrastructure, Real Estate, Urban development & Management.

Founded by Industrialist Seth Walchand Hirachand in year 1926, HCC Ltd has constructed majority of India's landmark infrastructure projects, having constructed 50% of India's Nuclear Power and over 25% of India's Hydel Power generation capacities, over 3,100 lane Km of Expressways and Highways, more than 200 Km of complex Tunneling and over 324 Bridges. Today, HCC Ltd. serves the infrastructure sectors of Transportation, Power and Water.

Landmark projects executed by the HCC include the Bandra Worli Sea Link – India's first and longest open sea cable-stayed bridge; the Farraka Barrage – world's longest barrage; Kolkata Metro – India's first Metro; the most challenging sections of the Mumbai-Pune Expressway – India's first six-lane concrete expressway and Kudankulam Nuclear Power Plant – with India's first and largest Light Water Reactors, having a capacity of 2 X 1000 MW.

Being the first construction company in India to implement Occupational Health & Safety and Environment Management systems, ISO certified Quality and robust Corporate Governance norms, HCC has achieved the fastest implementation of SAP- ERP across all its over 50 project construction locations, some even at record breaking altitudes of 11,000 feet in the Himalayan ranges.

The Company has invested in the early adaption of advanced engineering equipment, new and innovative technology and strategic international associations. HCC today has a knowledge asset of more than 3000 officers, including 1,715 engineers. It employs more than 30,000 workers across its project sites.

HCC's order book as of March 31, 2012 was Rs.15,336 Cr, and it had clocked revenues of Rs.4,013 Cr during FY 2011-12. It has achieved annual growth at an average of 18.7% CAGR for the past 6 years. HCC is committed to Sustainability practices in the areas of Water initiatives, HIV/AIDS awareness, Community Development, Education and Disaster Response and Relief. Over years, HCC has been at the forefront of rescue and relief operations in range of natural disaster scenarios. It is

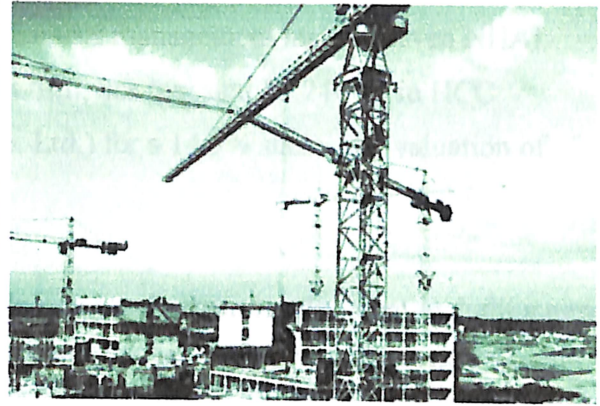
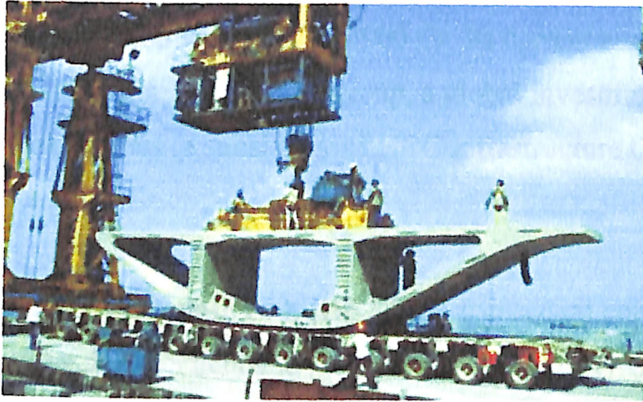
amongst the first few companies globally to endorse the United Nations' Global Compact (UNGC)'s CEO Water Mandate.

HCC is member of the executive committee of the TERI Business Council for Sustainable Development (TERI-BCSD). In recognition of its Sustainability Practices, HCC was accorded the distinction of being the only Indian company to be featured amongst ten global company case studies in a Climate Report issued by the UNGC and United Nations' Environment Programme at the Rio+20 conferences organized by the United Nations at Brazil in June 2012.

HCC's Sustainability Reports have consistently been rated with Application Level Check A+ grade by the GRI (Global Reporting Initiative), Netherlands.

HINDUSTAN CONSTRUCTION CORPORATION Group of companies

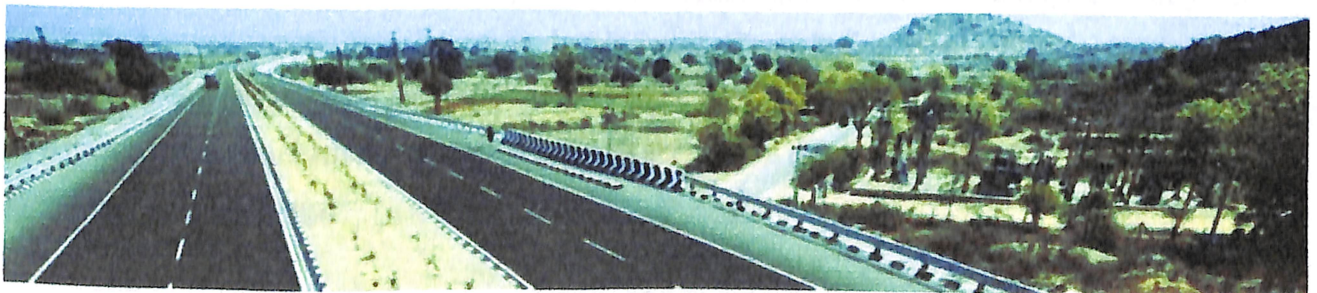
HINDUSTAN CONSTRUCTION CORPORATION Real Estate (HREL)
Real estate development arm



HINDUSTAN CONSTRUCTION CORPORATION Ltd
Engineering and construction arm



HINDUSTAN CONSTRUCTION CORPORATION Infrastructure
Asset ownership subsidiary



The HCC Group of companies now comprises of HCC Ltd, HCC Infrastructure Co. Ltd, HCC Real Estate Ltd, Lavasa Corporation Ltd and Steiner AG in Switzerland.

HCC Infrastructure Co. Ltd. is a leading infrastructure developer engaged in the creation and management of premium assets in the areas of transportation, power and water. HCC Infrastructure has a portfolio of over Rs.6,900 Cr. Its current assets under management include seven NHAI concessions. The Xander group, a global investment firm, has invested Rs.240 Cr in HCC Concessions (a subsidiary of HCC Infrastructure Co. Ltd.) for a 14.5% stake, at a valuation of Rs.1,650 Cr.

HCC Real Estate Ltd. (HREL) is focused on commercial real estate development including new urban development and management projects. HREL holds a 65% stake in Lavasa. The Company has developed 247 Park, a state-of-the-art business destination at Vikhroli (West) in Mumbai. The 1.8 million square feet, 247Park is India's largest standalone LEED certified gold rated green building. Other projects in the pipeline include Phase II of 247Park and the proposed Rs 40,000 Cr waterfront city spread over 4,000 acres in the state of Gujarat.

Lavasa Corporation Ltd. is focused on developing a planned Hill City, Lavasa, which is a 3-hour drive away from Mumbai near Pune. It is 1/5 the size of Greater Mumbai, and is spread across a picturesque landscape of 23,000 acres. Built to the highest environmental standards and having won international awards for sustainable urbanism, Lavasa hosts a complement of global leaders in hospitality, tourism, education, healthcare, research and biotechnology. Lavasa is seen as the blueprint for the many future cities India will need as it responds to massive rural-to-urban migration. In fact, the states of Gujarat and Karnataka already have concrete plans to develop Lavasa-like cities in Dholera near Ahmedabad and also on the outskirts of Bangalore, respectively.

Steiner AG is Switzerland's second largest total services contractor. With a heritage of nearly 100 years, the company specializes in turnkey development of new buildings and refurbishments, and offers services in all facets of real estate development and construction. Steiner AG, which is HCC's first international acquisition, provides HCC with access to a rich experience of constructing world-class integrated buildings.

Kishanganga Hydel project in Jammu & Kashmir

Hindustan Construction Company Ltd (HINDUSTAN CONSTRUCTION CORPORATION), India's leading Infrastructure and Construction Company in joint venture with Halcrow Group Ltd. U.K. Halcrow has been awarded the best prestigious and challenging 330 MW Kishanganga hydro-electric project by National Hydroelectric Power Corporation Ltd. (NHPC).

The contract is on turnkey basis and valued approximately INR 2756.46 crore. The HINDUSTAN CONSTRUCTION CORPORATION-Halcrow Consortium will have a share in the ratio of 97:3 respectively.

The Kishanganga Hydroelectric Project was located on river Kishanganga, at tributary of river Jhelum, in Baramulla district of Jammu & Kashmir. The project involves the construction of a 38m high concrete faced rockfill dam, 23.6 km of head race tunnel and an underground powerhouse. A maximum gross head of 664 m is proposed to be utilised to generate 1351 Million Units of energy, in a 91% dependable year with an installed capacity of 3x111 MW.

