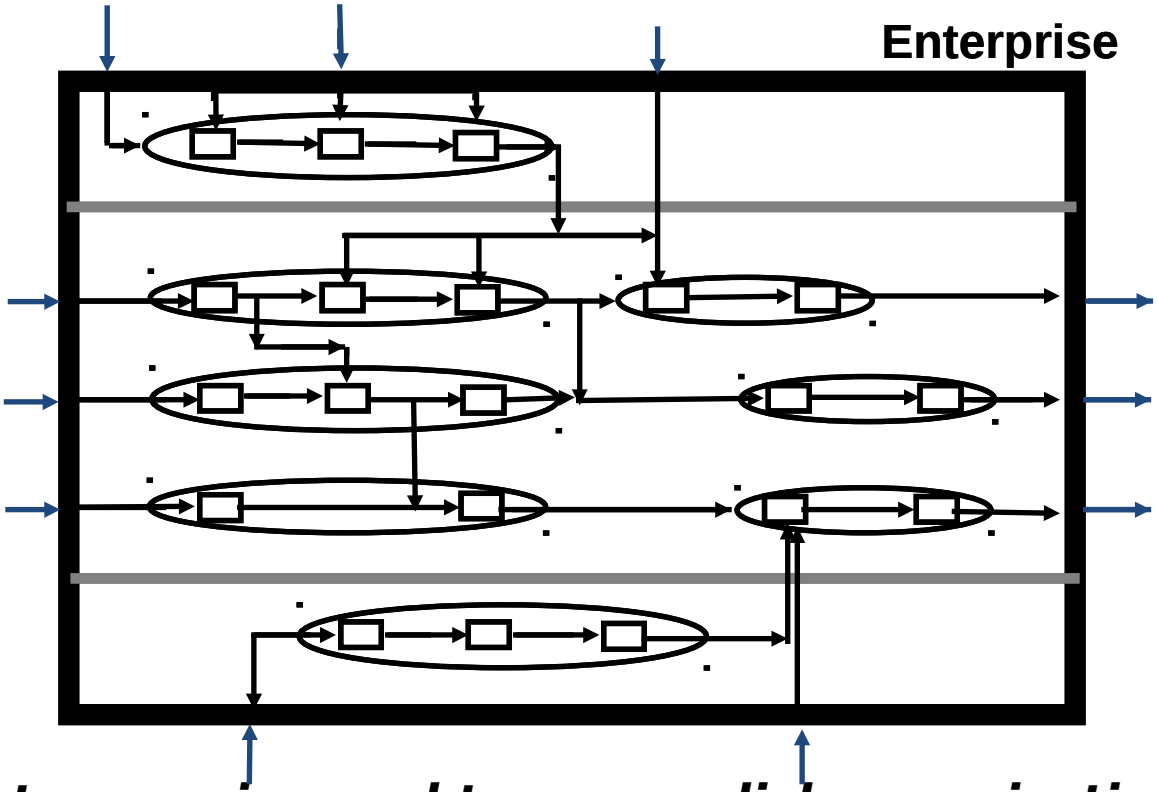
Enterprise Engineering

What is an Enterprise?

An Enterprise is a complex system of cultural, process, and technology components ...



... a system engineered to accomplish organizational goals.

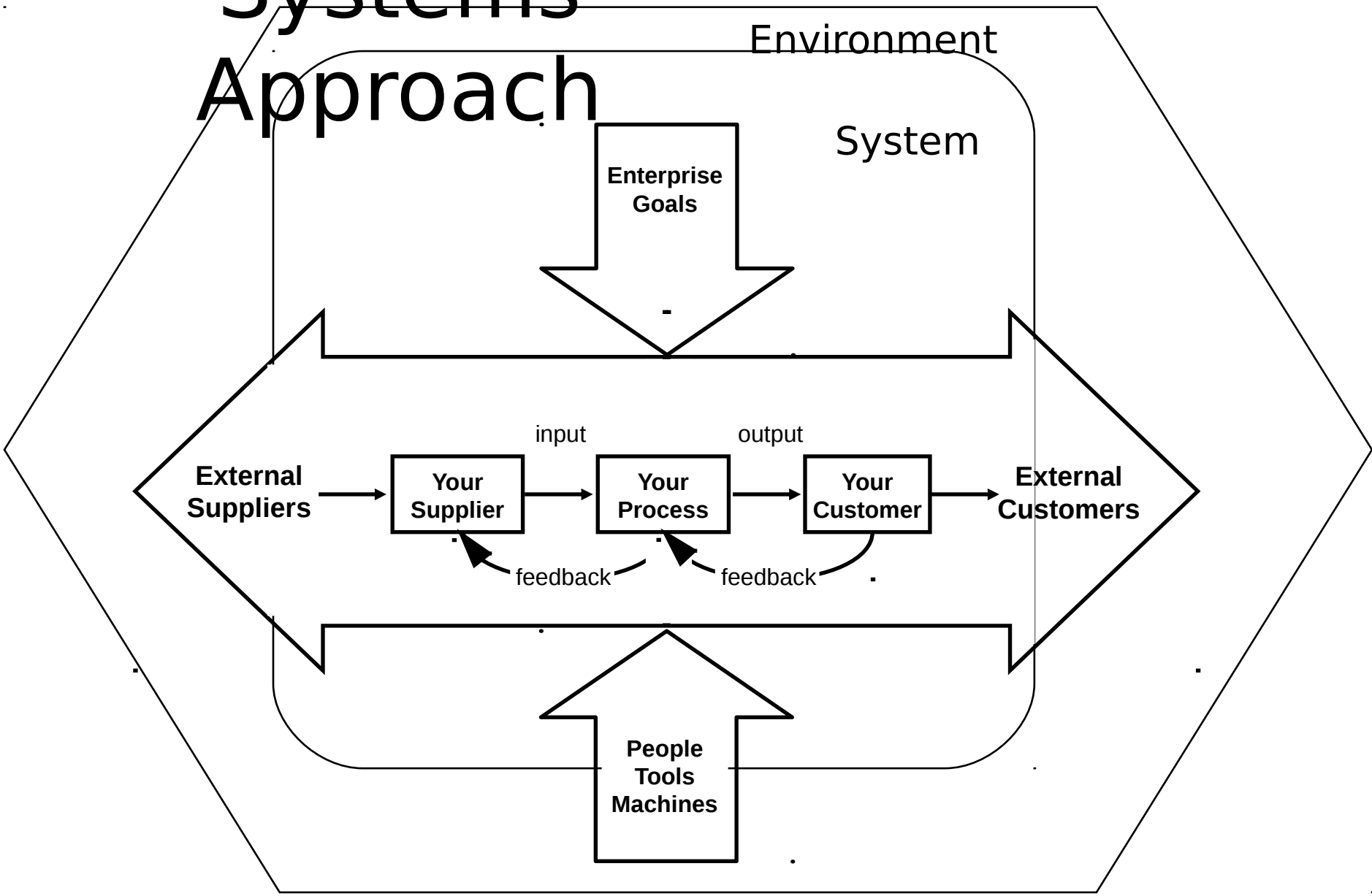
What do Engineers do?

