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Information Technology, a Catalyst for Process Optimization

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Abstract

Rapid product development and virtual prototyping are fast becoming commodities of world class companies. In order to maximize their effectiveness, one must be able to measure and change business processes.

Efforts like Business Process Reengineering (BPR) and Concurrent Engineering (CE) that help define process improvement methodologies are being adopted by more and more organizations. This paper will cover a small array of information technology (IT) tools that aid the paradigm shift from traditional, functionally-oriented operations to process-oriented ventures. Software tools are plentiful but cannot be used as stand-alone resources. Successful utilization is dependent upon a holistic approach to change management with adequate planning, personnel and financial resources, know-how and information technology.

Analysis of organizations in terms of processes and process flows increases our understanding of core competencies and weakness enabling business success. This paper addresses issues raised when implementing IT as a catalyst for finding process-oriented solutions. BPR and CE are initiatives that bear similar attributes and are equated to be different sides of the same coin. The two have been freely intermixed in the following paper.

J. Rix et al. (eds.), *Virtual Prototyping*

Keywords

Process optimization, business process reengineering, process management, process analysis, PEAT, SIFRAME

1 INTRODUCTION

The demise of protected market structure due to recent political revolution, and multinational trade agreements (i.e., GATT) have not only opened gates of once restricted markets, but also created new challenges for organizations on a global scale. Technology has provided and continues to provide solutions to a series of information related problems. The cost of technology (Figure 1) is decreasing at a phenomenal rate.

The rapid change in technology has also created an environment where the market life of a product has decreased due to the introduction of new and more advanced products on a regular basis. Companies that cannot meet the challenges of decreasing the development time cycles to a level comparable with product life without losing quality, are bound to end up like dinosaurs.

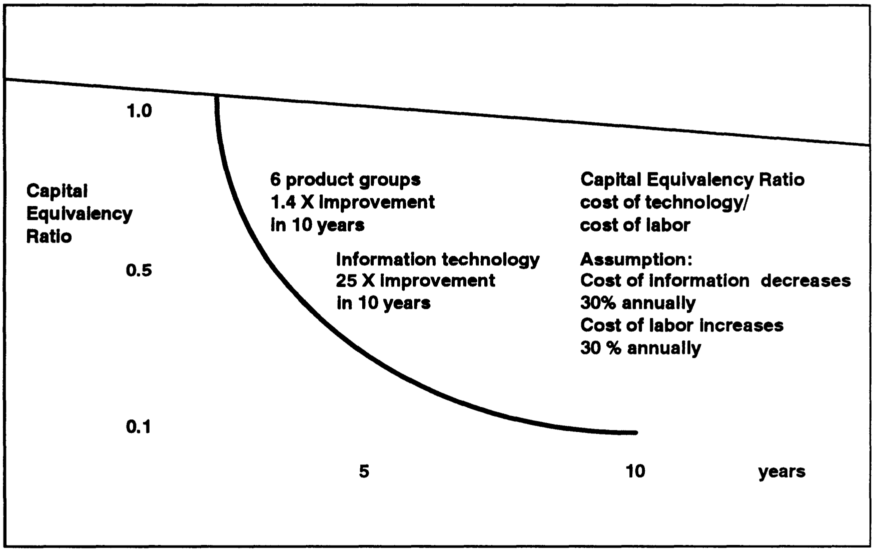

Figure 1 Cost of Information Technology (Benjamin and Yates)

