e-Engineering

-- A Unified Methodology for Enterprise Transformation

e-Engineering is a comprehensive approach for implementing results-oriented, customer-focused enterprise management in any organization. This approach provides a flexible framework that allows an organization to establish effective, compliant, management practices that reflect the organization's unique culture and requirements, and then integrate and automate enterprise performance measurement.

"e-Engineering" because it applies equally to all Enterprises -- large and small, public and private, for profit and non profit. It is Effective, Efficient, and is Essential for E-business and E-commerce.

Table of Contents

e-Engineering – A Unified Approach

"e-Engineering" is a term that incorporates all the activities that enterprises perform to improve productivity, optimize resources, deliver quality products and services, and meet customer expectations and demand. These can include traditional activities such as reorganization, concentration on core competencies, and integrating new technologies. e-Engineering also includes techniques and methods such as business process re-engineering, continuous process improvement, total quality management, enterprise architecture, and enterprise application modernization. One thing that distinguishes today's successful enterprise, business and government, is the ability to adapt to changes in environment, in markets, and in customer expectations. In order to survive into the 21st century, an enterprise must make change management an integral, enterprise-wide process. Often this change requires enterprise executives and managers to think in radical terms, often recommending dramatic overhaul of entire operations at a single stroke.

"Most of [the nation's management gurus] agree that [an enterprise] should organize itself on the basis of process, such as fulfilling an order, instead of functions, such as marketing or manufacturing," writes John Byrne in *Business Week*. "That takes the enterprise's focus off its own internal structure and puts it on meeting customers' needs, where it belongs. [They] generally agree that time can be squeezed out of every job; that self-managed teams throw more challenge and meaning into employment; and that enterprises sorely need to create networks of relationships with customers, suppliers and competitors."

According to Byrne, they also tend to agree that smaller is better, yet they do not applaud wholesale downsizing as a cure-all. "If all you try to do is flatten your existing organization, you'll kill it," says Michael Hammer, president of Hammer and Co., Cambridge, MA. "The fat is not waiting around on top to be cut. It's marbled in, and the only way you get it out is by grinding it out and frying it out." This may mean that enterprises need to totally "re-engineer" how work gets done -- new goals, new methods, new processes, new measures, new technologies.

e-Engineering, which applies equally to well-established and newly-forming enterprises, responds to the fundamental business drivers of the 21st century: migration to "agile" production, globalization of markets, changing labor pools, and volatile political and business environments.

e-Engineering Life Cycle

For clarity, the e-Engineering life cycle is described in this paper as a series of activities and tasks that have a clearly defined beginning and end and a logical progression from task to task. In "real life," e-Engineering is not so monolithic. Activities are performed "just in time," i.e., when they are most needed in an enterprise's unique environment to improve only those management practices that need to be improved.

e-Engineering provides both a road map and a vehicle for an enterprise's journey into the future. The e-Engineering life cycle involves a multi-phased approach that coordinates strategic, operational, and organizational demands. Figure 1 illustrates the major activities of the e-Engineering cycle:

