

Appendices
MISQ Archivist

for

Business Process Change:
A Study of Methodologies, Techniques and Tools

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A total of eight appendices (Appendix 1 through Appendix 8) and an associated reference for these appendices have been placed here. In addition, there is currently a search engine located at <http://theweb.badm.sc.edu/bpr/> to assist users in identifying BPR techniques and tools.

Appendices 1-8

Contained in MISQ Archivist

Appendix 1: Detailed Description of the Research Methodology

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Appendix References

Appendix 1:

Detailed Description of the Research Methodology

Referring to Table 1, the researchers conducted the following research steps:

Steps 1&2: Literature Review and Market Assessment

The authors conducted a literature search on the current state of BPR MTTs using secondary research sources which include scholarly and trade literature, CD-ROM product data bases, on-line market intelligence services such as Computer Select, ABI/Inform, and reports from market research firms such as IDC, Seybold's and Gartner Group, product announcements, public bulletin boards, as well as recently published books and periodicals (e.g., Spurr, Layzell, Jennison & Richards, 1994; Hansen, 1994). This effort produced a list of initial sources of research data as shown in Appendix 2, which classifies these sources into two groups: 1) BPR Market Researchers and Consultants, and 2) BPR Tools and Technology Vendors.

Steps 3: Semi-structured Interviews

In Step 3, where additional information was deemed necessary, a request was made to those firms identified in Appendix 2 to conduct an interview. A semi-structured interview protocol was developed and then tested for clarity with the funding organization. Selection of key informants in each organization was accomplished through identifying "the person most knowledgeable about the issue of interest," (Huber and Power, 1985, p. 174) usually one of the senior partners in the consultant firm or someone having real project or product knowledge. A majority of the firms (55%) agreed to either an on-site or a telephone interview.

The interview began with open ended questions regarding the respondents and his/her organization's view of reengineering. The interview progressed into details of their organization's offering to the BPR market place which included methodologies practiced, use of advanced techniques and tools. To enhance the accuracy of the interview reports, we adopted Huber and Power's (1985) suggestion regarding tandem interviewing with each interview involving two researchers to allow one to conduct the interview and the other to probe and transcribe the information. Observations corroborated well between interviewees and with published sources. In many cases the BPR tool vendors provided demonstrations of the functionality and use of their tools and described each module's applicability to a BPR project.

Step 4: Establishing the Research Database

In addition to information collected from interviews, a large volume of research data were obtained from library search and requests to vendors. Many techniques and tools mentioned frequently by BPR experts during the interviews were added to the list. Some techniques such as activity based costing (ABC) (Tunney & Reeve, 1992) and quality function deployment (QFD) (Akao, 1990) were identified based on well documented books and journals. A request was mailed to the vendors for product descriptions and demonstration disks. For a selected number of tool vendors, interview sessions were arranged at vendors' development facilities to conduct hand-on assessments of their tools. When possible, demonstration copies of software were obtained and tested in a software evaluation lab set-up for the project.

Results of these information collection efforts were systematically filed and accumulated in three separate research databases: one for methodologies (25 records), one for techniques (72 records) and the third for BPR software tools (102 records).

Step 5: Discovering a Composite S-A Pattern Through Induction

Based on the inductive approach prescribed by research methodologists (Dubin, 1969; Zaltman, LeMasters, and Heffring, 1989) and the inductive research steps reported in prior IS studies (e.g. Earl, 1993; Orlikowski, 1993), the researchers developed the following sequential steps to derive the potential Stage-Activity pattern from the data base of 25 BPR methodologies.

1. Each researcher individually analyzed the commonalities and differences between the 25 methodologies in terms of stages and activities, identified a set of *distinct reengineering activities* included in each methodology and wrote down a brief description for each activity.
2. The three researchers held a group meeting to examine the collection of activities. A set of *core activities* was identified through interpretation, discussion, reconciliation and consensus voting. Standardized descriptions were then developed for each of these activities.
3. Each researcher individually *sequenced* the core activities and divided them into *groups* that he perceived to logically constitute a stage based on temporal affinity and similarity in overall purpose.
4. The researchers next held a meeting on the sequencing and grouping determined by individual researchers. Based on discussion, the researchers reached a consensus on the sequencing and grouping of activities. Definitions of the various groups, i.e., the stages, were then assigned.