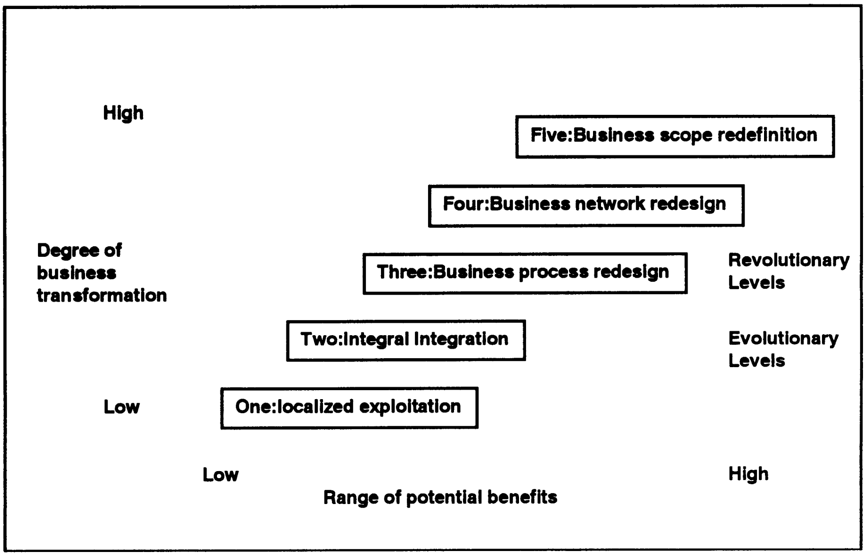

Figure 2 Five levels of IT induced reconfiguration (Venkatraman)

2 BPR AND CE

The extent of change an organization attempts to induce reflects the extent of failure or benefit that may be realized. (Figure 2) BPR and CE are inter-related. "At the heart of business reengineering lies the notion of discontinuous thinking -- identifying and abandoning the outdated rules and fundamental assumptions that underlie current business operations."(Hammer and Champy) CE deals with cross-disciplinary groups working together with the aim of achieving the goal of rapid product development. The key to both CE and BPR is the understanding of "What is a Process?". "In definitional terms, a process is simply a structured, measured set of activities designed to produce a specified output for a particular customer or market."(Davenport)

2.1 Process awareness and understanding

Before undertaking an improvement initiative a company must understand its current situation. The area of process analysis is becoming more scientific -- focusing on hard data and metrics to identify the weaknesses and strengths of an organization. Not only is IT a catalyst for CE, but it also allows for effective change management associated with CE and BPR initiatives. Effective change management enhances functional agility, translating into rapid new product introduction, quicker customer response time, prompt service and other factors that characterize successful organizations.

2.2 Reengineering demystistified

Reengineering the Corporation, by Hammer and Champy, alerts industry to the need for a change from task based thinking to a process-oriented focus. Task based thinking -- the fragmentation of work into its simplest components and their assignment to specialist workers has influenced the organizational design of companies for the last two hundred years. The shift to process based thinking is already under way, and is illustrated in the radical changes that mainstream companies have made. Not all BPR and CE engagements succeed. It is estimated that 70% of all so-called efforts fail. (Datamation) Failure can be attributed to socioeconomic, sociotechnological and humanistic reasons.

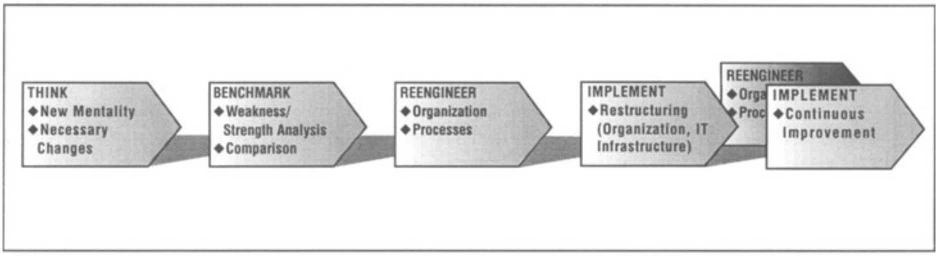

Figure 3 A simplified view of steps that an organization follows to analyze its processes and perform CE-based reengineering.

The first three steps require a series of brainstorming sessions to define how the organization should conduct its business. These steps, though driven by human input, must be aided by process optimization software and process modellers (e.g. Siemens PMG PEAT methodology and SNI GRAPES tool). These tools use predefined matrices to identify the cost and attributes of the processes which make up an organization. These tools do not eliminate the thinking involved, but merely make it easier to play the "what if" game. The results of the analysis are operational benchmarks for processes and process flows, as well as a series of guidelines on how business should be conducted.

The latter steps identify the need for an IT-supported structure that allows the recommendations of the first three steps to be implemented, incorporating also the mechanism for capturing execution matrices, thus aiding in the continuos improvement process. It is at this stage that most engagements fail due to the difficulty in merging methodology with technology.

3 IT REQUIREMENTS

The first three steps call for the analysis and simplification of processes. IT is the gateway to successful process-oriented change management, and is an catalyst for fast process analysis, simplification, and optimization. This requires three distinct steps which must be performed sequentially.