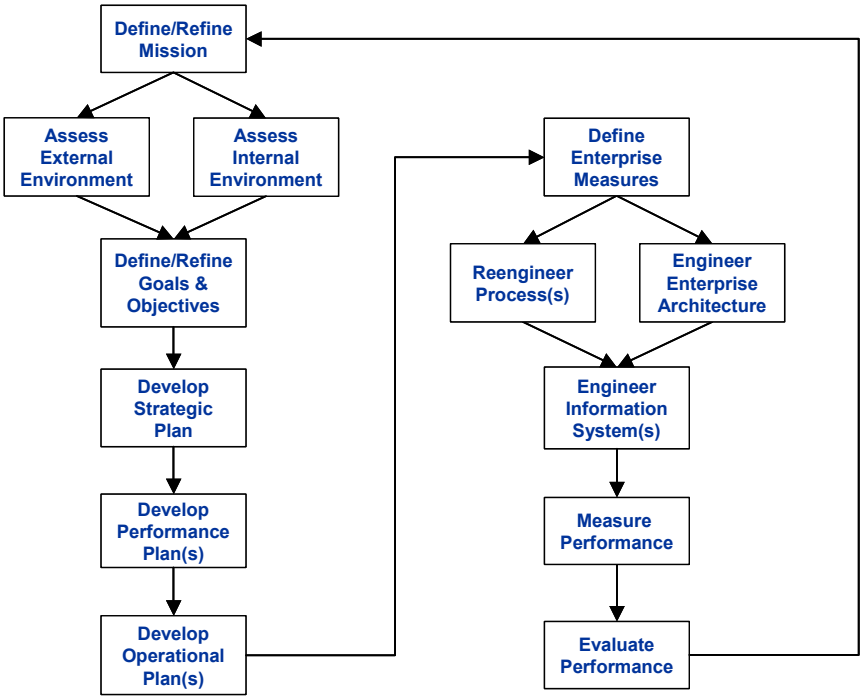

Figure 1. e-Engineering Life Cycle

1. Describe the enterprise mission in a brief statement of scope and purpose: what the enterprise does, how, and for whom.

2. Make assumptions and gather data about external factors, for example, government policies, rates of inflation, markets, and demographic changes.

3. Assess enterprise strengths and weaknesses.

4. Establish goals, objectives, and measures linked to the enterprise mission.

5. Develop strategic and operational plans to meet the goals and objectives.

6. Design/re-design and integrate cross-functional processes to meet goals and objectives.

7. Implement information systems that support enterprise processes and assist decision-making.

8. Evaluate performance to ensure that goals and objectives are being met.

9. Reevaluate and change goals, objectives, processes and measures as necessary.

Every step of the e-Engineering approach includes proven techniques and best practices that have been successfully implemented in numerous enterprises – large and small, commercial and government, national and international.

Some of the many e-Engineering best practices include Enterprise Planning, Enterprise Performance Measurement and Management, Enterprise Architecture Engineering, Enterprise Process Engineering, and Enterprise System Engineering.

Enterprise Planning

Enterprise Planning encompasses strategic planning, performance planning, operations planning and all other activities that help an enterprise define its direction and strategic measures of success.

The first enterprise planning activity is to define or refine enterprise scope and mission. The next, and perhaps most critical, activity in any enterprise planning endeavor is to document enterprise environmental elements and their relationships, including expectations of stakeholders (the enterprise's stockholders, suppliers, regulators, customers, employees, etc.), strengths and weaknesses of the enterprise, and any assumptions about external factors. From this data, long-term strategic plans are developed and documented. These executive-level plans identify goals, objectives, success factors, cross-functional processes, priorities, performance measures and potential resource requirements for all enterprise elements.

Enterprise Planning is a process, not an event. It is repeated in a disciplined fashion on a periodic basis. The frequency of planning is based upon the enterprise environment. The more rapidly the environment changes, the more often strategic planning is necessary. In any enterprise the entire range of planning should be done at least annually. Figure 2 illustrates the typical scope of Enterprise Planning.

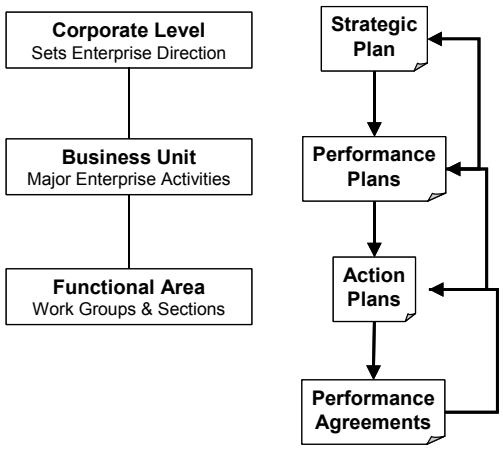

Figure 2. Enterprise Planning

Strategic Plans set mission, charter, values, strategic goals and performance indicators, key strategies and enterprise priorities. Strategic plans represent executive-level planning and are the drivers for all other planning.

Every major enterprise activity develops performance plans that support the enterprise strategic plan. These program or tactical-level plans also contain goals, objectives, performance indicators and strategies but are focused on a single subordinate enterprise activity or program.