This is EPC contract where HINDUSTAN CONSTRUCTION CORPORATION will be responsible for Engineering, Construction and Procurement of all items including civil and associated infrastructure works; supply, testing, installation, and commissioning of all electromechanical plant, machinery and hydro-mechanical components including generating units. The project will be completed and commissioned in an estimated 84 months.

HINDUSTAN CONSTRUCTION CORPORATION has contributed significantly in infrastructure development of Jammu and Kashmir. It has built the state's largest hydro-electric power project - the Salal Dam and is currently also developing five other infrastructure projects.

This includes three hydel power projects viz. Chutak HEPP (in Kargil), Nimoo Bazgo HEPP (in Leh) and URI HEPP in addition to the historic 84 km Mughal Road and the Pirpanjal Tunnels of the Udhampur-Srinagar-Baramulla rail link.

ERP Introduction

Initially ERP originated as extension of MRP (material requirements planning; later manufacturing resource planning) and also CIM (Computer Integrated Manufacturing). It was introduced by the research and analysis firm Gartner in 1990. ERP systems are now attempt to cover all core functions of enterprise, regardless of organization's business or charter. These systems can be found in non-profit organizations, non-manufacturing businesses, and governments.

To be considered ERP system, a software package must provide function of at least two systems. For example, a software package that provides both accounting and payroll functions could technically be considered ERP software package.

Examples of modules in ERP which formerly would be stand-alone applications include: Supply chain management ,Product lifecycle management, (e.g. Manufacturing, Purchasing, and Distribution), Warehouse Management, Sales Order Processing, Customer Relationship Management (CRM), Online Sales, Financials, Decision Support System and Human Resources. Those organizations with sufficient in-house IT skills is to integrate multiple software products — choose to be implemented only portions of ERP system and develop the external interface to other ERP or stand-alone systems for other application needs.

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

- **Manufacturing** Engineering, capacity, bills of material, scheduling, workflow management, cost management, quality control, manufacturing process, manufacturing flow, manufacturing projects.
- **Supply chain management** Order to cash, order entry, inventory, purchasing, supply chain planning, product configurator, supplier scheduling, inspection of goods, commission calculation, claim processing.
- **Financials** General Ledger, accounts payable, cash management, accounts receivable, fixed assets.
- **Project management** costing, billing, performance units, time and expense.

- **Human resources** Human resources, time and attendance, payroll, training.
- **Customer relationship management** - Sales and marketing, commissions, call center support service and customer contact.
- **Data warehouse** - and various self-service interfaces for customers, suppliers, and employees
- **Access control** - user privilege as per the authority levels for process execution
- **Customization** - to meet the extension, change in process flow, addition.

ERP advantages

In absence of ERP system, a large manufacturer may find itself with more software applications that cannot communicate or interface effectively with one another. Tasks that are needed to interface with one another may involve:

- Integration among every different functional areas to ensure productivity, proper communication and efficiency
- Design engineering
- Order tracking, from the acceptance through fulfillment
- The revenue cycle, from an invoice through cash receipt
- Managing inter-dependencies of the complex processes bill of materials
- Tracking three-way match between purchase orders (what was ordered), costing (what the vendor invoiced) and inventory receipts (what arrived)
- The accounting for all these tasks: tracking the revenue, cost and profit at granular level.

ERP Systems centralize the data at one place. Benefits of this include:

- Eliminates problem of synchronizing changes between multiple systems
- Permits control of business processes that cross functional boundaries
- Provides top-down view of the enterprise (no "islands of information")
- Reduces risk of loss of sensitive data by consolidating multiple permissions and security models into a single structure.

Some security features are included within ERP system to protect against the outsider crime, such as industrial espionage and the insider crime, such as embezzlement. ERP vendors are moving toward better integration with other kinds of information security tools.

ERP Disadvantages

Problems with ERP systems are mainly due to inadequate investment in ongoing training for the involved IT personnel - including those testing and implementing changes - as well as lack of corporate policy protecting the integrity of data in ERP systems and ways in which it is used.

Disadvantages

- Customization of ERP software is limited.
- Re-engineering of business processes to fit "industry standard" prescribed by ERP system may lead to a loss of a competitive advantage.
- ERP systems can be expensive.
- ERPs are often seen as too rigid and too difficult to adapt the specific workflow and business process of the some companies—this cited as one of main causes of their failure.
- Many of integrated links need high accuracy in other applications to be work effectively. A company may achieve minimum standards, and then over time "dirty data" will reduce reliability of some applications.
- Once system is established, switching costs are very high for any one of partners (reducing strategic and flexibility control at corporate level).
- The blurring of the company boundaries can cause big problems in accountability, lines of responsibility, and employee morale.
- Resistance in sharing the sensitive internal information between all departments can reduce the effectiveness of the software.
- Many large organizations may have multiple departments with separate, chains-of-command independent resources, missions etc. and consolidation into single enterprise may yield limited benefits.
- The system may be too complex measured against actual needs of customers.
- ERP Systems centralize the data at one place. This will increase the risk of loss of sensitive information in event of a security breach.

ERP Implementation

This phase includes initial installation of software, its configuration, the initial load of data into new application, and any work that might be required for application to interface properly with IT environment of the customer, such as integration with the other applications, and whether integration is batch or in real time. The implementation phase is typically broken into three major steps:

1. Software installation
2. Configuration
3. Integration

The installation step is very important since an incomplete initial installation of the software can lead to significant lost time in the further steps of implementation. Streamlined configuration tools are critical in keeping the application implementation project on time, since, during configuration; all specifics of customer business requirements are captured and then shared across implementation staff.

Finally, integration step is a typically one of the most challenging - with many hidden and unanticipated costs. Three factors - complexity of the applications to interface with, the complexity of the integration and the complexity of the business processes between applications tools that may require multiple experts and the multiple types of expertise - make it difficult to establish detailed project plans and thus accurately estimate project costs. For analysis and comparison of vendor approaches to implementation, experts utilized seven criteria:

1. Application installation wizard
2. Advanced configuration
3. Process modeler
4. Advanced data loading and moving
5. Process-oriented integration
6. Pre-packaged integration between vendor applications
7. Built-in web services integrations

Let's examine each of the seven feature sets in the installation category.

Application installation wizard

Both Siebel and Microsoft offer a streamlined installation wizard i.e. comprehensive and well packaged. PeopleSoft offers application installation wizard that will removes manual steps and automates key installation processes, including configuration of the underlying database. By contrast, while SAP uses wizards, its installation procedure and wizards are proprietary, more complex and very often require implementers to step out of automated process to handle tasks that were omitted during planning phase. Oracle has improved its installation wizard tremendously over previous releases, but still wizard is inconsistent across modules and requires additional manual steps to accomplished outside the wizard.

Advanced configuration

PeopleSoft has gone further than any of the vendor in enabling the application to configured by product or by the business processes. For example, PeopleSoft Setup Manager Configuration tool enables implementation staff to connect to the documentation online and navigate through documentation by selecting features and product directly from configuration screen. Both Oracle and Siebel provide advanced tools to support definition of business processes and data flows. SAP provides tools that are to be more complex and require more technical expertise. Microsoft limits end user ability to fully configure applications.

Process modeler

PeopleSoft provides 1,200 pre-defined models that will cover PeopleSoft best practices business process flows. Oracle Workflow allows the business processes to be modeled using a drag-and-drop designer and produces visual diagram of business process. Siebel, customers can add pre-defined or custom business processes, sub-processes, branching, and to create a workflow process tailored to their unique business requirements. SAP offers functionality in the process modeling only within context of its own applications. The ability to manipulate existing business processes within Microsoft Great Plains is limited and requires customization work.

Advanced data moving and loading

Microsoft simply doesn't allow advanced data loading and moving. Oracle iSetup simplifies and automates the initial setup of data. Oracle iSetup is question-driven wizard that automatically generates application to the related parameters and flows such as chart of accounts, rules and expense policies. PeopleSoft provides advanced data-loading and moving capabilities, including ability to load data online from Excel spreadsheets into PeopleSoft applications through the component interfaces. SAP provides free set of tools and procedures that make it possible to transfer data from a variety of sources without any programming.

Pre-packaged integration between vendor applications

PeopleSoft Process Integration Packs deliver an all levels of required integration: routing, cross-reference maps, data transformation, and standard-based adapters/connectors for complete end-to-end integration. PeopleSoft currently provides a five pre-packaged integrations for the key SAP and Oracle business processes out of box. These pre-packaged integration's replace need for custom integrations, therefore saving customers up to 61% off the cost of custom integration. While not offering pre-packaged integration packs, Oracle maintains an adapters to most commonly used applications. Oracle adapters do help reduce effort for custom integration. SAP encapsulates the integration tasks within its NetWeaver platform, but it still requires deep technology expertise to complete integration. Siebel Universal Application Network (SUAN) provides a common interface layer for the Siebel Application to interface with non-Siebel application but requires third-party components. Microsoft introduced toolbox for integration to replace Great Plains integration tools (Integration Manager). It is reported to be great improvement over previous proprietary tools but has not yet reached level of completeness and usability comparable to other vendors.