Design things!

Same as other engineers, Enterprise Engineers design things.

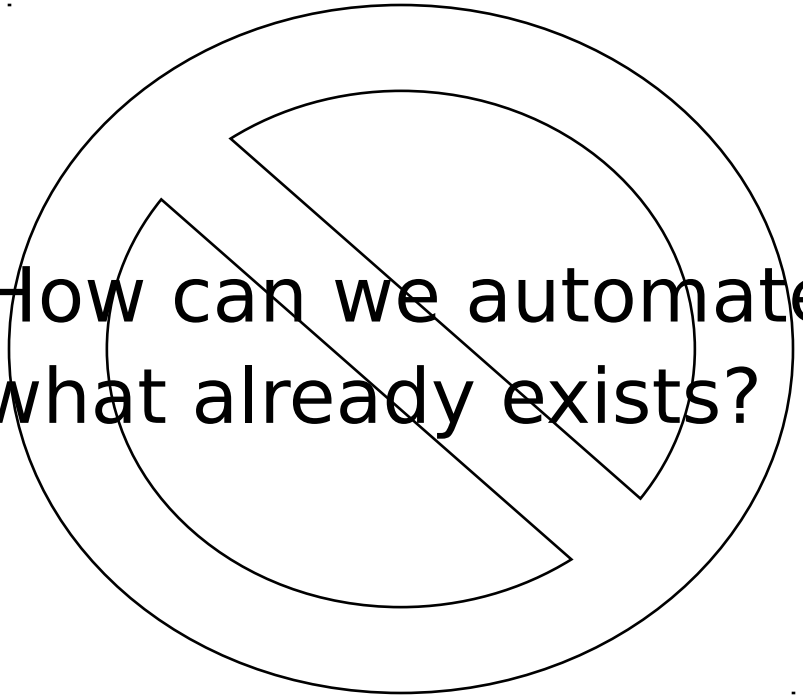
Only their thing is the enterprise

Systems Approach



Wrong use of Automation

Design



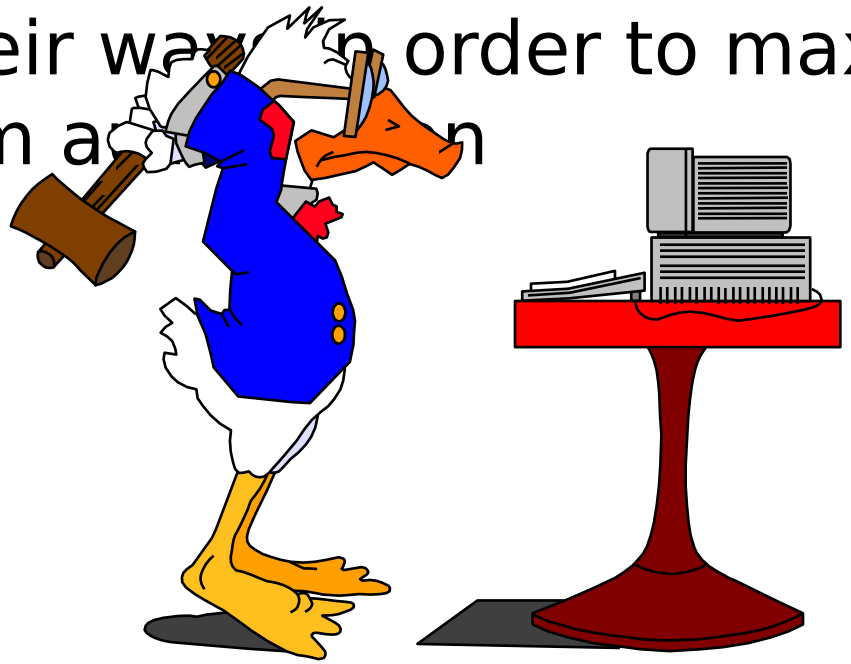
How can we automate what already exists?