Functional areas with every major subordinate unit also prepare plans that govern their activities. Action plans document tasks and measures that are fully supportive of the enterprise strategic plan and program performance plans. As enterprise units develop their respective plans they provide feedback that either validates higher-level plans or instigates changes in those plans.

Enterprise Performance Measurement and Management

Establishing the right performance measures is key to successful enterprise management. An enterprise must be able to tell whether progress is being made on its critical goals and whether stakeholder expectations are being met.

It is important to develop enterprise performance measures that are cross-functional and which are linked to appropriate strategies, objectives, budgets and performance criteria. In our approach, management's targets and thresholds for the measures, often using external benchmarks, are documented in detail during the planning process and later, as each process is engineered. These data elements form the structure for an enterprise's performance measurement system. Performance measurement documentation includes the content of management reports and the path of the data from source to final report recipient.

The combination of all the reports of all the performance measures becomes the basis for an enterprise data warehouse and an Executive Information Portal (EIP) that is truly tailored to enterprise management requirements.

Executives and managers use the information produced by the EIP to reinforce initiatives, reward behavior and change strategies. Employees use it to adjust operations and respond to strategic needs. By linking timely, accurate measures to specific goals and objectives, enterprise performance management becomes more of a science and less of an art. This also helps to ensure the enterprise is using the right measures of its effectiveness. Having poor or wrong measures is worse than having no measures. *Whatever an enterprise measures is what it will get*.

Enterprise Architecture Engineering

Enterprise planning elements and performance measures become the basis for an enterprise architecture model, which is a requirement of the Clinger-Cohen Act. Enterprise architecture provides the “blueprint” for e-Engineering.

A building is constructed using architectural diagrams (blueprints) that clearly depict the building's infrastructure (structural elements, walls, electrical wiring, plumbing, etc.). High performing enterprises are engineered from architectural models that reflect enterprise infrastructure (policies, goals, measures, critical success factors, etc.).

Blueprints are also used to enlarge a building or make any significant modifications. Without a diagram of the infrastructure, such changes are quite difficult and costly, and can even be dangerous. It is the same with enterprises. First update the enterprise's architecture model so that it reflects changes (e.g., new performance measures, product lines, or services) and then modify the enterprise to support the change.

An enterprise architecture links an enterprise’s strategic plan and performance plans ("business architecture") with its enterprise information architecture, enterprise service component architecture, and enterprise technical architecture. A well-documented architecture is a logical organization of information pertaining to multi-level, multi-dimensional, enterprise-wide elements:

- Strategic goals, objectives, and strategies
- Business rules and measures
- Information requirements
- Processes, systems and applications
- Relationships between architecture data elements
- Technology infrastructure
- Guidelines, standards, policies, and procedures.

Every enterprise has an architecture. However, it is usually undocumented and the elements are inconsistent. Most likely some of the architecture elements are embodied in strategic and performance plans, published and unpublished polices and procedures, and system documentation. Unfortunately, there are also a lot of enterprise architecture elements, particularly business rules, that are embedded in software application code, and even more that exist only as employee "tribal knowledge."

Undocumented enterprise architecture is unmanaged enterprise architecture and a sure recipe for chaos. On the other hand, a fully documented enterprise architecture can be used to accomplish the following:

- Facilitate quality software engineering and enterprise change management by linking strategic requirements to systems that support them and by linking the business model to application designs
- Enable strategic information to be consistently and accurately derived from operational data
- Promote data sharing, thus reducing data redundancy and reducing maintenance costs
- Improve productivity through component development, management and reuse
- Reduce software development cycle time
- Evaluate commercial products and services
- Share information with customers and business partners

An enterprise architecture must be “engineered” if it is to gain these benefits. This requires rigorous and repeatable process that is strategically-driven, information-centric, model-based, and technology independent. Enterprise *Architecture* Engineering results in a useable enterprise management tool that exactly meets the needs of the enterprise. It involves six very different activities:

1. Model the new architecture,
2. Reverse engineer the existing architecture(s),
3. Compare architectures,
4. Analyze the gap,
5. Transition to new architecture,
6. Acquire, develop, and reengineer systems, including data warehouses and data marts based upon new architecture.