3.1 Process mapping

The technique of flowcharting processes using IT. Mapping exercises begin with an interview of the process owner -- the individual with the most intimate understanding of the flow of the business. It is critical that issues of time, cost, staffing and value be addressed accurately for each step in the process. A well constructed map should illustrate all the steps in a specific process regardless of the number of functions involved or their geographic locations; as well as, salient subprocesses, interactions, hand-offs, loops, decision trees and case statements. The map is the prerequisite for all future improvement steps. The success of the reengineering endeavor is directly linked to the accuracy of the diagram. (Figure 4)

3.2 Process evaluation and analysis

The second step is a metrical diagnosis of data in the process map, cost and time being the key criteria. The diagnostic outputs provide the organization with an empirical assessment of its current operational status. The data allows the organization to examine how the process flows [normal vs. best and worst case scenarios] which leads to internal benchmarking and/or the articulation of quantifiable goals for process simplification and improvement. Information extracted during the analysis stage becomes the basis for process simplification and reengineering. The IT structure must support the realization of the goals and recommendations identified at this stage.

3.3 Process simplification, optimization and reengineering

Process simplification, true to its name, is the examination and potential elimination of non-value-added steps in a process. An "optimized" process falls out of simplification. Non-value added activity can be identified by asking the question: *Is the customer willing to pay for this?* Note that not all non-value added work should be automatically eliminated and should not be confused with cost added. It may be critical to the process. If the task in question does not add value, then it must be ruthlessly examined and if possible changed or eliminated. Simply cutting and pasting steps in a process is detrimental to the initiative. Optimization is a prerequisite to reengineering, and mandates the obliteration of superfluous, cost/time adding steps and the adoption of a progressive way of thinking. Perhaps the greatest obstacle to this paradigm shift is "unlearning" bad practices. IT is a catalyst for identifying *why are we doing what we are doing* and making recommendations for improvement.

Given the removal of excessive non-value added steps, the initiative ascends to the next level, reengineering. This is the culmination of all diagnostic work and the beginning of a rearchictecture of key business elements: methods, metrics, processes, and organization.

Without adequate IT support, reengineering is an impossible endeavor, requiring elaborate calculations and exorbitant time and personnel costs. Effective software catalysts have become essential, and therefore must be examined. SIEMENS PEAT package, tabulates relational data rapidly and generates summary outputs of process maps. Built in flexibility allows the user to analyze probable reengineering strategies without jeopardizing the financial or operational well being of the organization.

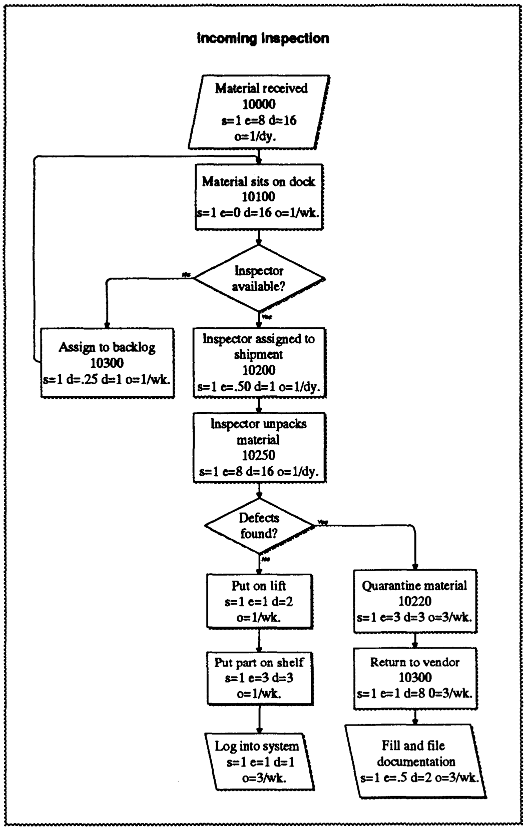

Figure 4 Process map example

3.4 Process mapping criteria

Figure 4 represents a snapshot of a much larger process map. Each box in the diagram represents a separate task and includes:

effort	(e)	or the focused, "hands-on" work time
duration	(d)	or the total time for the step from start to finish
staffing	(s)	or the number of persons involved
and occurrences	(o)	the frequency of the step

3.5 Data aggregation and analysis

Data from the map, as well as additional statistics gathered during the interview are tabulated by PEAT and include the following summary outputs for each discrete process. (An aggregate process analysis can also be done with the same results): Total Duration, effort, occurrences, staffing, value-added activity, non-value added activity, functional interactions, process owners, hand-offs, major task category (i.e. shipping, receiving, installing, manufacturing, engineering, etc.), minor task category (i.e. communicating, validating, preparing, core action, reformatting, etc.)