Process-oriented integration

Oracle Workflow supports basic process-oriented integration and modeling of it. Siebel's approach to the process-oriented integration is to publish its process-oriented business services as a web services. PeopleSoft's new interactive integration repositories enable customers to display integration points from business process point of view and generate integration process plans. SAP's integration approach has been focused on business processes, but it relies heavily on proprietary technologies.

Microsoft Integration Manager includes a set of templates that allow the control of the underlying business logic.

Built-in web services integrations

PeopleSoft provide a built-in web services and fully supports industry standards for web services. Oracle supports the web services integration at an every layer of its application framework (database, , application layer, middle-tier) using open connector standards such as SOAP, UDDI and WSDL. Siebel's strategy is to expose its business processes as a web services to deliver business services-driven integration. SAP provides the integration based on web services through its SAP NetWeaver platform.

Usability

This phase includes all key functionality that will related to application ease of use. It covers topics such as ability to perform tasks with minimum amount of errors, intuitive use of application, end user productivity, ability to learn how to use application effectively with minimum amount of training, number of clicks or screens required to perform a specific task, support for advanced users, alignment with industry standard interfaces, response times, and ease of adapting application terminology to the customer business cases. With this kind of scope to issue of usability, it does provide value to build and evaluate an objective comparison on usability of various applications.

Usability, in fact, can impact positively or negatively total ownership experience. First and foremost, usability has direct impact on end user adoption, which can break or make a deployment. Poor usability can be lead to ongoing hidden costs through lower error-prone applications, end user productivity, or applications that are misaligned with company's business processes.

Five criteria were involved in the analysis assessment of usability:

1. Task-oriented navigation
2. Navigation configurability
3. Task-oriented dashboards
4. Web Client
5. Integrated office productivity.

Let's examine each of the five feature sets in the usability category.

Task-oriented navigation

It is designed to allow users to use business process based navigation to complete tasks. PeopleSoft delivers easy-to-read graphical layout that displays the task-based terminology and icons representing portal registry content. Navigation pages not only have consistent layout throughout application, but users can more quickly and easily locate navigation items by scanning new 2-level navigation shortcut collection. This process based flow for application is consistent from top level portal page down to specific application pages, where application pages have process driven recommended actions and selectively show only fields that are relevant to current stage of specific business process. To ensure optimal design of this task based navigation metaphor, PeopleSoft performs usability tests with at least 100 customers per application per release. This continuous investment in a customer driven solution design enables the PeopleSoft to continually improve usability and explains the high degree of usability compared to other vendors. Oracle's screens may be rearranged slightly to align better with customer's business processes and tasks, but the ability is not systematic across all modules and requires high level of expertise in Oracle. Within SAP, navigation may be customized but requires custom development on top of the SAP Portal, which is the part of SAP NetWeaver and is not currently used by most customers. Both Siebel and Microsoft have focused much development effort on usability and both deliver simplified user interface, leading to applications that are relatively easy to navigate.

Navigation configurability

Most vendors provide tools to technical staff and implementation team to customize application interface in order to better fit business needs and business processes of customer. Microsoft provides only limited tools to customize application interface. All modifications made to a Microsoft Great Plains' navigation and interface is done through custom coding rather than configuration, point-and-click and wizard-driven tools. With PeopleSoft, Siebel and Oracle, it is easy to create personalized and customized navigation pages and choose to use all these pages in addition to, or instead of, default navigation pages that are provided out of the box. SAP requires advanced programming to achieve level of configuration and customization of interface that might be fit for the average user.

Task-oriented dashboards

Oracle and Microsoft offer only limited functionality with task-oriented dashboards. Through task-oriented, pre-built dashboards that organize key tasks, such as an applicant job tracking and reporting, PeopleSoft delivers greater productivity to the end users. PeopleSoft is so focused on the usability and end user productivity that new releases can ship only when majority of new users tested can complete key tasks without any assistance in timed usability exercise. Siebel also supports task oriented dashboards that are end user-oriented. By comparison, vendors such as a SAP have not fully migrated their interface toward more task-oriented navigation and still require users to click forth and back between multiple screens to complete various steps necessary for a specific business task.

Web client

All of PeopleSoft modules and applications, including PeopleSoft Enterprise One, are fully web-enabled and also do not require the download of application code on end user workstation. This feature facilitates upgrades that are very transparent to the end users and that do not require attention of either the end user or technical staff regarding client side issues. Siebel has added 100% web deployment in most recent version of its software. Previously Siebel, some code had to be downloaded to the client. While Oracle claims to be a 100% web enabled, some code components are still downloaded to client. And unfortunately, Oracle's web architecture is not consistent across all Oracle modules. SAP is not yet a fully web-enabled. By contrast, Microsoft's applications are still mostly client-server, and release upgrades can trigger significant disruption to the business operations through additional downtime and unnecessary incremental costs to upgrade each end user workstation.

Integrated office productivity

Microsoft has developed one of the most integration points between its desktop applications and its business applications, such as Microsoft Office and Outlook. Siebel provides a basic integration between its sales force automation modules and email. Meanwhile, PeopleSoft CRM provides integration to the standard desktop software tools like Microsoft Office Suite and Lotus Notes as well as mobile devices including laptops, Blackberry and Pocket PC devices to ensure user adoption and enable new levels of user effectiveness. Integration with personal productivity tools is area that

remains underdeveloped for SAP and Oracle, but each vendor does offer some capabilities in this area.

Maintenance, Upgrades and Support

Maintenance includes all post-implementation activities that are required to keep application operational under stressed and normal conditions. It includes on going support, upgrades (patches and minor and major upgrades), all tuning and diagnostics activities managed by administrators to maintain application running in optimal conditions, and archiving of historical data. Maintenance costs have important impact on overall ownership experience, due to traditionally labor-intensive and repetitive nature of these activities. Tuning and Diagnostics facilitate the upgrade process by staying current on releases, while poor diagnostics tools lead to business disruption and unpredictable downtimes. Seven criteria were involved in expertise assessment of the maintenance phase:

1. Diagnostic and technical support
2. Remote and online support
3. Performance diagnostics and tuning
4. Patch management
5. Automated upgrade process and toolsets
6. User-centric performance testing
7. Data archiving.

Let's examine each of the seven feature sets in the maintenance, support and upgrade category.

Diagnostic and technical support

Microsoft, Oracle, SAP and Siebel support is delivered the "traditional" way: knowledge base on web and phone calls with technical support. PeopleSoft is only vendor to provide a built-in diagnostic framework through embedded diagnostics scripts that let customers send secure, real-time production system snapshots to the PeopleSoft's support center. This unique capability ensures faster issue diagnosis and resolution. With Oracle, SAP and Siebel, diagnostics and resolution information is exchanged between customer and vendor through tailored emails that depend on availability, the responsiveness, and knowledge of the vendor's support staff. In some cases, support requires

extensive communication and exchange of files such as log files that contain the exact configuration of the customer implementation.

Remote and online supports

All vendors provide some form of a remote support and online capabilities to help customers self-diagnose issues. Both PeopleSoft's and Oracle's online support databases are rich in content but can be time consuming to navigate. Siebel provides some support content over the web but, once a problem has been logged online, always promotes interaction with the customers over web self service support. SAP has recently introduced multiple web sites to provide better post implementation information to its customers, but the efforts remain fragmented across various interaction points with customers.

Performance diagnostics and tuning

Oracle, PeopleSoft, and SAP provide a built-in, instrumented performance monitoring tool that tracks the application performance in real time as well as by component. The tool provides comparisons to average performance levels to proactively identify and troubleshoot non-performing components. Siebel supports industry-standard application response-time management that simplifies performance tuning across all tiers of the Siebel Smart Web Architecture and supports proactive performance monitoring by a third-party ARM-compliant monitoring application. Because it requires third-party software, Siebel is not rated as highly. With Microsoft, performance monitoring is done at the platform level (Windows/NT); no specific application performing tools are available.

Patch management

Applying patches to enterprise applications can be a very time consuming and disruptive activity. SAP, Oracle, and Siebel make their list of patches fully available on the web but provide limited guidance and automated tools to select which patches are relevant to a specific configuration. PeopleSoft has streamlined this task by offering a Change Assistant toolset that supports the automatic checking of pre and post- requisites and by automatically selecting which patch should be applied for the customer to be current. Microsoft releases new versions of patches for its applications very infrequently (less than once a year), so the features with respect to patch management are well suited.

Automated upgrade process and toolsets

SAP offers tools to identify pre-requisites and guide technical staff through the various steps of an upgrade. The SAP upgrade process is only partially automated, with many complex tasks to be performed manually. PeopleSoft provides Upgrade Assistant, an automated upgrade tool with well tested and complete upgrade scripts. Starting with Enterprise Human Capital Management 8.9 customers, PeopleSoft has re-engineered the upgrade process from eight steps to five with Accelerated Upgrades. Now customers can use a visual compare tool to identify customizations and an ETL-based data migration tool to ensure downtime is less than a day. Oracle offers upgrade scripts and tools but with a lesser degree of automation. Microsoft provides basic upgrade automation tools that are adequate for Microsoft's low frequency of releases.