These steps are illustrated in Figure 3.

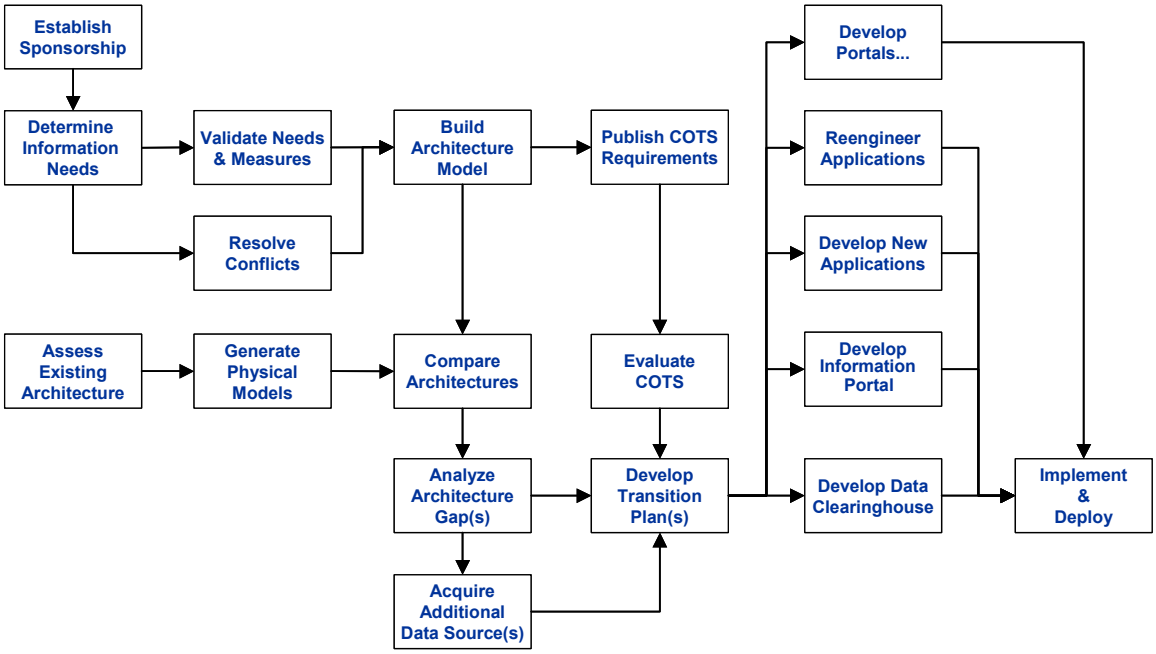

Figure 3. Enterprise *Architecture* Engineering

Enterprise Architecture facilitates communication within an enterprise: between enterprise units, across hierarchical boundaries, and between system users and system developers. Enterprise Architecture is a continuum of architecture models that represent the information requirements of the entire enterprise along with the applications and technologies that meet those requirements. The enterprise architecture models become the source for every application and database design (physical) model including Enterprise Portals, Data Warehouses and Data Marts.

Enterprise Architecture also provides a medium for better communicating with potential vendors. The logical enterprise model can be used as the benchmark against which to evaluate commercial applications. If a vendor has used a structured, model-based approach to developing its application components, then those models can be compared readily with the enterprise model.

Figure 4 illustrates the many uses of a well-defined and well-managed Enterprise Architecture. These include:

- Enterprise Portal Development & Deployment
- Data (Information) Warehouse Engineering & Management
- Business to Business & E-Business Information Management
- Enterprise Application Integration
- Quality Rapid Application Development (QRAD)
- Packaged Software Evaluation, Implementation & Integration
- Business and Business Process (Re)Engineering