Replace to make fundamentally better

Wrong use of Automation

System must fit the users and not the reverse?

Not always, frequently the users must change their way in order to maximize profits from automation



Redesign, then automate!

- Little change, little payoff
- Big change, big payoff

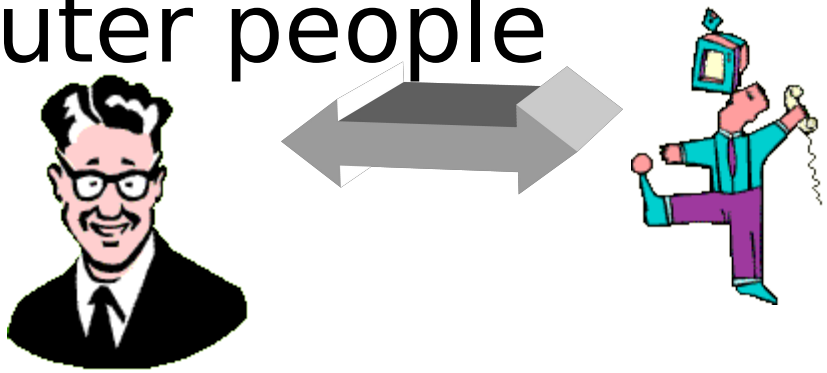
- A small change with some payoff may mean it is much more difficult to make the right change later.

Russell Ackoff

- “If each part of a system, considered separately, is made to operate as efficiently as possible, the system as a whole will not operate as effectively as possible.

Key concept

- JOINT creativity of business and computer people



Architecture - Martin

- “The architecture of an enterprise is the basic overall organization within which work takes place.

- Note how this compares with later definitions

Enterprise Engg Definition (Martin)

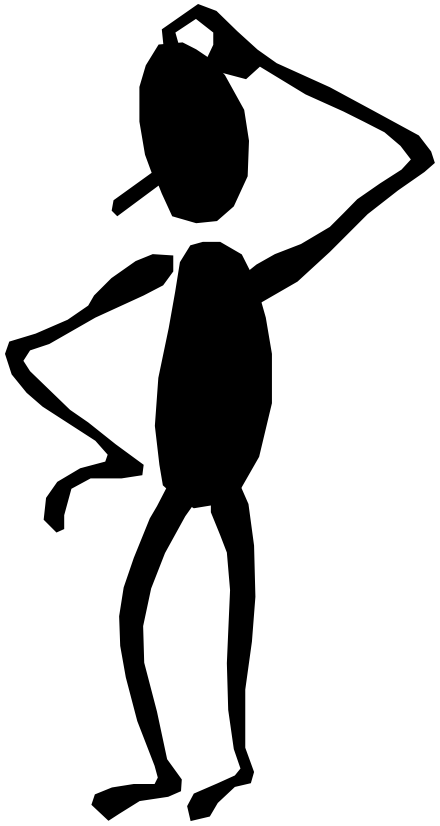
- … an integrated set of disciplines for building or changing an enterprise, its processes, and systems.
- It integrates the most powerful change methods and makes them succeed.
- The goal is a human-technological partnership of maximum efficiency in which learning takes place at every level. (Martin)

Goal of the Enterprise Engineer

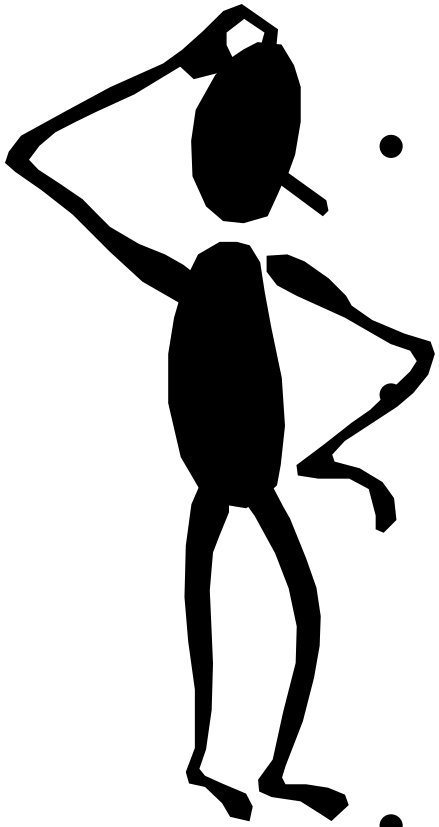
- “Identify and integrate the most valuable and successful ways to change an enterprise, and to take them into a professional discipline with a teachable methodology and measures of effectiveness.”

What do Enterprise Engineers do?

- Identify and Integrate best and most successful ways to change an enterprise



What do Enterprise Engineers do?