User-centric performance testing

PeopleSoft allows customers to submit test cases, which are used as part of the application testing and release process. PeopleSoft is the only vendor to test functionality and performance using real customer data on volume database systems. Oracle relies mostly on its database performance test to validate the performance of its application. SAP offers test services reported to be so expensive that very few customers opt to use them. Siebel has been focused on usability since it released its first CRM application, and user-centric testing is an integral part of its product development cycle. Microsoft delivers good usability but the functionality delivered is less sophisticated.

Data archiving

Oracle only provides purge capabilities and does not allow customers to archive or restore/reinstate archived data into production. Both SAP and PeopleSoft provide archive, purge, and restore capabilities natively. In addition, PeopleSoft provides rules-based archiving templates enabling administrators to set up different archiving rules for different regions for better global compliance support. Siebel and Microsoft do not directly offer archive, purge or restore capabilities.

ERP Vendors

Microsoft

Microsoft has no formal ownership experience program defined. Microsoft has developed its cost management strategy based on very low software price point and close to 100% out-of-the-box deployments with little ability to customize software. As a result, Microsoft offers basic functionality that doesn't require extensive training, but it also doesn't necessarily deliver full value expected by the customer in view of ownership experience.

Oracle

Addressing cost of ownership is the heart of Oracle's philosophy for Enterprise Applications. Based on Oracle e-Business Suite, an integrated suite of an application, Oracle claims that it can lower implementation costs by avoiding unnecessary costs, such as those associated with a costly custom integration between applications. Although Oracle's approach has some merit - some measurable benefits have been highlighted through ROI case studies, serious concerns are still being raised regarding what Oracle has delivered to date.

PeopleSoft

Structured in formal program, PeopleSoft dedicated over 1,000 developers and \$800 million to improve Total Ownership Experience for customers. Rather than focusing simply on best practices that improve ownership experience, PeopleSoft has a rethought its entire set of applications to ensure that they are built from ground up to minimize deployment and maintenance costs.

SAP

Many users of SAP applications have, over the years, noted complexity of SAP applications, resulting high implementation costs, and consequent budget overruns. In response to these issues, SAP today highlights SAP NetWeaver as centerpiece to SAP's product strategy for decreasing the complexity and cost of ownership for SAP applications. Currently, impact of SAP NetWeaver on overall SAP cost of ownership remains to be proven. SAP has not yet provided proof points validating that it's a customer benefit from improved ownership experience through implementation of SAP's latest technology.

Siebel

Siebel's customer experience initiative was first focused on customer satisfaction and high-level ROI measurements. It is only recently (12+months) that Siebel has focused more specifically on cost-of-

ownership issues (mainly in response to customers' complaints). Siebel's improvements to its software development process are guided by the experience and insight gained from close examination of 200 Siebel 7.x deployments.

Selection Methodology for ERP System

An ERP system selection methodology is the formal process for selecting an Enterprise Resource Planning (ERP) system.

Irrespective of whether the company is multi national multi-million dollar organization or small company with single digit million turnover, the goal of system selection is to source system that can provide functionality for all of business processes; that will get complete user acceptance; management approval and, most importantly, can provide significant return on investment for shareholders.

Since in mid-70s , when there was wide-spread introduction of computer packages into leading companies to assist in Material Requirements Planning software companies have strived, and for most part succeeded, to create packages that assist in all the aspects of running a business from Manufacturing; Supply Chain Management; Human Resources; through to Financials. This led to the evolution of ERP Systems.

In the last decade, companies have also become interested in enhanced functionality such as Customer Relationship Management and e-Commerce capability.

Given all of the potential solutions, it is not uncommon for companies to choose a system that is not the best fit for the business and this normally leads to a more expensive implementation. Thus, it is understandable that "ERP Costs can run as high as two or three percent of revenues". A Proper ERP System Selection Methodology will deliver, within time and budget, an ERP system that is best fit for the business processes and the user in an enterprise.

Poor System Selection

It is seldom that companies adopt a fully objective system selection methodology when choosing an ERP System. Some of the common mistakes that companies resort to are:

Incomplete Set of Requirements

When a new ERP has been implemented in an enterprise, Wallace & Kremzar state that "it requires people to do their job differently" . Therefore, it is very important to understand the requirements of each user for current processes and for future processes [i.e. before and after the new system is installed]. One can then review systems that have the best fit from a functionality perspective. It is also imperative that the requirements go into great detail for complicated processes or processes that may be unique to a particular business.

Reliance on Vendor Demos

Vendor Demonstrations tend to be focus on very simplistic processes. A typical demonstration will show an ideal order to cash process where a customer orders a quantity of product that is in stock. The reality in most businesses is that most customers have varying and more complicated commercial arrangements and products are not always in stock.

Over-Emphasis on System Cost

According to Finlay and Servant "The differential in purchase price between packages is unlikely to be the dominant factor". While the cost of an ERP system is very important for a company, there tends to be a lack of focus on the other important decision criteria such as functionality; future proofing; underlying infrastructure [network & database]; and e-commerce capability among others.

Selection Bias

It is not unusual that the decision on which system to purchase is made by one individual or by one department within the company. In these situations, an ERP system that may be excellent at one function but weak at other processes may be imposed on the entire enterprise with serious consequences for the business.

Failure to use Objective Professional Services

One the main reasons for failure in system selection is the understandable lack of knowledge within the company. Experienced Consultants can provide excellent information on all of the packages that are available in the marketplace; the latest functionality available in the most common packages and, most importantly, can assist the user in deciding whether a specific requirement would provide added value to the user and to the business. However, it is worth noting that the professional help must be provided by objective consultants who have no affiliation with ERP System vendors. "If a

consultancy has built up an expertise in the use of a particular package then it is in its interest to recommend that package to its client”.

Inability to Understand Offering by ERP Vendor

"It is estimated that approximately 90% of enterprise system implementations are late or over budget". A plausible explanation for implementations being late and over budget is that the company did not understand the offering by the vendor before the contract was signed. A typical example of this would be the scenario where a vendor may offer 5 days of services for the purpose of data migration. The reality is that there is a huge amount of work required to input data onto a new system. The vendor will import the data into the new system but expects the company to put the data into a file that is easy to import into the system. The companies are also expected to extract the data from the old system; clean the data and add new data that is required by the new system. "ERP, to be successful, requires levels of data integrity far higher than most companies have ever achieved – or even considered. Inventory records, bill of materials (BOM), formulas, recipes, routings, and other data need to become highly accurate, complete and properly structured". This typical scenario is one of many issues that cause implementations to be delayed and invariably lead to requests for more resources.

A Proper System Selection Methodology

To address the common mistakes that lead to a poor system selection. It is important to apply key principles to the process, some of which are listed hereunder:

Structured Approach

The first step in selection of a new system is to adopt a structured approach to the process. The set of practices are presented to all the stakeholders within the enterprise before the system selection process begins. Everyone needs to understand the method of gathering requirements; invitation to tender; how potential vendors will be selected; the format of demonstrations and the process for selecting the vendor. Thus, each stakeholder is aware that the decision will be made on an objective and collective basis and this will always lead to a high level of co-operation within the process.

Focused Demonstrations

Demonstrations by potential vendors must be relevant to the business. However, it is important to understand that there is considerable amount of preparation required by vendors to perform demonstrations that are specific to a business. Therefore it is imperative that vendors are treated

equally in requests for demonstrations and it is incumbent on the company [and the objective consultant assisting the company in the selection process] to identify sufficient demonstrations that will allow a proper decision to be made but will also ensure that vendors do not opt out of the selection process due to the extent of preparation required.

Objective Decision Process

"Choosing which ERP to use is a complex decision that has significant economic consequences, thus it requires a multi-criterion approach." There are two key points to note when the major decision makers are agreeing on selection criteria that will be used in evaluating potential vendors. Firstly, the criteria and the scoring system must be agreed in advance prior to viewing any potential systems. The criteria must be wide-ranging and decided upon by as many objective people as possible within and external to the enterprise. In no circumstance should people with affiliations to one or more systems be allowed to advise in this regard.

Full Involvement by all Personnel

The decision on the system must be made by all stakeholders within the enterprise. "It requires top management leadership and participation. It involves virtually every department within the company". Representatives of all users should:

- Be involved in the project initiation phase where the decision making process is agreed;
- Assist in the gathering of requirements;
- Attend the Vendor Demonstrations;
- Have a significant participation in the short-listing and final selection of a vendor.

The implementation of an ERP system takes a significantly longer time and level of resource than the selection process. However, the extent of the implementation will be profoundly influenced by the level of resource and objectivity within the selection. Companies that use a proper System Selection Methodology reap the benefit not only during the implementation phase but also and most significantly during the life of the ERP System.