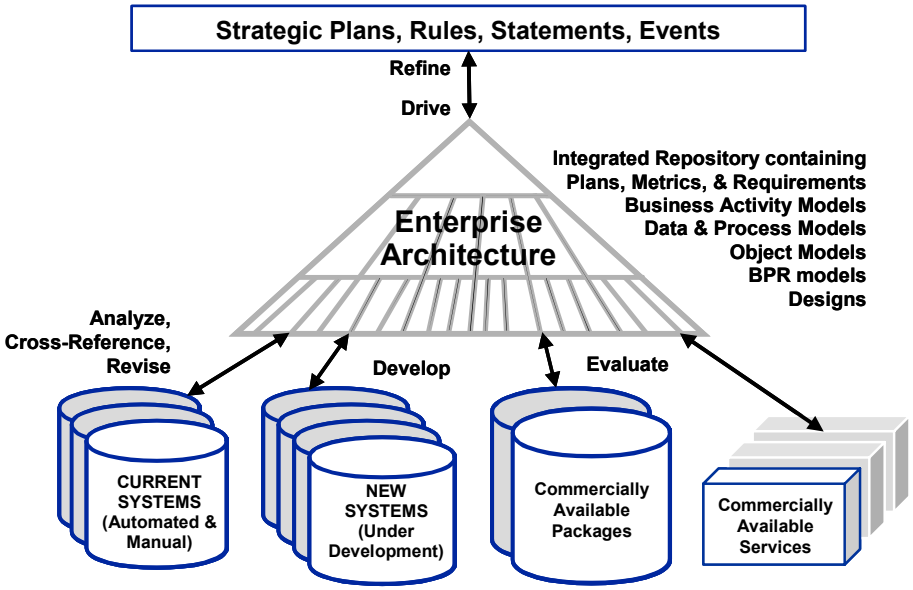

Figure 4. Using the Enterprise Architecture

e-Engineering is easier and less costly when based upon accurate architectural models of the enterprise. Further, enterprise performance measurement is easier and consistently produces desired outcomes when developers and decision-makers have access to an enterprise architecture (metadata) that accurately reflects enterprise infrastructure.

Enterprise Process Engineering

Once strategic business architecture elements have been documented, process-engineering teams begin improving enterprise processes. This part of e-Engineering is Enterprise Process Engineering (EPE). EPE is an architecture-driven version of the Integrated Process Engineering (IPE) methodology pioneered by PricewaterhouseCoopers. EPE and IPE both evolved from Business Process Reengineering (BPR).

EPE facilitates redesigning core and support processes in order to improve business performance by:

- Recognizing a business as a complex entity consisting of processes, people, culture, and technology.
- Focusing activity on addressing customer needs completely
- Setting and achieving challenging performance targets
- Using Enterprise Architecture as the “blueprint” for process reengineering and improvement

Enterprise Process Engineering teams include the managers and staff actually involved with the process. It is always easier for people who are familiar with a process to improve it. The teams use e-Engineering tools to diagram and document enterprise processes. The resulting enterprise architecture models are rich with detail and linked to applicable goals and objectives.

Just as blueprints depicting a house must be readable to those who use them, so, must the models and diagrams, which depict the enterprise's architecture, be usable by those who must make e-Engineering decisions.

The way in which enterprise models are developed also affects the usability of the enterprise architecture. For example, waiting until every element has been modeled before beginning improvements may eventually result in an excellent enterprise architecture, but it is unlikely that management or workers will be interested in such a long-term investment. When remodeling a house, the most successful approach is often to proceed a room at a time; so it is when remodeling enterprises. e-Engineering encourages enterprise teams to make improvements one process at a time.

Improving enterprise processes that are not critical to enterprise success is, at best, a waste of time and resources. At worst, it can have a detrimental impact on the enterprise by focusing attention needed for crucial functions on areas that are of little relative value. e-Engineering allows enterprises to shape processes as efficient and effective ways to meet strategic goals and objectives. Initial focus typically targets high impact areas such as customer service, new product delivery, or significant revenue areas. e-Engineering concentrates on what the enterprise actually needs so that efforts result in both long-term and short-term accomplishments.

Once an existing process has been modeled, it is analyzed thoroughly and improvement opportunities are identified. Potential improvements are tested using the "what if?" simulation capabilities of an e-Engineering tool set, keeping costs at a minimum. Only those improvements that show promise in the simulations are integrated. New processes are similarly designed and tested using the simulation tools before they are integrated into enterprise operations.