- Two aspects

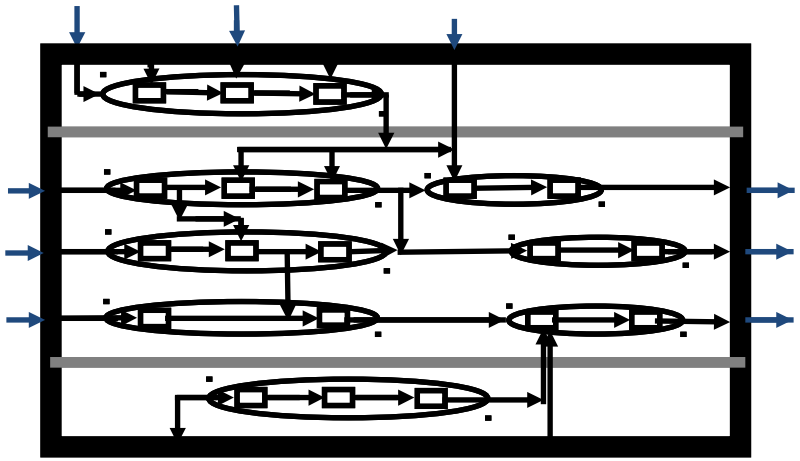
Understand new mechanisms

  - New ways of organizing work
  - New Corporate Architectures must be understood

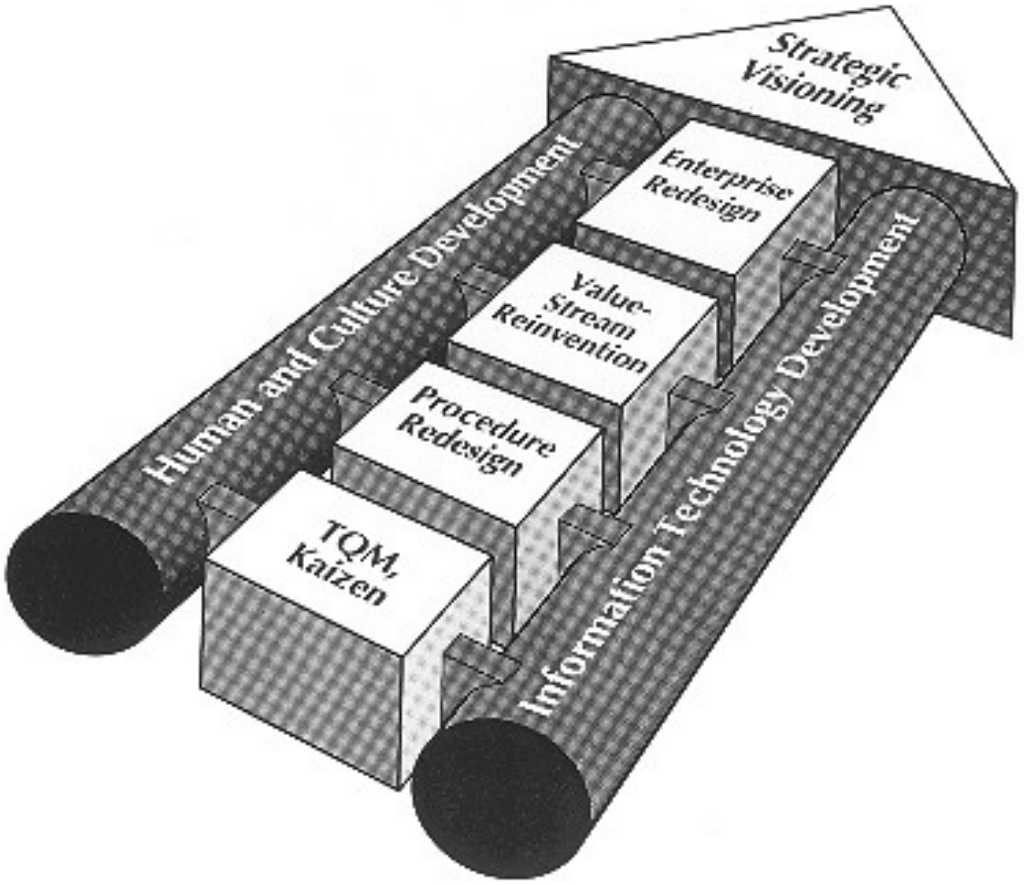
- Understand methods that can change an enterprise

Two questions Enterprise Engineers always ask

- What should the enterprise be?
- How do we get there from here?



Seven Components of Enterprise Engineering

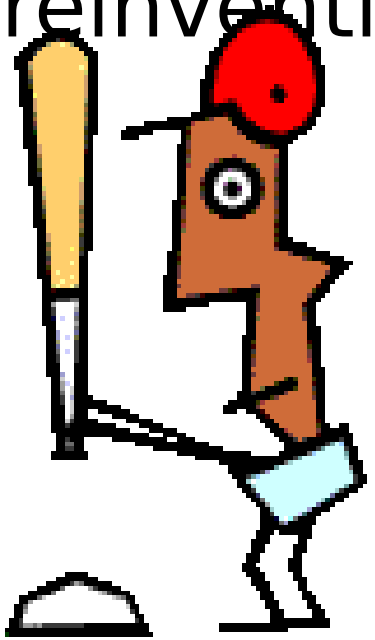


TQM, Kaizen

- Continuous change applied across an enterprise
- Kaizen - Japanese term for continuous improvement
- Everybody improves everything all the time

Procedure Redesign

- Discontinuous reinvention of existing processes
- Quick hit
- Low lying fruit



Value Stream Reinvention

- Discontinuous reinvention of “end to end” streams
- Breakthrough improvement for the CUSTOMER

Enterprise Redesign

- Discontinuous redesign
- Holistic change to a new world architecture, sometimes accomplished by building new business units of subsidiaries.

All for changing processes

- Simplifying work
- Improving results

Simplification of Work (note order)

- Eliminate (bureaucracy and non-value added)
- Simplify (work flow, etc.)
- Work Smarter
- Reduce Middlemen (eliminate)
- Refine IIS
- Automate
- Automate Automation

Strategic Visioning

- What is a vision?