The reengineering team or cross functional CE task force examines the process flow and cross references it with summary PEAT outputs. Tasks are scrutinized discretely and collectively. Finally, points of entry into the process are identified, so that the change initiative can begin in earnest. Decisions to change should be based on indisputable evidence not on emotional ties. This scientific approach to process simplification and reengineering provides an objective portrayal of an organization with little attention paid to functional blocks. Furthermore, the "why me?" victim mentality common to CE and BPR initiatives can be confronted with honest, empirical feedback. The realization must also be flexible enough to allow for ongoing changes, as neither the market place nor the technology used are stagnant in nature. CE and BPR initiatives by their nature induce drastic, holistic change but continue to evolve after goals are met.

4 CRITICAL SUCCESS FACTORS

Any IT realization of the recommendations of process analysis will need to address four major issues in a very flexible yet disciplined manner:

- Process
- Teamwork
- Tools
- Data

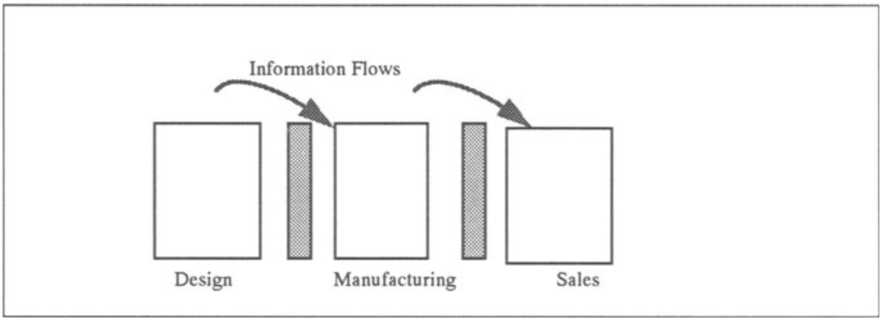

Figure 6 Functional Blocks

4.1 Process

In an organization based on Tayloristic philosophies, the functional blocks, manned by specialists are responsible for performing independent tasks without much outside influence. The designers in the design block perform their function without the influence of either the marketing or manufacturing blocks. This structure leads to higher development costs and delayed product release. In the past, the issue of quality and customer satisfaction was not dependent upon the organizational structure, rather on the abundance of resources.

Today, in order to obtain maximum return on investment, product development must be organized in terms of processes, identifying the best possible techniques for achieving organizational development goals. The processes chosen to achieve the organizational goals must be both flexible and cross functional.

The flexibility of the processes defines the organization's capability to react to changing market needs. The dynamic and diverse state of the market demands that organizations with long presence potential must be both proactive and reactive.

In a functionally based architecture, borders between the functional blocks as well as dissemination of information among hierarchical levels leads to time and resource waste. By only addressing functional processes, the above stated problem is not removed. To realize improvement, processes must be cross functional.

4.2 Teamwork

The main challenges to cross-functional teams is communication. Often times, individuals from different functional areas develop independent languages and systems. IT provides a catalyst for finding a solution to the communication issues. The IT structure supporting cross functional teams must allow free communication on a common plane.

IT systems supporting team behavior must provide concurrent access to global information.

4.3 Tools

Tools are instruments used by people to perform their tasks more effectively and achieve organizational goals. This can range from simple word processors to complex artificial intelligence applications. Investment in IT tools can only be justified when tools are used to optimum capacity. IT system should help reduce the learning curve as new tools are introduced.

4.4 Data

Data generated during the reengineering of an operation reveals information about performance and for process improvement. In the product development process, data generated pertains to innovation and technology used in design, manufacturability, service, etc. The aerospace industry requires the storage of airplane design and construction data for decades. IT structures must provide the capability and flexibility for storing information and allow easy retrieval and access.

Use of relational databases (RDBMS) has simplified storage aspects. Nevertheless, lack of distributed IT architecture has not allowed for their extensive use in an enterprise wide solution. Siemens PEAT package uses a simple relational database to store a multioperational company's process data in one repository. This allows simplified and continuously updatable benchmarking information.