As the enterprise changes, the enterprise architecture must be changed as well. Otherwise, the architecture will not accurately reflect the enterprise and will become a questionable source of assistance for decision-making and improvement. Suppose the blueprints for a house show the electrical lines that were originally installed, but someone rewired a few rooms without changing the diagrams. If an electrician were to use those out-of-date blueprints for another remodeling job, the result could be confusion, higher cost and possible injury. Likewise, enterprises that invest in developing enterprise models, but fail to provide for maintenance can expect the value of the models to diminish over time, and, if still used, to have a negative impact

Enterprise System Engineering

In today's enterprises, knowledge and information are key resources on a par with capital, personnel, plant and equipment. Information systems are tightly interwoven within today's enterprises, requiring close coordination. For example, the impact of enterprise process improvement often requires significant change in how information is processed, which means that systems supporting changed processes must also be changed. Often, completely new systems are needed. Conversely, implementing new technologies or applications may require enterprise process change.

Quality enterprise processes must be supported with quality information systems. It is important to note that in our approach, information systems are never developed or purchased before the business processes they support have been improved. Good software that supports inefficient or unnecessary processes can never be characterized as quality systems.

A subset of e-Engineering is Enterprise System Engineering (ESE – pronounced “easy”). This is the part of the author’s unified method that consistently allows quality information systems to be developed from quality software components. Quality information systems are more than just error-free code. They also have the following characteristics:

- Support enterprise strategic objectives
- Meet business area requirements
- Are reliable, flexible, and scaleable
- Share corporate data and standards
- Built from reusable components
- Delivered on time and on budget

ESE uses Enterprise Architecture as the framework for developing and managing quality systems. The models that comprise an Enterprise Architecture reflect the business goals and critical success factors of the enterprise. The "business models" are technology independent, and can be revised, amended, and refined independently from the implementation environment of physical systems. The models provide a firm base from which software component designs are developed.

Linking software components to business requirements through an Enterprise Architecture ensures that components are developed only to meet specific business needs. Architecture models help bridge the gap between business information requirements and information systems and allow improved communication between business experts (information users) and system designers (information system providers).

Logical model components include links to documented business requirements for the components. These links -- requirement to logical model element to physical design object -- provide the best structure for component management and make change management both easier and faster. Quality requirements become quality models; quality models become quality designs; quality designs become quality components that make up quality information systems (see Figure 5).

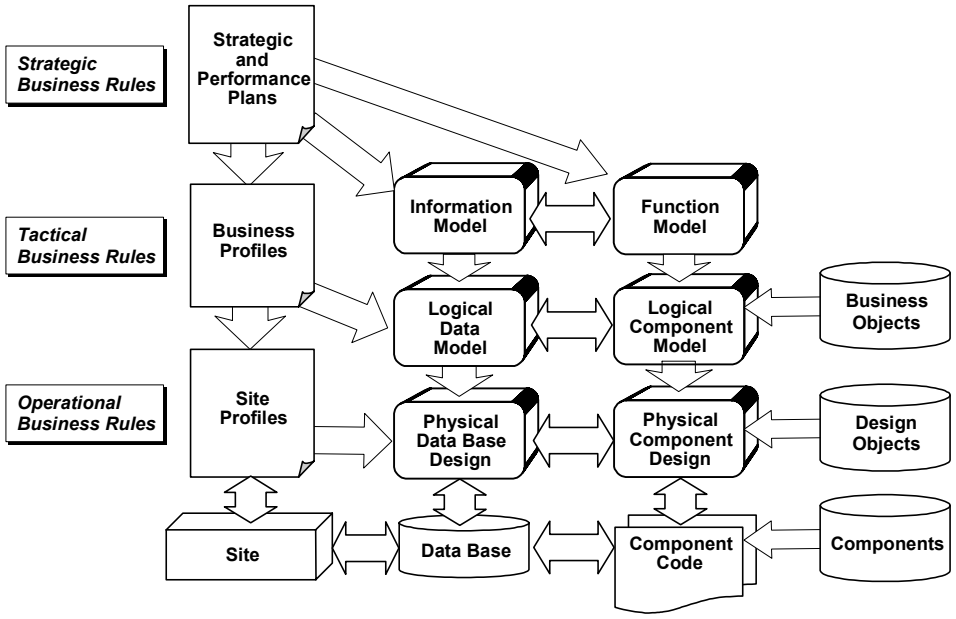

Figure 5. Enterprise System Engineering
from information need to information system

Quality is designed in -- not tested in!