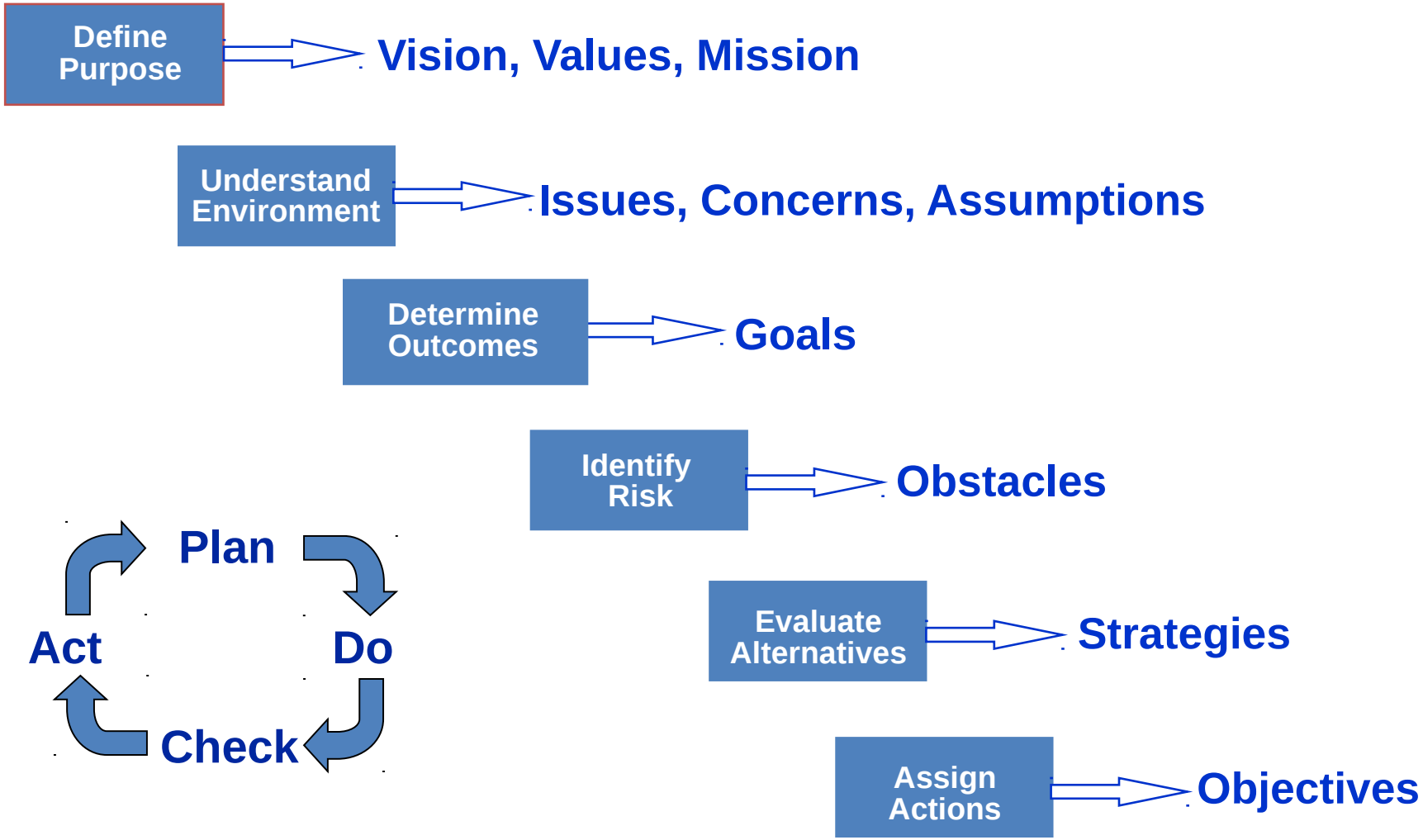
Strategic Visioning

Resisting the Tide of Change

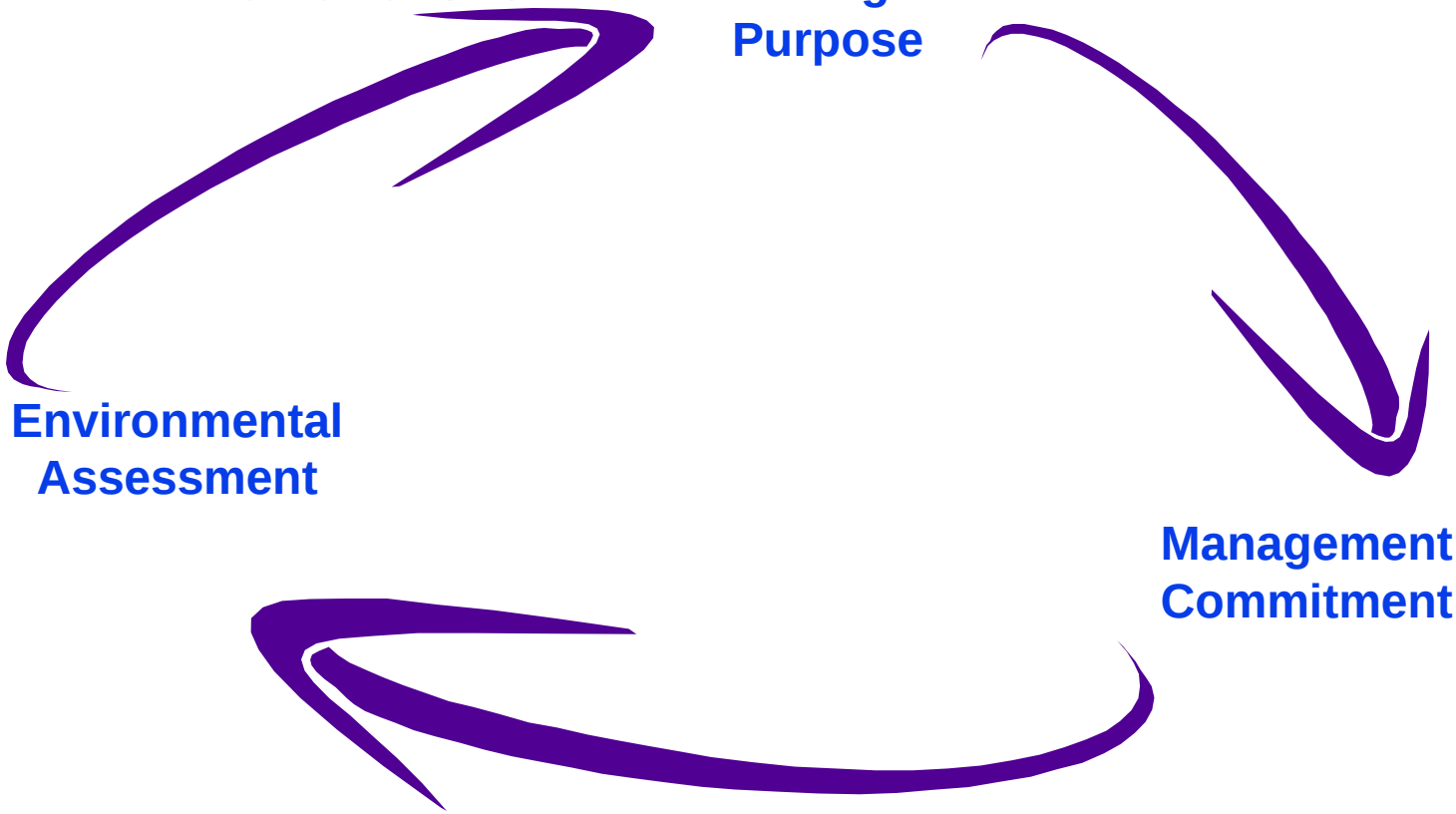
"Doing your best is not enough."
W. Edwards Deming

You must know what to do, how to do it and be willing to pay the price to do it.

A Disciplined Planning Process



An Iterative Process



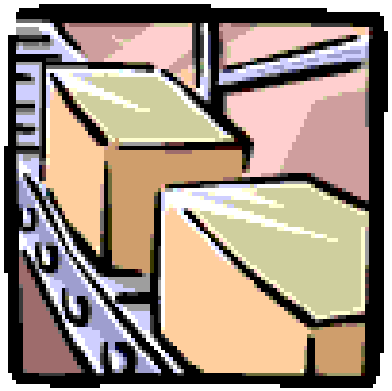
World View

- Enterprise Engineering
  - Enterprise can be viewed as a complex system
  - Enterprise is to be viewed as a system of processes that can be engineered both individually and holistically
  - Engineering rigor is required in transforming an enterprise
- Enterprise CAN be engineered

IT and BPR

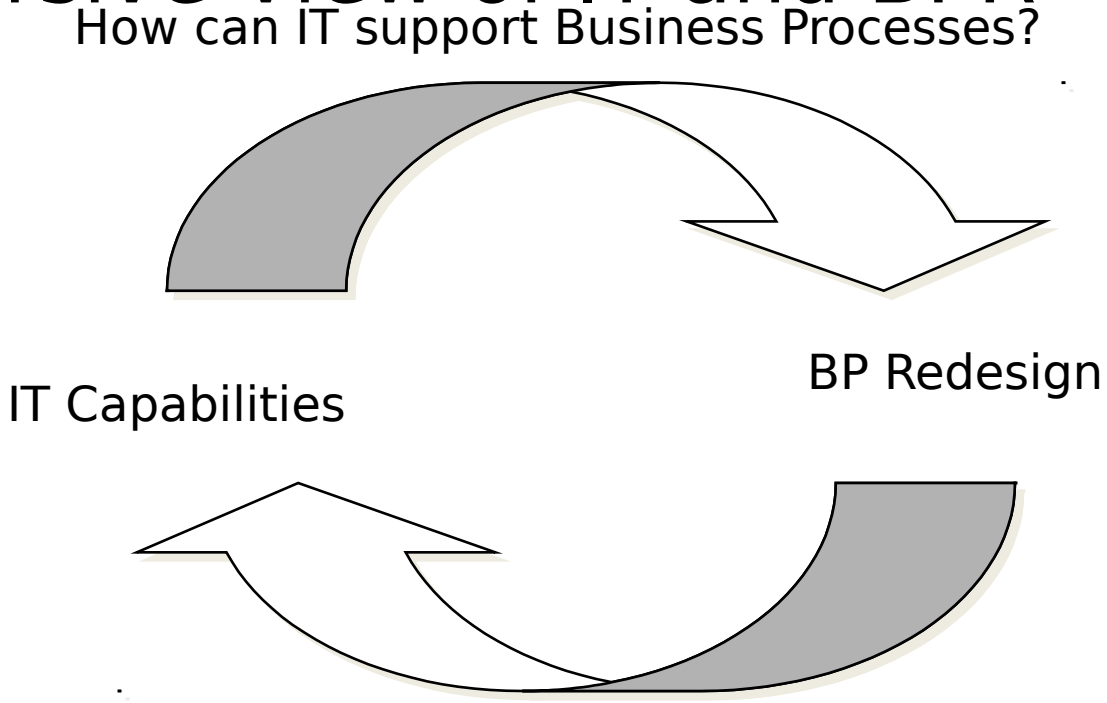
- IEs use IT in Manufacturing

- IEs now penetrate offices



The New IE

- Recursive View of IT and BPR



Enterprise Engineering

- **Enterprise engineering** is a sub discipline of systems engineering,
- It applies the knowledge and methods of systems engineering to the design of businesses.
- Examines each aspect of the enterprise, including business processes, information flows, and organizational structure.
- Enterprise engineering may focus on the design of the enterprise as a whole, or on the design and integration of certain business components.
- Deals with the modeling and integration of various organizational and technical parts of business process and functions"