The lack of distributed databases, however, results in islands of independent, non-connected repositories, resulting in inconsistency and maintenance overheads. Only recently, with the introduction of distributed databases is this problem being addressed. The introduction of Object Oriented Database Management System (OODMS), allows for a more realistic, flexible and abstract repository design. Companies are still reluctant to use the new database technique in their IT solution due to the lack of international standards. The emergence of new standards (e.g. CORBA ...) will have a profound effect on this.

5 SYSTEMS

The previous sections covered the Siemens PEAT package used to analyze and simplify an organizations processes. The subsequent sections covered the four factors to be considered in the implementation of an IT structure. The following sections cover two types of tools used to provide an IT solution.

5.1 Product data management systems (PDMs)

PDMs are in essence data vaults based either on a RDBMS or OODBMS technology. PDMs offer powerful functionality for classification, management, access and control of data stored in the databases. This allows users to manipulate and manage data in a very flexible manner. PDMs use a non distributed database as the underlying repository -- creating database islands, and rendering the information exchange difficult.

Most PDMs encourage teamwork via the use of locking mechanism, be it on an individual or cooperative level. This form of interaction is not sufficient for it does not provide project clarity for all participants.

Some PDMs are emerging with adhoc workflow management systems. A workflow in general refers to the execution of jobs according to particular rules. The workflow incorporated within PDMs allows data to be grouped into work packets. This work packet is transmitted electronically to users per rules identified during the think, benchmark and reengineer phase of BPR/CE.

PDMs allow for a collection of independent workflows, offering only a partial view of the project. Furthermore, it is not possible to interconnect these partial views into a matrix of processes that define the project in its entirety. As well, workflow systems are sequential in nature and cannot guide users in determining the downstream effect of process execution. Workflows do not provide an effective mechanism to capture process metrics nor aid in the continuos improvement process

5.2 Process management systems

Systems are available which use processes as the basis for modeling, unlike PDMs which use data. PEAT allows organizations to analyze their business in terms of processes and identify a simplified model, a network of interconnected, interrelated business flows. Systems are appearing where the network process model can be addressed and implemented directly. Siemens Nixdorf's SIFRAME is one such system.

SIFRAME's emphasis on processes allows work to be broken down into its discrete parts. Each work element is assigned to a team, associated with a process flow, that defines work procedure. Each process is further associated with tool(s), its environment and related data set. In this manner, four aspects of processes, team, tool and data are covered in a unified domain.

6 CONCLUSION

This paper addresses an array of issues concerning the relationship between IT and process improvement. It is designed to give the reader a broad overview of the subject. Suffice it to say that the key to successful BPR, CE, process simplification, and other related topics, is an awareness, understanding, and utilization of the four critical factors: process, teamwork, tools, and data.

The above sections have only covered a single IT package aiding in process analysis and simplification and two IT packages used to implement recommendations from the process analysis phase.

There are other tools available that also provide IT solutions to the above mentioned problems but were not addressed in this paper.

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8 BIOGRAPHY

Kevin Fliess graduated from Washington and Lee University in Lexington, VA in 1993. He holds a BA in Politics and German. As a student, Kevin interned with Siemens at their world headquarters in Munich, Germany in corporate purchasing and corporate logistics. He is currently working as an associate consultant for Siemens Corporation USA's Process Management Group: A highly focused, internal consulting organization dedicated to the enterprise success of the North American operating companies. He is responsible for on-site client management, technology development, and the continuing advancement of the process optimization service. Kevin would like to acknowledge Robert C. Daniell, Marc A. Kind, and Frank Wilhelm for their support and devlopment of the PEAT methodology and tools.

Adidev Jain earned a BE from Middlesex University, London, U.K. in 1987. His area of concentrations were Microwave and Telecommunications theory. He has since worked on topics ranging from digital signal processing, business process reengineering, data warehousing, process and object oriented design. His business and personal interests have taken him to various parts of the world, including Asia, Europe and the US This paper was written during his tenure as a senior systems engineer for the electronics giant Siemens Nixdorf Information Systems. Currently, Adidev is employed as a senior consultant, implementing object oriented designs with TRECOM Business Systems, a full service systems integration and consulting firm on the east coast.