With ESE, the extra time spent getting requirements right and designing logical components pays significant dividends in reducing the time spent designing and building software components. It also ensures that the organization can consistently develop quality information systems.

ESE incorporates the best practices of business and information management. ESE provides the means to achieve rapid development of quality software components, little or no maintenance, and satisfied information system users.

e-Engineering Critical Success Factors

Change Management

e-Engineering often requires significant change throughout an enterprise. Managing enterprise change, particularly culture change, requires three things: management commitment, universal approval, and appropriate measures and rewards.

Management Commitment

In order for anything to happen in an enterprise, including change, executives and managers must be *consistently* committed to making it happen. Only enterprise leaders can ensure that resources necessary to effect the change are available. Consistent commitment means that the change becomes both an enterprise strategy and an enterprise goal that leaders continuously and obviously support.

The visibility of leadership support is a primary factor in achieving universal approval for change. Leaders must also have the authority to make change, measure change, and reward change.

Universal Approval

Change is successful only when the people involved approve of the change. They understand the need for the change. They believe the change is good for the enterprise and good for them. They agree that the change being undertaken is the right change. Peter Senge, in his book *The Fifth Discipline,* describes the need for universal approval in order to implement systemic change: *"People want change, they don't want to be changed."*

Measures and Rewards

Getting everyone to want change is difficult. It requires a level and degree of communication and cooperation not found in most enterprises. Maintaining universal approval is even more difficult. The best way to achieve and maintain universal approval is to ensure that the process and results of change are measured appropriately and accurately and communicated enterprise-wide. Good results and changed behavior must be rewarded. At the same time, unchanged behavior and poor results should not be rewarded. Employees will not work toward change if they continue to be rewarded for old practices. In addition to rewarding changed behavior, in some enterprises, it may be necessary to implement some means of penalizing those who hinder change.

e-Engineering Environment

The most ignored critical success factor is the one that can have the greatest impact. In order to succeed with management reform, an enterprise must have an environment that promotes and facilitates e-Engineering best practices and techniques. The elements of this environment include project teams, tools, skills and help from experienced consultants.

Project Team(s)

In addition to consistent management commitment, sponsorship and involvement, there is another critical enterprise culture element. The teams that will actually implement e-Engineering practices must have certain characteristics. They must understand the importance of strategic information. They must be able to analyze and document business requirements in business language. They must be dedicated to the project. They must have sufficient resources. They must practice effective project management. Every team member must have appropriate skills, knowledge and experience, be sufficiently familiar with the e-Engineering approach, and be able to effectively use the e-Engineering tool set.

State-of-the-art tools

Key to successfully applying the e-Engineering approach is a set of computer-based tools. These tools should provide an easy-to-use means for documenting, modifying and managing strategic and performance plans and then managing execution of those plans in accordance with plans, policies, legislation and other requirements.

The tool set should include extensive reporting capability and state-of-the-art modeling, charting, analysis and information system design tools so that it can facilitate compliance, and at the same time, support Enterprise Process Engineering and Enterprise System Engineering. All Enterprise Architecture models should be managed using a single, "industrial strength" repository.

e-Engineering that involves wholesale enterprise change can be quite difficult to implement and manage. The innovative and constructive use of information technology, particularly a metadata management repository, at every step in the life cycle, can make such change much easier.

Skills and Knowledge

A specialized set of skills and knowledge is required to efficiently engineer an enterprise, including its architecture, performance measures and related systems. They include:

- Experience with tools and best practices
- Strong communication (speaking and writing) skills
- Ability to interact with everyone in an organization from office workers to the CEO.

The necessary skills and knowledge may be acquired by hiring experienced consultants, or by training internal staff. The most effective approach is for consultants to begin an enterprise's e-Engineering activities while helping internal staff become skilled so that the enterprise eventually becomes self-sufficient.