Successful ERP Implementation

Businesses have a wide scope of applications and processes throughout their functional units; producing ERP software systems that are typically complex and usually impose significant changes on staff work practices. Implementing ERP software is typically too complex for "in-house" skill, so it is desirable and highly advised to hire outside consultants who are professionally trained to implement these systems. This is typically most cost effective way. There are three types of services that may be employed for - Consulting, Customization, Support. The length of time to implement an ERP system depends on size of the business, the number of modules, extent of customization, the scope of the change and willingness of the customer to take ownership for the project. ERP systems are modular, so they don't all need be implemented at once. It can be divided into various stages, or phase-ins. The typical project is about 14 months and requires around 150 consultants. A small project (e.g., a company of less than 100 staff) may be planned and delivered within 3-9 months; however, a large, multi-site or multi-country implementation may take years.[citation needed] The length of the implementations is closely tied to the amount of customization desired.

To implement ERP systems, companies often seek help of an ERP vendor or of third-party consulting companies. These firms typically provide three areas of professional services: consulting, customization and support. The client organization may also employ independent program management, change management, business analysis, and UAT specialists to ensure their business requirements remain a priority during implementation.

Data migration is one of most important activities in determining success of an ERP implementation. Since many decisions must be made before migration, a significant amount of planning must occur. Unfortunately, data migration is last activity before production phase of an ERP implementation, and therefore receives minimal attention due to time constraints. The following are steps of a data migration strategy that can help with success of an ERP implementation:

- Identifying data to be migrated
- Determining timing of data migration
- Generating data templates
- Freezing tools for data migration

- Deciding on migration related setups
- Deciding on data archiving

Process preparation

ERP vendors have designed their systems around standard business processes, based upon best business practices. Different vendor(s) have different types of processes but they are all of standard, modular nature. Firms that want to implement ERP systems are consequently forced to adapt their organizations to standardized processes as opposed to adapting ERP package to the existing processes. Neglecting to map current business processes prior to starting ERP implementation is a main reason for failure of ERP projects. It is therefore crucial that organizations perform thorough business process analysis before selecting ERP vendor and setting off on implementation track. This analysis should map out all present operational processes, enabling selection of ERP vendor whose standard modules are most closely aligned with established organization. Redesign can then be implemented to achieve further process congruence. Research indicates that risk of business process mismatch is decreased by: linking each current organizational process to organization's strategy; analyzing effectiveness of each process in light of its current related business capability; understanding automated solutions currently implemented.

ERP implementation is a considerably more difficult (and politically charged) in organizations structured into nearly independent business units, each responsible for their own profit and loss, because they will have different processes, data semantics, business rules, authorization hierarchies and decision centers. Solutions include requirements coordination negotiated by local change management professionals or, if this is not possible, federated implementation using loosely integrated instances (e.g. linked via Master Data Management) specifically configured and/or customized to meet local needs.

A disadvantage usually attributed to an ERP is that business process redesign to fit standardized ERP modules can lead to a loss of competitive advantage. While documented cases exist where this has indeed materialized, other cases show that following thorough process preparation ERP systems can actually increase sustainable competitive advantage.

Configuration

Configuring an ERP system is largely matter of balancing the way you want system to work with the way the system lets you work. Begin by deciding which modules to be installing, and then adjust the system using configuration tables to achieve best possible fit in working with your company's processes.

Modules — Most systems are modular simply for flexibility of implementing some functions but not others. Some common modules, such as accounting and finance are adopted by nearly all companies implementing enterprise systems; others however such as human resource management are not needed by some companies and therefore not adopted. A service company for example will not likely need a module for a manufacturing. Other times companies will not adopt module because they already have their own proprietary system they believe to be superior. Generally speaking the greater number of modules selected, greater the integration benefits, but also to increase in costs, risks and changes involved.

Configuration Tables – A configuration table enables company to tailor a particular aspect of system to the way it chooses to do business. For example, organization can select the type of inventory accounting – LIFO or FIFO – it will employ or whether it wants to recognize revenue by geographical unit, product line, or distribution channel.

So what happens when options the system allows just aren't good enough? At this point company has two choices, both of which are not ideal. It can re-write some of enterprise system's code, or it can continue to use an existing system and build interfaces between it and the new enterprise system. Both options will add time and cost to the implementation process. Additionally they can dilute system's integration benefits. The more customized system becomes the less possible seamless communication between suppliers and customers.

Consulting services

Many organizations did not have sufficient internal skills to implement ERP project. This resulted in many organizations offering consulting services for ERP implementation. Typically, a consulting team was responsible for entire ERP implementation including planning, training, implementation testing, and delivery of any customized modules. Examples of customization includes additional product training; creation of process triggers and workflow; specialist advice to improve how ERP is

used in the business; system optimization; and assistance writing reports, complex data extracts or implementing Business Intelligence.

For most mid-sized companies, the cost of implementation will range from around the list price of ERP user licenses to up to twice this amount (depending on the level of customization required). Large companies, and especially those with multiple sites or countries, will often spend considerably more on implementation than the cost of user licenses -- three to five times more is not uncommon for a multi-site implementation.

Unlike most single-purpose applications, ERP packages have historically included full source code and shipped with vendor-supported team IDEs for customizing and extending the delivered code. During the early years of ERP the guarantee of mature tools and support for extensive customization was an important sales argument when a potential customer was considering developing their own unique solution in-house, or assembling a cross-functional solution by integrating multiple "best of breed" applications.

"Core system" Customization vs. Configuration

Increasingly, ERP vendors have tried to reduce the need for customization by providing built-in "configuration" tools to address most customers' needs for changing how the out-of-the-box core system works. Key differences between customization and configuration include:

Customization is always optional, whereas some degree of configuration (e.g. setting up cost/profit centre structures, organizational trees, purchase approval rules, etc.) may be needed before software will work at all. Configuration is available to all customers, whereas customization allows individual customer to implement proprietary "market-beating" processes.

Configuration changes tend to be recorded as entries in vendor-supplied data tables, whereas customization usually requires some element of programming or changes to table structures or views. The effect of configuration changes on performance of system is relatively predictable and is largely responsibility of the ERP vendor. The effect of customization is unpredictable and may require time-consuming stress testing by implementation team.

Configuration changes are almost always guaranteed to survive upgrades to new software versions. Some customizations (e.g. code that uses pre-defined "hooks" that are called before/after displaying data screens) will survive upgrades, though they will still need to be re-tested. More extensive customizations (e.g. those involving changes to fundamental data structures) will be overwritten during upgrades and must be re-implemented manually.

By this analysis, customizing ERP package can be unexpectedly expensive and complicated, and tends to delay delivery of obvious benefits of integrated system. Nevertheless, customizing ERP suite gives the scope to implement secret recipes for excellence in specific areas while ensuring that industry best practices are achieved in less sensitive areas.

Extension

In this context "Extension" refers to ways that delivered ERP environment can be extended with third-party programs. It is technically easy to expose most ERP transactions to outside programs, e.g. Scenarios to do with archiving, reporting and republishing (these easiest to achieve, because they mainly address static data);

Transactional data capture scenarios, e.g. using scanners, tills or RFIDs, are relatively easy (because they touch existing data); however because ERP applications typically contain sophisticated rules that control how master data can be created or changed, some scenarios are very difficult to implement.

Maintenance and support services

A maintenance and support service involves monitoring and managing an operational ERP system. This function is often provided in-house using members of the IT department, or may be provided by a specialist external consulting and services company.

Research Methodology

For this study, research was organized along with key ownership experience criteria that allowed research to capture quantitative and qualitative information across major components of enterprise applications. The list of criteria was thoroughly defined to take into account the experience of not only technical staff, but also end users who must accomplish specific business tasks with application.

The software versions that were compared included:

- Microsoft Great Plains version 7.6 and previews of Microsoft Great Plains version 8.0
- Oracle E-Business Suite 11.4.9
- PeopleSoft Enterprise 8.8 and 8.9 and Enterprise One 8.11
- SAP: my SAP Business Suite R/3 4.7 and SAP R/3 Enterprise 4.8
- Siebel 7.5 and Siebel 7.6

The research also included functional areas such as Financial and Human Capital Management Systems (FMS & HCM), Supply Chain Management (SCM), Customer Relationship Management (CRM); and application lifecycle phases such as installation, implementation, configuration, usage, maintenance, support, and upgrades. We have broken the entire process down into five steps:

- Reviewed vendors' web sites and their positioning documents, as well as their hard copy and online documentation.
- Utilized analyst reports, technical reviews and press articles those are available to the general public.
- Validated, using defined criteria, the information collected in steps 1 and 2 through in-depth interviews with consulting panel of experts. For interview process, preference was given to respondents with multi-year experience and experience with the latest version of the application to ensure that entire application lifecycle was properly covered.
- Analyzed and compared findings from this primary and secondary research to generate rating for each vendor on specific criteria. In this analysis and comparison, the respondent's experience with multiple vendors was leveraged as well.

- Aggregated comparisons and ratings along three major phases of the enterprise application ownership lifecycle.