Step 6: Examining Reliability and Validity of the S-A Framework

Two tests were conducted in this step: one laboratory-based reliability test and the other field-based validity test. Twelve subjects participated in the laboratory test as judges in a Q-sort exercise. Invited judges included IS professionals with BPR experience from local firms, software tool experts from the sponsoring firm, as well as business faculty and doctoral students with research knowledge of BPR. Each judge was given a packet consisting of an overall instruction sheet and 25 response sheets, one for each methodology. On the first half of each sheet was the summarized description of a reengineering methodology (without disclosing its source) in terms of stages and activities. For each methodology, subjects were instructed to indicate which one of the 6 stages in the composite S-A Framework best matches a particular stage in terms of the activities included. The judges were instructed that the same stage number may be entered in multiple spaces and no space should be left blank.

Results of the Q-sort were analyzed following the guidelines and procedures for measuring reliability of qualitative data. These procedures, as outlined recently in marketing research by Rust and Cooil (1994), assume a decision theoretic loss function, formally model the loss to the researcher of using wrong judgments, and show how this produces a new reliability measure called "proportional reduction in loss" (PRL) which generalizes many existing quantitative and qualitative measures. Surprisingly, for high levels of inter-judge agreement, very few judges are necessary. Using the table provided by Rust and Cooil (1994) and assuming a proportion of interjudge agreement of only .50, the PRL level for judging five categories (which is less than the 6 categories situation involved in the current study) reaches .85 when there are only four judges. The twelve judges used in this study is clearly more than adequate number of judges based on Rust and Cooil's recommendation.

As explained in Rust and Cooil (1994), the "proportional reduction in loss" (PRL) measure can be viewed as a direct extension and generalization of Cronbach's alpha to qualitative cases. As outlined in Appendix 3, the PRL levels can be found in various cells of the table in parentheses following the name of each stage sorted. Adopting Nunnally's (1967) reliability rule of thumb of .70 for exploratory research, we found a very high proportion of interjudge agreement between the 12 judges, with PRL levels exceeding .80 for 130 among a total of 134 stages to be sorted. In fact, most of the PRL levels reach the maximum level of 1.00 indicating extremely reliable mapping results.

In addition to reliability, external validity was ascertained through in-depth interviews conducted with BPR project directors at three sites: a telephone company, a computer service firm and a paper and pulp company, that had completed a comprehensive BPR project prior to the interview. The interview involved the following steps:

1. Briefly introduce the purpose of the interview and ask for a general description of the reengineering methodology applied at the site in terms of the sequence of stages, and activities within each stage. Techniques and tools used in the project were also discussed.
2. A standard template was presented to the respondent which included activities contained within the S-A framework.
3. If an activity conducted during the project was similar to a certain activity in the composite S-A Framework, the respondent was asked to indicate this by placing a check beside that particular activity in the template. The sequencing of these activities as conducted at the site was also indicated by entering a sequence number in the box adjacent to the activities.
4. The respondents were requested to indicate if they had conducted any activity not included in the framework.

Results indicated that the sequence of stages and activities at the three sites were closely aligned with those of the composite S-A framework. The mapping between the framework and the telephone company's S-A sequence had an almost 100% fit. The computer service firm and the paper and pulp company were particularly interesting as both firms had initiated their projects with a pre-conceived solution centered around IT application. They conducted the Redesign and Reconstruct stages first, but soon realized that the "solution" did not serve the business needs. In both cases, the project team reverted back to the Envision and Initiate stages to develop a business vision and justification first prior to any IT implementation. The fact that they reverted back to the sequence of stages as laid out by the composite S-A framework may be regarded as one form of "field experiment with outcomes" (Lee 1989) demonstrating validity of the framework.

Step 7: Mapping of BPR Techniques & Tools to the S-A Framework

During interview sessions, interviewees were asked to list those BPR techniques used and, when, and for what activities each technique applied. BPR practitioners at the three case study sites were also asked to indicate where techniques were used at each stage/activity of their project. Tool vendors outlined a range of techniques that formed the basis for the development of their software design and logic. Finally, literature review provided additional insight.

Adopting an approach similar to that used by Hackathorn & Karimi (1989), tools were mapped to those techniques for which they are designed to support and techniques were mapped to particular activities in the S-A Framework, as shown in Appendices 4, 5 and 6. The mapping of techniques to activities was initially attempted by each individual researcher based on a review of collected data, expert and vendor recommendations, and the logical procedures of a techniques. The three researchers then convened to discuss their mapping results and finalize a

techniques map. The mapping of tools to techniques was based on the researchers' understanding of how a technique may be supported by particular tools as well as by tool vendors' recommendations. It must be stressed that, due to the evolving nature of the BPR field this mapping should be viewed as an initial assessment of the MTT relationships.