Contd…

- Encompassing the application of knowledge, principles, and disciplines related to the analysis, design, implementation and operation of all elements associated with an enterprise
- This is an interdisciplinary field which combines systems engineering and strategic management
- It seeks to engineer the entire enterprise in terms of the products, processes and business operations
- This field is related to engineering management, operations management, service management and systems engineering

Contd…

- In the context of software development,
  - a specific field of enterprise engineering has also appeared that deals with the modeling and integration of various organizational and technical parts of business process and functions
- In the context of information systems development,
  - this has become an area of activity for the organization of systems analysis, and an extension to the existing scope of Information Modeling
- It can also be viewed as
  - An extension and generalization of the systems analysis and systems design phases of the software development process

Contd…

- Enterprise modeling can form part of
  - The early,
  - middle and
  - Late

  information system development life cycle
- Explicit representation of the organizational and technical system infrastructure is being developed in order to understand the orderly transformations of existing work practices
- This discipline is also known as Enterprise architecture, or along with Enterprise Ontology, defined as being one of the two major sub-fields of Enterprise architecture

Contd...

- Enterprise engineering involves
  - formal methodologies,
  - methods and techniques

  are designed, tested and used extensively in order to offer organizations reusable business process solutions
- Uses
  - Computer Integrated Manufacturing Open Systems Architecture (CIMOSA) methodology
  - Integrated DEFinition(IDEF) methodology
  - Petri Nets
  - Unified Modeling Language(UML) or Unified Enterprise Modeling Language (UEML)
  - Enterprise Function Diagrams (EFD)

Contd…

- **Computer Integrated Manufacturing Open Systems Architecture**
  - Provides templates and interconnected modeling constructs to encode business, people and information technology (IT) aspects of enterprise requirements.
  - This is done from multiple perspectives: Information view, Function view, Resource view and Organization view

Contd…

Integrated DEFinition(IDEF) methodology(IDEF)

- first developed as a modeling language to model manufacturing systems, has been used by the U.S. Airforce since 1981 and
- Originally offered four different notations to model an enterprise from a certain viewpoint
- IDEF shows how a business process flows through a variety of decomposed business functions with corresponding information inputs, outputs and actors.
- Like CIMOSA, it also uses different enterprise views
- Moreover, IDEF can be easily transformed into UML-diagrams for the further development of IT systems
- These positive characteristics make it a powerful method for the development of Functional Software Architectures

Contd…

Petri Nets

- Petri Nets are established tools used to model manufacturing systems
- The most advantageous properties are
  - the ability to create simple representation of states,
  - concurrent system transitions and capabilities
  - thereby allowing modeling of the duration of transitions.
- As a result Petri Nets can be used to model certain business processes with corresponding state and transitions or activities therein as well as out
- **Unified Modeling Language (UML)**
- **Enterprise Function Diagrams**
- EFD is a used as a modeling technique for the representation of enterprise functions and corresponding interactions.

Electronic Organism

- As systems become more complex, the design of these systems must be automated.
- Automation of Automation
- Reaction times shrink, complexity increases, decisions become less intuitive.

Contd...

- Algorithmically controlled computers *are simple,* because they need not contain the creative infrastructure of the algorithmic division of labor
- but they also *have to be simple*, because otherwise they could not be algorithmically controlled off-line by humans.
- Electronic organisms, in fact all organisms , *have to be complex,* because they have to contain all the creative infrastructure necessary for their creation, reproduction, maintenance and action,
- but they can easily *afford to be complex,* because there is no need for detailed communication with a programmer.

Contd…

- Electronic Organisms
  - Have the ability to react immediately to unforeseen challenges, without the need for a programmer to recognize the situation and
  - deal with it by modifying a program.
  - Do so by recurrence to fundamental goals and organizing principles, just as programmers do so now
- Electronic organisms will live, grow and evolve in the rapidly growing world of installed computers and networks, just as microbes, plants and animals live in natural ecosystems.

Contd...

- Strong forces are pushing technology towards electronic organisms.
- Rapidly growing installed processing power worldwide is creating expectations of novel functions of increased complexity.
- Novel computer functions produce a quadratically growing need for coordination.
- Software production is a black hole for human intellectual power, and society will soon no longer be able to satisfy that demand-results in **software crisis**
- The example of animal and human nervous systems and of organisms in general lead the way to the solution of these problems
- A general expectation that autonomous electronic organisms will create security problems is due to a fundamental misunderstanding

What are Business Processes?