Plan for ERP Implementation

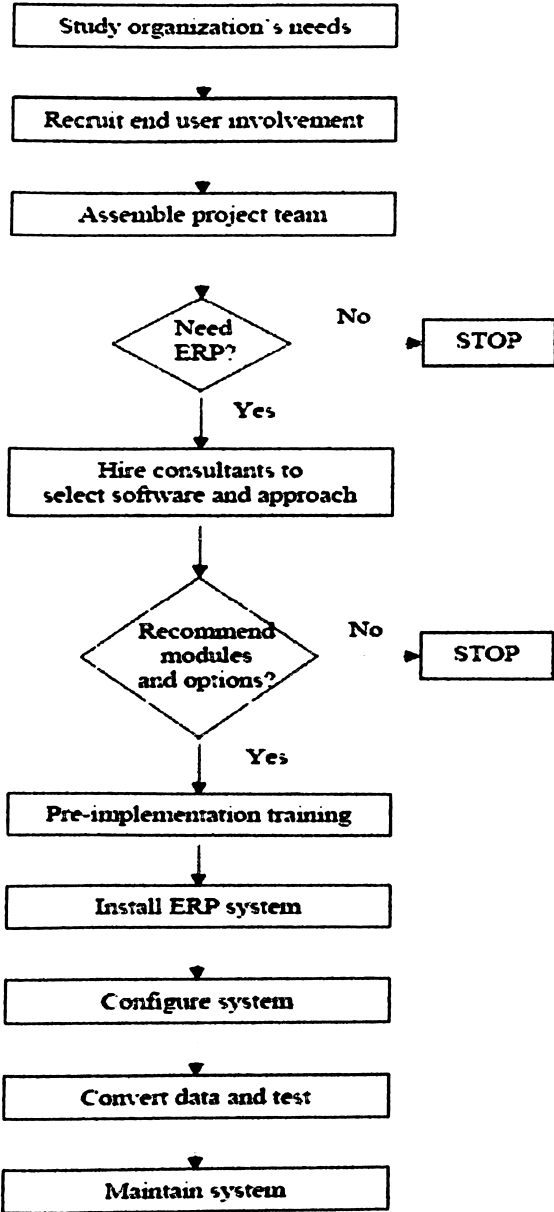
Managers must conduct a feasibility study of current situation to assess organization's needs by analyzing the availability of software, hardware, databases, and in house computer expertise, and make the decision to implement an ERP where integration is essential. They must also set goals for improvement and establish objectives for implementation, and calculate the break-even points and benefits to be received from this expensive IT investment. The second major activity involves recruiting and educating end users to be involved throughout the implementation process.

Third, managers will form a project team or steering committee that consists of experts from all functional areas to lead project. After a decision is made, a team of system consultants will be hired to evaluate appropriateness of implementing an ERP system, and to help select the best enterprise software provider and best approach to implementing ERP. In most situations, consultant team will also recommend the modules that are suited best to the company's operations (manufacturing, logistics, financials, human resources, forecasting, etc.), system configurations, and Business-to-Business applications such as supply-chain management, customer relationship management, e-procurement, and e-marketplace.

The importance of adequate employee and manager training can never be overestimated. IT analysts usually recommend that managers reserve 11% of the project's budget for training. Different kinds and different levels of training must be provided to all business stakeholders, including managers, end users, customers, and vendors, before the system is implemented. Such training is usually customized and can be provided by either internal or outside trainers.

The system installation process will address issues such as software configuration, software testing and hardware acquisition. Data and information in databases must be converted to the format used in new ERP system and servers and networks need to be upgraded. System maintenance will address issues and problems that arise during operations. A post implementation review is recommended to ensure that all business objectives established during the planning phase are achieved. Needed modifications are tackled during this phase too.

ERP Implementation Plan



Why SAP

SAP has 30 years of active involvement in the construction industry, supporting more than a thousand construction businesses across the globe – leveraging the SAP for Engineering, Construction & Operations (SAP for EC&O) solution portfolio. A tightly integrated set of applications encompassing every aspect of your construction business, SAP for EC&O solutions help you complete more projects on time and within budget with fewer resources. The end result: maximum profit and business growth over the long term.

In the construction business, opportunities abound – but capitalizing on them has never been more challenging. Today, success is determined by what you know about your projects and when you know it. Your crews in the field may have all the high-tech tools and state-of-the-art equipment they need – but when information determines success, your management team needs to be similarly equipped.

Unfortunately, many construction companies struggle with nonintegrated, multiple-vendor legacy systems that provide untimely, inaccurate information and make it difficult to adapt to changing business requirements. If this describes your business software environment, you owe it to yourself to discover why global construction leaders trust the SAP for Engineering, Construction & Operations (SAP for EC&O) solution portfolio to help ensure business success.

SAP® applications span the full project and facility lifecycle, from planning and design to project management to operations. Combining proven best practices with unsurpassed functional depth, the

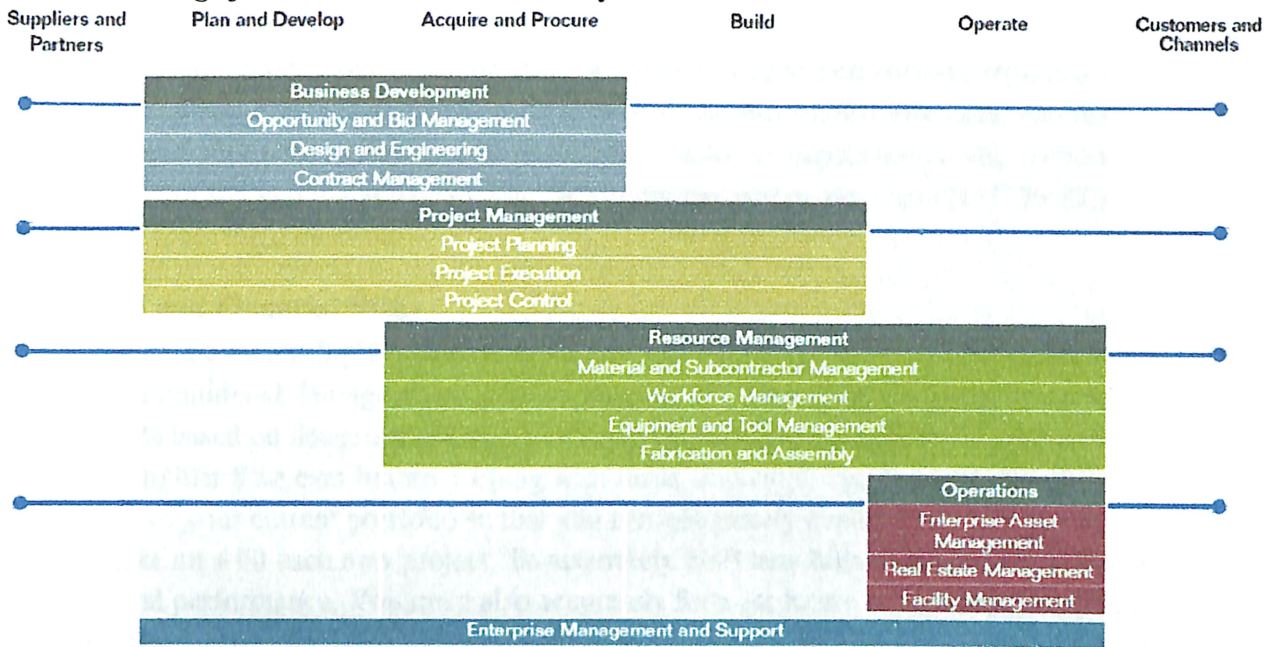
Solution portfolio helps you keep projects on track and within budget with comprehensive functions to manage resources such as material, labor, equipment, and tools. SAP for EC&O solutions also help you interact with strategic partners, manage documents, and track the shipment and quality of materials. With greater visibility and improved control across your entire project portfolio, you can increase accuracy, reliability, and accountability throughout your organization and significantly improve business performance. Read on to learn why companies that use SAP for EC&O solutions consistently outperform their peers with low total cost of ownership and effective management of more projects with fewer resources, while maximizing cash flow and ROI.

Complete Support for Construction Industry Processes In many ways, today's construction business can be summed up in a single word: more. Competition is more aggressive, projects are more complex, and schedules are more demanding. To maximize profits in this environment, you need to execute with precision and optimize your use of human and capital assets. So even though your project portfolio is growing, your vision across the enterprise is becoming progressively cloudier.

That's why your continued growth and success depends on greater transparency across all levels of your enterprise. And this is where the SAP for EC&O solution portfolio can help. An integrated, comprehensive set of solutions based on years of construction industry experience, SAP for EC&O

solutions give you the visibility to manage a multitude of projects at lower cost and with greater ease than previously possible.

Solution Coverage for the Construction Industry



As illustrated in the figure, SAP for EC&O solutions span your entire project lifecycle – from business development and design to procurement, construction, and handover. Near real-time visibility across your entire project portfolio provides the insight you need to make informed decisions on a day-to-day basis. Integrated best practices, full process integration, task automation, and convenient alerts all help you empower project managers to maximize asset utilization and increase profit margins. You can also manage suppliers, subcontractors, and employees more effectively for improved business performance.