Some limitations of this research approach:

Perhaps the most severe limitation of this research approach concerns its cross-sectional design which provides only a "picture in time." This is particularly relevant given the dynamic nature of this rapidly evolving topic. For example, since the completion of the field survey component of this project, new methodologies such as PADM (Wastell et. al., 1994) and new tools such as TurboBPR have been introduced. However, while individual components of the S-A Framework may change, the basic MTT relationship can be expected to have enduring value to BPR researchers and practitioners. Secondly, since the selection of the study's cases was not random, claims on external validity may be limited. Notwithstanding these limitations, the researchers used rigorous qualitative research methods such as Q-Sort, semi-structured interviews with protocols, probing, inductive pattern discovery, and reliability and validity testing to strengthen the inquiry. The sum of these research parts were aimed at providing an extensive assembly of knowledge on BPR methodologies, techniques and tools. Thus, this study represents a comprehensive, if not complete, collection of BPR activities from which sub-set of elements may begin to be configured to form a view of business process change.

Appendix 2: Sources of Research Data

BPR Market Researchers & Consultants

A. T. Kearney
Action Technologies Inc.
Andersen Consulting
AT&T Quest/GIS
Booz Allen & Hamilton
Cooperative Systems Consulting
CSC Index
D. Appleton Co.
Deloitte & Touche
DMR Group
EBS Associates
EDS
Ernst & Young
Gartner Group
Gateway
Gemini Consulting
Hammer and Company
Hewlett Packard
IBM Consulting
IDC Corp.
IDEF User Group
International Systems and Services (ISS)
IOPT Club, U.K.
KBSI Inc.
McKinsey & Company, Inc.
Meritus
Nolan & Norton Co.
Oxford Associates
Patricia Seybold Group
Price Waterhouse
SRI
Texas Instrument
Wang Labs

BPR Tools & Technology Vendors

ABC Technology
ABT Inc.
Action Technologies Inc.
Andersen Consulting
Ascent Logic Corp.
AT&T
Bachman Information Systems
CACI
Cap Gemini Innovation
Co-ordination Systems Ltd.
Coopers & Lybrand
CSC Index
D. Appleton Co.
DEC
EDS
FileNet Corp.
Groupe Bull Inc.
IBM
ICL
IDS
ImagineThat Inc.
ITI Corp.
KnowledgeWare Inc.
LBMS Inc.
Logic Works
Meta Software
Micro Analysis and Design, Inc.
Micrografx Inc.
Microsoft Corp.
Oracle Corp.
P-E International
Pacesetter Software
Popkins Software
ProModel Corp.
Qualisoft Corp.
Scitor Corp.
Siemens Nixdorf Inc.
Systems Modeling Corp.
Texas Instrument
TOP-IX Ltd.
Viewstar Corp.
Virtual Software Factory
Wang Labs

Appendix 3: Mapping and Reliability of Stages to BPR Methodologies *

Composite Methodology**

Methodology Source ⁺	Stage 1 Envision	Stage 2 Initiate	Stage 3 Diagnose	Stage 4 Redesign	Stage 5 Reconstruct	Stage 6 Evaluate
A. T. Kearney (Harrison and Pratt, 1993)	A. Set Direction (1.00) C. Create the Vision (1.00)		B. Baseline & Benchmark (0.99) D. Launch Problem Solving Projects (0.27) E. Design Improvements (1.00)	F. Implement Change (1.00)	G. Embed Continuous Improvement (1.00)	
AT&T GBCS			A. Data Collection (1.00) B. Analysis (1.00) C. Decision Point (0.27)	D. Design (1.00) E. Integration (1.00)	F. Implementation (1.00)	G. Stabilization (1.00)
AT&T PQMI	B. Define Process and Identify Customer Requirements (0.82)	A. Establish Process Management Responsibilities (1.00) C. Define and Establish Measures (0.82)	B. Define Process and Identify Customer Requirements (0.82) D. Assess Conformance to Customer Requirements (1.00) E. Investigate Process to Identify Improvement Opportunities (1.00)	F. Rank Improvement Opportunities and Set Objectives (0.95)	G. Improve Process Quality (Apply Quality Improvement Cycle) (0.95)	
AT&T Reengineering +PQMI	A. Evaluate Benefits, Costs, and Risks (1.00)			B. Design the Process (1.00)	C. Implement the Process) (0.95)	C. Implement the Process (0.95) D. Develop the Final Implement Plan and Select the Cut-over Strategy (1.00)