- … a set of logically related tasks performed to achieve a defined business outcome

- A set of processes forms a business system

- Characteristics of business processes
  - Customers - recipients of outcomes
  - Cross organizational boundaries

Redesign with IT - Five Steps

- Develop Business Vision and Process Objectives
- Integrated Development(ID) Processes to be Redesigned
- Understand and Measure the Existing Process
- ID IT Levers
- Design and Build a Prototype of the New Design

Types of Processes

Process Dimension & Type	***Typical Example***	***Typical IT Role***
Entities		
Interorganizational	Order from a supplier	Lower transaction costs; eliminate intermediaries
Interfunctional	Develop a new product	Work across geography; greater simultaneity
Interpersonal	Approve a bank loan	Role and task integration
Objects		
Physical	Mfg a product	Increased outcome flexibility
Informational	Create a proposal	
Activities		
Operational	Fill order	Reduce time and costs; increase output quality
Managerial	Develop a budget	Improve analysis; increase participation

Management Issues

- Management Roles - commitment even through across functional boundaries
- Processes and Organization
- Skills - new ones required
- Continual Organization Improvement
- IT Organization in Enterprise may change
- Continuous Process Improvement

Vernadat - Text - Definitions

- Enterprise - within the bounds of the company
  - intra-enterprise integration
- Extended Enterprise - beyond the bounds of the company
  - inter-enterprise integration
- Agility -adapt quickly (able to respond to unanticipated change)
- Virtual Enterprise - Extended enterprise on a temporary basis.

Problems with EI/EE

- *Cost (unclear)*
- *project size and duration*
- *Complexity*
- *management support - does not clearly relate to strategy*
- *skilled people*

Loose Integration vs Full Integration

- Loose
  - simple exchange of info
  - no guarantee of same interpretation
  - ex. Dedicated interface
- Full
  - specificities are known only the the one system
  - two systems contribute to a common task
  - two systems share the definition of items exchanged

Horizontal vs Vertical Integration

- Business viewpoint
- Horizontal - from “dock to stock”
  - technologically dependant
- Vertical - various mgmt levels
  - decision flow

Process Alignment

- The greatest challenge facing businesses today is the unrelenting pace of change.
- Every organization wants to improve its ability to respond rapidly, dynamically and economically to market forces.
- Well-defined processes are the key to becoming a more responsive and adaptable enterprise.

Contd…

- In a process-centric organization, processes are integrated holistically, are well designed and visible to management, and are measured and managed against corporate strategy and goals.
- Process-centric companies have well defined processes that are horizontally and vertically aligned, are well governed, and produce cost-effective and reliable outcomes.

Contd…

- Business Process Management (BPM) provides
  - a comprehensive system for improving processes,
  - aligning business processes with business goals and
  - assuring underlying IT applications, human competency and
  - organization designs support the process performance objectives.

Contd…

- Within the BPM there are two constituencies, both using the term "BPM.“
  - One constituency uses the term to refer to changing the way processes are designed, managed and measured.
  - The other uses the term "BPM" to refer to IT efforts to create and install BPM systems, including the development of rule-based systems, automated process monitoring systems, and software standards.

Contd…

- Presently ,IT is developing a new generation of software tools that make it easier for IT to align its applications and databases with business processes
- BPM software products have
  - the potential to significantly improve a company’s performance, and
  - efforts to organize IT developments in ways that align and support business processes is a major step forward in managing IT

Contd…

- However, the more important issue is getting business organizations to embrace a process-centric approach to management

To be a process centric company

- a company needs to master and integrate all of the process elements within the organization and
- overcome the gap that lies between those interested in the human aspects of process change and
- those interested in the automation of processes

Contd…

- If your company is to become process-centric you need to develop a central business process architecture that ties corporate strategy to both human and IT implementation.
- Senior managers
  - need to invest the time in developing the business process architecture,
  - need to monitor the performance of the processes defined in the architecture and
  - they need to set priorities and manage the processes and the people engaged in all levels of process change.

Contd…

- When this occurs you will have built business process right into the fabric of your organization, assuring that your company’s people and processes are aligned to improve organizational performance
- Everyone interested in reaping the multiple proven benefits of a process centric approach to business process change needs to reach out to others and define BPM as broadly as possible.
- To assure this happens we need to work together to assure that BPM embraces all possible process change efforts.

Framework to manage integrated change

- The alignment between Business Processes (BP) and Information Technologies (IT) is a major issue in most organizations
- It directly impacts on the organization's agility and flexibility to change according to business needs.
- The concepts upon which alignment is perceived are addressed in what is called today the "Enterprise Architecture", gathering business and IT together

Contd...

- Many Enterprise Architecture Frameworks have been proposed, focusing on different concerns and with different approaches for guiding the development of an IT infrastructure well suited for the organization.
- Each Enterprise Architecture Framework has its own concepts, components, and methodologies to derive the component all the required artifact.
- However, when the main concern is alignment, we may consider simpler architecture concepts and simpler methodologies because the focus is not to define development artifacts but only to check their consistency

Contd...

- Integration framework composed of a collection of technologies and services which form a middleware to enable integration of systems and applications across the enterprise
- Supply chain management applications (for managing inventory and shipping), customer relationship management applications (for managing current and potential customers), business intelligence applications (for finding patterns from existing data from operations), and other types of applications (for managing data such as human resources data, health care, internal communications, etc.) typically cannot communicate with one another in order to share data or business rules

Contd…

- For this reason, such applications are sometimes referred to as islands of automation or information silos.
- This lack of communication leads to inefficiencies, wherein identical data are stored in multiple locations, or straightforward processes are unable to be automated

Contd…

- Enterprise application integration is the process of linking such applications within a single organization together in order to simplify and automate business processes to the greatest extent possible, while at the same time avoiding having to make sweeping changes to the existing applications or data structures.
- In the word EAI is the “unrestricted sharing of data and business processes among any connected application or data sources in the enterprise.”