SAP for EC&O solutions are world class software that your organization can implement quickly. Built from the ground up in close cooperation with SAP customers around the world. The Visibility You Need for Business Insight Figure: Solution Map for Engineering, Construction, and Operations Suppliers and Partners Plan and Develop Acquire and Procure Build Operate Customers and Channels

SAP Solution in Detail – Complete Support for Construction Industry Processes configurable, helping ensure a close fit to your organization’s specific needs. You can also use defined-scope implementation services from the SAP Active Global Support organization to assist with training, deployment, or ongoing support as you see fit. All SAP for EC&O solutions are highly scalable – because your software should never limit your future growth opportunities. And because the software reduces or eliminates the need for third party add-ons, it helps lower your risk and total cost of ownership while accelerating your time to value. When it comes to your business, SAP for EC&O

solutions offer an unparalleled breadth of support for business processes and depth of functionality targeted to the needs of the construction industry.

Adapting to Today's Risks, Challenges, and Opportunities

In a constantly changing business environment, you must continually find new ways to respond to changes in project scope, costs, and schedules. Whether it's underperforming subcontractors, unforeseen field conditions, a stretch of bad weather, or sudden supply shortages, you must overcome each obstacle in your path to stay on course and meet customer expectations. The sections below examine some of the varying situations you face every day and explore how SAP for EC&O solutions can help you meet them head-on.

Operational and Financial Risks

Project owners are increasingly trying to shift more and more risk onto you. Contractual demands for penalties and liquidated damage clauses are on the rise. For "fast track" projects, you may even have to submit bids based on designs that are still in progress. Completion schedules are shrinking, and cash flow is tighter than ever before. Coping with these challenges requires better visibility into the performance of your current portfolio so that you can adequately evaluate how much risk you are willing to take on with each new project. To accurately craft new bids, you need structured access to your historical performance. You must also accurately forecast future availability of employees and equipment and shorten the duration of progress billing cycles to maintain cash flow. SAP for EC&O solutions provide the tools necessary to turn these challenges into opportunities.

Resource Management

The two keys to a successful project are being on time and within budget. Meeting these objectives consistently requires successful management of labor, materials, equipment, and subcontractors on each project. The industry-specific functionality and tight integration across the entire SAP for EC&O solution portfolio enable efficient project execution – necessary to maximize your profitability.

Collaboration

As you become involved with your projects earlier in the design stage, owners require more detailed and frequent interaction. Tighter schedules require better communication with suppliers and subcontractors. The collaboration tools in SAP for EC&O solutions make it easier for you to share information and project processes and foster strong relationships with all stakeholders.

Talent Shortages

The growing shortage of quality project managers and engineers is real – and forecasts only show the trend increasing. SAP for EC&O solutions provide the tools necessary to recognize, reward, and retain your key talent. With skills-inventory functionality, you can better match abilities to needs. Knowledge management allows you to more effectively grow talent internally. Equipping managers and engineers with better tools increases job satisfaction and reduces the burnout that leads to turnover.

Opportunity Expansion

The cyclical nature of the construction industry has likely motivated you to expand your service offerings into adjacent opportunity areas. Whether you're focused on developing additional core competencies, moving into the design area, or seizing opportunities in facility operations and maintenance, SAP for EC&O solutions can provide the tightly integrated application support you require to expand.

Tight Integration Means Better Project Execution

Do you find yourself fitting your operational methodologies to your current IT environment? Shouldn't it be the other way around? SAP for EC&O solutions have the proven ability to adapt to your current and future business needs. Instead of a patchwork of legacy systems and multivendor point solutions that impede visibility and hamper business performance, the SAP for EC&O portfolio offers tightly integrated solutions from a single source, making it far easier to achieve your business objectives. Complementary integrated offerings from SAP partners add to what is already one of the largest application footprints in the construction industry. In an integrated environment, your software is more reliable. It also provides more timely and accurate information and is easier and less expensive to manage. The breadth and depth of SAP for EC&O solutions include the full range of functionality available in the SAP ERP application. In addition, the industry specific functionality in the solution portfolio spans HR, business development, quotations, planning, scheduling, project management, craft planning, subcontractor and supplier management, resource management, and project closeout and turnover.

Integration also increases visibility across all projects, resulting in immediate gains including better management of assets, employees, subcontractors, and suppliers, as well as tighter control of budgets and schedules and increased cash flow. The unified view enabled by SAP for EC&O solutions delivers a centralized way for accessing consistent company information and integrated project data.

In addition to viewing project costs and schedules, you also have quick access to vital documents, such as contracts or CAD drawings, across all projects. You can view and compare projects side by side, taking note of successful practices in one project and implementing the same practices in others. You can also allocate your workforce resources optimally, giving priority to projects in the most critical phases. These are real and tangible benefits – and that is why SAP's construction industry customers regularly outperform their peers in revenue growth, operating margins, and return on invested capital. Some of the most important processes supported by SAP for EC&O solutions are described below.

Building Information Modeling

With SAP for EC&O solutions, you can better manage your projects from the design stage through the entire project lifecycle, with integrated building information modeling (BIM) functionality. Allow every participant in the value chain – from designer and engineer to procurement agent, construction manager, and facility manager – to add to the information pool, generating more accurate data with less effort. This reduces friction in the design-build-manage cycle and facilitates more accurate space,

maintenance, asset, and capital planning. BIM functionality also allows better analyses while making schedules more reliable. And with direct cost savings, business process improvements, and better decision support, you can improve project profitability on a consistent basis.

Project Management

One of the key components in any construction solution is the project management functionality. The project management solution from SAP has been proven in more than 2,000 installations worldwide. You'll find it robust and functionally comprehensive. If yours is like most construction companies, your current project opportunities are more complex and require tighter schedules. Securing projects with higher-margin opportunities means establishing competitive differentiation with a prospect base that's becoming increasingly more sophisticated in its demands and expectations. Staffing issues are becoming more common amid a shrinking labor market. Geographically dispersed opportunities bring additional challenges. As you work to address issues like these, you may find that your current software foundation is more hindrance than help. By contrast, you'll find that applications for project management from SAP cover all key project management processes and incorporate support for proven best practices to help you reach your fullest potential as quickly as possible. The following are some examples of the processes covered.

Cost and Quotation Management

For any construction company, the quotation process sets the groundwork for generating new business and maintaining profitability. Quoting too high could take you out of the running. Quoting too low can cut into profits. The key is striking the right balance, and this requires access to historical cost and performance information. When looking at a prospective new project, consider whether you can answer the following questions:

- Which past projects best match this opportunity?
- Where were these projects carried out?
- What staff do I have with the requisite skills and are they willing to relocate?
- What supply chain elements (such as subcontractors, vendors, and fabricators) are in place?
- What are my historical costs, and how do I pull them forward to present-day levels localized for this project?
- What is the optimum contract and budget structure? With SAP for EC&O solutions, you can answer these questions with a level of speed and accuracy that was previously impossible. And when the project is awarded, the details from the proposal process become the base for your execution stage.

Communication Management

Efficient, effective communication is one of the keys to success in a dispersed project-oriented work environment. This is why SAP for EC&O solutions help you efficiently collaborate and share information across your project team, including joint venture partners, subcontractors, vendors,

engineering partners, and owners. With integrated document management functions, you can manage your contract and project documents – update, track, and efficiently share information with all stakeholders.

Project Schedule Management

To keep projects on schedule, you need to know what the schedule is and what the reality on the ground. Supporting both top-down and bottom-up views, the SAP for EC&O solution portfolio lets you measure actual performance against your baseline estimates so that you know how you're doing at all times. It also couples your defined project scope and budget with change-management procedures, allowing continual control of scope and costs. In addition, SAP technology enables immediate integration to market leading third-party scheduling tools.

Integrated Planning

Without a consistent, integrated view of all your running projects, it's difficult to make strategic planning decisions at the portfolio level. SAP for EC&O solutions addresses this challenge by enabling the visibility you need to view and manage resources, dates, costs, and revenue across your entire project portfolio.

Resource Allocation

To ensure success, you need to assign the right resources to the right projects while balancing availability and demand from other projects. With increased visibility across all resources at your disposal, SAP for EC&O solutions makes it easier for you to assign resources according to skills, availability, and capacity across all your projects. In addition, the software helps you manage the labor intensive craft-planning function with greater effectiveness.

Workforce Management

If your workforce is your most valuable asset, managing it is one of your most important jobs. SAP for EC&O solutions can help with functionality that makes it easier to manage your professional labor, craft labor, and crew production at the job site while meeting the HR requirements of a dispersed, project-based workforce. You can expedite labor more easily with complete visibility of your available skill sets and current work assignments.

Equipment and Tool Management

You've made a significant investment in your equipment and tools – and if your company is like most, you want to maximize your return on this investment. Processes do this with powerful functionality for managing equipment and tools – from requirements and location planning to calculating the equipment rental costs and transporting the equipment. This helps you maximize the utilization and profitability of your equipment and tools across your entire project portfolio.

Material Procurement

Efficient, structured procurement processes help keep costs down. This is why SAP for EC&O solutions provides functionality that helps you exert greater control over material procurement. You

can evaluate each potential partner and quotation, make informed decisions about multiple sourcing alternatives, automate order processing and invoice management, and optimize the cost and delivery of materials.