Booz Allen & Hamilton	A. Identify Your Capabilities (1.00) C. Identify Prime Business Processes (1.00) E. Set Priorities for Change (0.50)	B. Develop a Baseline. Put a Stake in the Ground (1.00) D. Profile Each Prime Process. Set Target for Each Prime Process. Develop the Prime Target (0.87)			F. Formalize and Initiate the Redesign Plan (0.87)	G. Monitor the Redesigned Business Process (1.00)
CSC Index	A. Focus (1.00)	B. Mobilize (1.00)		C. Design (1.00)	D. Launch (1.00) E. Transition (1.00)	F. Realize (1.00)
D. Appleton	A. Focus (1.00)		B. Diagnose (1.00) C. Benchmark (0.82)	D. Architect (1.00)		
Davenport & Short (1990)	A. Develop Business Vision and Process Objectives (1.00) B. Identify Processes to be Redesigned (0.95)		C. Understand and Measure Existing Process (1.00)	D. Identify IT Levers (1.00) E. Design and Build a Prototype of the Process (1.00)		
Davenport, Thomas (1993)	A. Identifying Processes for Innovation (1.00) B. Identifying Change Levers (1.00) C. Developing Process Visions (1.00)		D. Understanding Existing Processes (1.00)	E. Designing & Prototyping the New Process (1.00)		
Dun and Bradstreet SW	A. Initiate (1.00)		B. Analyze (1.00)	C. Redesign (1.00) D. Plan & Structure (0.82)	E. Implement (1.00)	

EBS Associates	A. Sr. Mgt. Strategic Visioning (1.00)	B. Organization and Project Selection (0.99) C. Team Formulation and Team Building (1.00) D. Training in Tools and Techniques (1.00)	E. Map, Measure, Measure and Benchmark (1.00)	F. Process Redesign (1.00)	G. Implement and Monitor Stabilize and Internalize (1.00)	
EDS	A. Initiation "Organize" (1.00)		B. As-IS "Orient" (1.00)	C. To-Be "Conceptualize" (1.00)	D. Transformation "Convert/Execute" (1.00)	
Gateway (Klein, 1994)	A. Preparation (0.95) B. Identification (0.27)	A. Preparation (0.95)	C. Vision (0.99)	D. Solution: Technical Design (1.00) E. Solution: Social Design (0.99)	F. Transformation (1.00)	
Hammer & Company (Hammer and Champy, 1993)	A. Mobilization (1.00)		B. Focusing (0.95)	C. Redesign (1.00)	D. Implementation (1.00)	
Business Process Improvement (Harrington, 1991)		A. Organize for Improvement (1.00)	B. Understanding the Process Characteristics (1.00)	C. Streamlining the Process (1.00)	D. Measurements, Feedback, and Action (Load, Aim, and Fire) (1.00)	E. Continuous Improvement (1.00)
International Systems Services	A. Identify/ Categorize Targets (1.00)		B. Assess Business Process (1.00)	C. Design Business Process (1.00)	D. Process Change (1.00)	
Knowledge Based Systems Inc., (KBS)			A. Acquire System Description (1.00) B. Identify Needs for BPR Study. Analyze As-Is Systems (0.95) C. Identify Improvement Opportunities (0.82) D. Perform Trade-off Analysis (0.99)	E. Develop Transition Plan (0.99)	F. Implement To-Be System (1.00)	G. Maintain System (1.00)
McKinsey & Company (Kaplan & Murdoch, 1990)	A. Identifying Processes (0.99) D. Developing a Vision (1.00)	B. Defining Performance Requirements (1.00)	C. Pinpoint Problems (1.00)		F. Making It Happen (1.00)	