Experienced, Full-Service Consulting:

The author and his associates can provide a wide range of training and consulting for enterprises that want to improve their enterprise and information management activities and want to do them right.

We are skilled not only in strategic planning and organizational management, but also in developing and implementing the kinds of automated systems with which successful enterprises can manage their critical information resources.

The author and his associates is uniquely qualified to help enterprises -- at any stage in their e-Engineering process -- prepare for, develop, implement, and improve any of the following practices:

- Enterprise Planning (at all organization levels)
- Enterprise Management (enterprise planning linked to performance)
- Performance Measurement & Management
- Enterprise Process Engineering (implementing best practices to improve performance)
- Performance Reporting (communicating results)
- Information Management (critical asset stewardship)
- Enterprise Architecture Engineering (using a consistent framework)

- Enterprise System Engineering (delivering quality data/information)

We are very experienced in helping clients gain the necessary expertise to effectively adopt best practices and use appropriate tools through facilitation, training, education, mentoring and coaching.

Summary

Adopting e-Engineering best practices allows an enterprise to define its strategy, design and implement processes which support the strategy, and then manage the processes to assure enterprise success -- all while maintaining focus on goals, success factors and stakeholder expectations.

e-Engineering, which applies equally to well-established and newly-forming enterprises, responds to the fundamental business drivers of the 21st century: migration to "agile" production, globalization of markets, changing labor pools, and volatile political and business environments.

Most industry analysts agree that the reason to invest in information technology is to add value to the enterprise. Linking information technology investment to business contribution is an important first step in supporting enterprise performance improvement. e-Engineering provides the ultimate value-added use of information technology.

The impact of e-Engineering often requires significant change in every enterprise activity and process. This includes changes in how information is processed as well as changes in the systems that support the changed processes. e-Engineering not only makes effective change management possible, it makes it easy.

e-Engineering allows enterprises to start from wherever they are and successfully make the transition to a results-oriented, performance-based enterprise that effectively uses all its resources – people, funds, facilities, equipment, and information – to meet enterprise goals and provide superior products and services to their customers.

The author and his associates have helped numerous clients successfully assimilate this approach and become self sufficient in its best practices and techniques. We are the preeminent providers of effective solutions to complex enterprise management problems.

For additional information about this topic please contact:

Visible Systems Corporation
711 Atlantic Avenue
Boston, MA
contact@visiblesystemscorp.com

Alan Perkins has been a Systems Analyst on the White House staff, Director of the US Army Data Processing School in Germany, Vice President of R&D for a virtual corporation, Vice President of Consulting for Visible Systems Corporation and General Manager of a high-tech consulting firm. He has provided information and enterprise management consulting to numerous companies, associations and government agencies.

Mr. Perkins specializes in Enterprise Architecture Engineering. He helps clients quickly engineer enterprise architectures that are actionable and adaptable. His approach results in architectures that enable and facilitate enterprise initiatives such as Corporate Portals, Enterprise Data Warehouses, Enterprise Application Integration, Software Component Engineering, etc.

The following are papers are available at www.visiblesystemscorp.com:

"Enterprise Architecture Engineering"

"Enterprise Architecture Engineering Critical Success Factors"

"*High-Performance* Enterprise Architecture Engineering – Implementing the Zachman Framework for Enterprise Architecture"

"Enterprise Change Management – An Architected Approach"

"Getting Your Acts Together – An Architected Solution for Government Transformation"

"A Strategic Approach to Data Warehouse Engineering"

"Data Warehouse Architecture – A Blueprint For Success"

"Critical Success Factors for Data Warehouse Engineering"

"How to Succeed in the 21st Century – Critical Information Management Success Factors"

"XML Metadata Management – Controlling XML Chaos"

"Business Rules Are Meta-Data"

"Enterprise Application Modernization – Solving IT's Biggest Problem"

"Strategic Enterprise Application Integration"

"e-Engineering – A Unified Method"

"Enterprise Portal Engineering"

"Quality Software [Component] Engineering"

"Software Engineering Process Improvement"