Subcontractor Management

When working with dozens of subcontractors on many individual jobs, even the most seasoned project manager can become overwhelmed. SAP for EC&O solutions reduce this pressure by automating the tasks associated with managing the subcontractors you work with on a daily basis. You can coordinate subcontractor activities, track performance, and help ensure timely payment. This enables you to control the quality, cost, and timeliness of work provided by others.

Change Management

The ability to initiate and track changes to project scope, budget, and costs is critical for effective project and risk management. The SAP for EC&O set of solutions helps you manage all changes through a single interface, enabling you to keep track of where each change order stands in the queue and how many are waiting to be approved. The software also creates an audit trail for each change, providing you with critical protection should a customer question any work done.

Performance Management

To know how you're doing with each project, you have to take measure. SAP for EC&O solutions makes it easier for you to evaluate project performance through integrated key performance indicators (KPIs). These can include critical measures such as percentage of completion, productivity, and earned value. With the software, you can also compare these KPIs against your baseline budget and schedule.

Risk Management

To minimize your risk, you need to keep projects on track. With tight project controls that produce early warnings in the form of alerts and exception reporting, SAP for EC&O solutions help you minimize your risk. Financial KPIs – organized by project or in the aggregate – allow you to stay abreast of potential problems and address them early in the cycle. You can proactively manage your project performance using methods such as earned value and forecasting.

Critical-Path Management

It's not always self-evident which aspects of a project are more important than others. This is why SAP for EC&O solutions support integrated critical-path method scheduling, which allows you to know in advance which project components are critical in maintaining your completion schedule. With this information, you can dedicate extra resources to potential bottlenecks before schedules slip.

Cost Control

Without strict cost control, you can quickly experience the kinds of cost overruns that can doom any construction project. To help you avoid cost overruns, the SAP for EC&O solution portfolio supports integrated cost reporting for all types of costs (planned, committed, actual, and forecast). This is

further enhanced with powerful exception reporting that quickly alerts you to potential problem areas before they derail a project.

Project Cash Flow

With SAP for EC&O solutions, your expected cash flow is forecast across your entire project portfolio, facilitating capital requirements planning and allowing you to evaluate actual-cash position versus forecast. With integral processes, you can generate milestone-based progress billings at the earliest opportunity – optimizing your cash flow and reducing capital requirements.

Project Simulations

It's always best to know ahead of time how any proposed project change will affect schedules and costs down the line. With SAP for EC&O solutions, you can use powerful simulation functionality to examine multiple what-if scenarios and analyze the impact of possible changes. This helps you decide the most advantageous course of action among many choices.

Contract Closeout

The last thing you want when completing a job is a troublesome handover that leaves a bad impression of an otherwise well-executed project. This is why SAP for EC&O solutions support integrated processes that enable you to quickly gather all required documentation and execute a smooth handover to the owner or operator. Whatever your project management challenges are today or in the future, the project management functionality provided by the SAP for EC&O solution portfolio can address them. You can keep costs down, schedules on track, and customers continuously satisfied.

Talent Management

Chances are, the single factor that limits your growth the most is your available human asset pool. The SAP Talent Visualization application by Nakisa – an industry-leading talent management solution – helps you manage and apply resources based on a detailed skills inventory. By recognizing and rewarding your most important and in-demand skill sets, you are better able to maintain key in-house talent. By highlighting pending shortages, you can deal with them in advance by conducting training and skills advancement programs, attracting semiretired talent, or turning to outsourced alternatives.

Integrated knowledge management tools allow your employees to function at higher expertise levels and master new skill sets rapidly. Collaborative components built into SAP for EC&O solutions allow you to stretch scarce management and subject-matter-expert talent across multiple projects by assembling virtual project teams with the skills necessary to manage complex projects.

Equipment and Tools Management

Are you getting the maximum ROI from your equipment and tool assets? With the SAP Equipment and Tools Management for Engineering, Construction & Operations (SAP Equipment and Tools Management for EC&O) package, you get unmatched vision and control of these important but often

mismanaged assets. From small specialty items to your “big iron,” you know exactly where every tool and piece of equipment is located. The software also indicates the operational status of each item and when it will be available for reassignment. Improved visibility and utilization typically lead to lower stocking levels and reduced reliance on external rentals. SAP Equipment and Tools Management for EC&O allows you to set internal cost charging and billing according to your requirements. The software automatically maintains and updates information on depreciation, maintenance costs, and profitability from internal rentals. It also tracks equipment uptime – along with scheduled and unscheduled maintenance – and monitors warranty status, sending out alerts that remind managers of maintenance tasks required to keep warranties in good standing. SAP Equipment and Tools Management for EC&O also tracks insurance status and requirements.

Procurement

The project-based procurement methodology employed by SAP for EC&O solutions focuses on bottom-line results, reducing the costs of materials and services acquired in support of your projects.

The streamlined procure-to-pay processes require less administrative effort and provide a more efficient purchasing methodology, fewer errors, increased productivity, faster cycles, and lower processing costs. You can use bill-of material takeoffs from CAD drawings to generate initial material requirements. By supporting powerful project-based procurement functions that help you generate quick, significant, and sustainable cost savings, SAP for EC&O solutions deliver the following benefits:

- Better sourcing decisions that optimize the overall value contribution from your Suppliers
- Greater flexibility for capturing, sharing, and continuously enhancing your sourcing knowledge
- Increased ability to manage compliance of suppliers, business units, approvers, and individual buyers
- Streamlined business processes for both buyers and suppliers, allowing increased focus on your value-added activities
- Open architecture and structure facilitating data interchange with your key suppliers’ procurement systems
- Quicker turnaround of expedited purchases, thus minimizing project schedule disruptions

Corporate Performance Management

With the SAP for EC&O solution portfolio, you can proactively measure performance using a single, trusted data source and meet stakeholder requirements for in-time and in-context information. You can quickly review each project’s current and projected future impact on your profit and loss. With an integrated solution, you can also perform key financial performance management activities that support strategy and execution; budgeting, planning, and consolidation; and modeling and optimizing

profitability. All stakeholders can readily see how their actions impact your organizational performance.

Turnover to Owners and Operators

Your customers are also looking to you to simplify their asset management efforts. They are demanding that you transmit facility turnover data to them in a structured format that allows easier retrieval, queries, and ad hoc reporting of asset information and documentation.

With the BIM functionality supported by SAP for EC&O solutions – coupled with the SAP Visual Information for Plants application by NRX – you can comply with this requirement as a matter of course. By providing engineering, maintenance, operations, and supply chain users with configurable role-based access to needed information, these tools streamline asset management, maintain interoperability, and deliver a single view of asset master data across the enterprise. Relevant content is accessed through an intuitive user interface that fosters information exchange and collaboration.

Specialized Hardware and Network Support

SAP for EC&O solutions has the flexibility to enable interaction with current and future hardware systems and communication infrastructures to support tasks such as:

- Data interchange with CAD systems
- Radio-frequency identification (RFID) and bar-code tags and labels
- Data collection and monitoring systems
- Geographic information systems
- Satellite-linked remote-job-site data entry
- Information and alerts to mobile devices
- Interaction with other XML-based interfaces

The SAP for EC&O solution portfolio is powered by the SAP NetWeaver® technology platform. Because SAP NetWeaver unifies technology components into a single platform, you can align your information systems with your business requirements and interact more effectively with new hardware technologies, communications infrastructures, legacy systems, partners, subcontractors, and vendors. SAP NetWeaver combines composition technologies and application functionality to reduce complexity and increase flexibility. You can compose applications using enterprise services, orchestrate business processes and events, manage enterprise information, and deliver applications and content to users more quickly and cost-effectively. As the foundation for service-oriented architecture (SOA), SAP NetWeaver allows organizations to evolve their current IT landscapes into a strategic environment that drives business change. SAP NetWeaver helps you perform a variety of IT practices including:

- **Data unification** – helps ensure that your master data is accurate, free of duplicated records, and normalized
- **Process integration** – makes disparate applications and business partners' systems work together
- **Business information management**
 - increases the visibility and reach of structured and unstructured enterprise data SAP NetWeaver will enhance your business flexibility and competitive advantage by enabling you to optimize your business processes and collaborate more effectively among all key stakeholders.

Conclusion

An ERP implementation is huge commitment from organization, causing millions of rupees and can take up to several years to complete. However, when it is integrated successfully, benefits can be enormous. A well-designed and properly integrated ERP system allows the most updated information to be shared among various business functions, thereby resulting in tremendous increased efficiency and cost savings. When making implementation decision, management must considered fundamental issues such as organization's readiness for a dramatic change, the degree of integration, key business processes to be implemented, e-business applications to be included, and whether or not new hardware need to be acquired.

In order to increase chance of user acceptance, employees must be consulted and be involved in all stages of implementation process. Providing proper education and appropriate training are also two important strategies to increase end user acceptance rate. The organization is also going through a drastic change, with changes in the way businesses are conducted, organization being restructured, and job responsibilities being redefined. To facilitate change process, managers are encouraged to utilize the eight-level organizational change process. Managers can implement their ERP systems in several ways, which include whole integration, the franchise approach, and the single-module approach. Finally, the paper concludes with a flow chart, depicting many of the activities that managers must perform to ensure a proper ERP implementation.

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