Meritus	A. Scoping (0.95)		B. Diagnostic (1.00)		C. Implementation (1.00)	
Nolan & Norton	A. Outline and Define Vision and Objective with Sr. Mgt. (1.00)		B. Business Analysis (1.00)	C. Systematic Outlining of Options for Redesign (0.95) D. Sr. Mgt. Review of Options (1.00)	E. Detailed Migration Strategy for Execution (0.95)	
Oxford Associates (Furey, 1993)	A. Identify the Process's Customer-driven Objectives (0.82)		B. Map and Measure Existing Process (1.00)	C. Analyze & Modify the Existing Process (1.00) D. Benchmark for Innovative, Proven Alternatives (1.00) E. Reengineer the Process (1.00)	F. Roll-out the New Process (1.00)	
Price Waterhouse	B. Cost/Benefit Evaluation (0.82)	A. Project Initiation (1.00)		C. Cost Management Planning (0.82)	D. Implementation (1.00)	
Stanford Research Institute (SRI)	A. Taking the Customers View (1.00) B. Taking Management View (1.00)	D. Working Group Education (0.99)	C. Current Process Definition and Measurement (1.00) E. Identify Change Opportunities (0.82)	F. Analysis of Recommended Action (1.00)	G. Approval Commitment Implementation (1.00)	
Texas Instrument	A. Customer Engagement (1.00)	B. Process Understanding (.0.95)		C. New Process Design (1.00)	D. Process Change (1.00)	
Wang BPM 2000	A. Define Business Goals (1.00)		B. Analyze the Business Process (1.00)	C. Redesign the Process (1.00)	D. Implement the New Process (1.00)	E. Measure the New Process (1.00)

+ The sequence of stages for the methodology before mapping is indicated by alphabets in front of the stage names.

* A total of 12 judges performed Q-sort and the mappings reflect the best (majority) choices.

** The number in each cell (in parenthesis) following the stage name is PRL Reliability (see Rust and Cooil, 1994)

Appendix 4: BPR Techniques Description and Mapping

Techniques are listed in alphabetical order by name. Categories to which a technique belongs (see Appendix 8) are italicized in the parenthesis. Stages and activities where the technique is applied are indicated at the end of each description.

- **10x Technique** (*Business Planning, Customer Requirements*): This is Andersen Consulting's goal-setting approach to reengineering business processes. The objective is to restructure the process to come within ten percent of the best practice (benchmark) within the industry. -- S₂A₅
- **Activity Based Costing** (*Capture & Model, Measurement*): This technique determines how a process and its subprocesses consume resources by identifying cost drivers to activities (Tunney & Reeve, 1992) -- S₃A₁ S₃A₂ S₄A₂ S₆A₁
- **Affinity Diagramming** (*Creative Thinking*): Sorts ideas generated from brainstorming into groups. Diagrams relationships within and between groupings. -- S₄A₁
- **Analytical Hierarchy Process** (*Bus. Planning*): A technique for organizing the goal for a decision into a hierarchy of subgoals (Saaty, 1980), and a systematic procedure for making trade-offs among these subgoals, which will provide the basis for determining the overall scores for various decision alternatives. -- S₁A₄
- **Assumption Surfacing** (*Business Planning, Change Mgt.*): Aimed at strategic problem solving, this technique treats the problem as one of examining assumptions underlying a policy rather than formulating and testing specific policies (Mitroff, et. al., 1979). Typical questions raised include: What assumptions have been traditionally held and why? What is the effect of making other assumptions? Can a policy stand up to other assumptions; can it tolerate them? etc. -- S₁A₂ S₄A₁ S₅A₁
- **Auditing** (*Measurement*): Investigates the reliability and integrity of a business process through sampling, trails, and other auditing methods. -- S₆A₁
- **Benchmarking** (*Business Planning, Customer Requirements, Change Mgt.*): Measures the performance of a process and compares the results with those achieved by "best practice" in the company, in the industry, or in "world-class" firms. -- S₂A₄ S₂A₅, S₃A₂, S₅A₁,
- **Behavioral Modeling Training Method** (*Change Mgt.*): This method seeks to combine the traditional lecture-based instruction method, which may be more appropriate for factual knowledge, and ETM (Exploratory Training Method) to cover procedural tasks. -- S₅A₃
- **Brainstorming** (*Creative Thinking*): Provides an open forum for spontaneous generation of ideas from members of a group. Creative thinking is stimulated through a process of adding on the others' concepts. -- S₁A₂ S₁A₃ S₄A₁ S₄A₃
- **Business Systems Planning** (*Business Planning*): A top-down, comprehensive IS planning methodology developed by IBM (1984). It centers around data and business processes and seeks to build a stable data architecture for the business. -- S₁A₂
- **Budgeting** (*Proj. Mgt.*): During BPR project planning, a budget for financial and human resources for the project can be prepared using standard budgeting techniques. -- S₂A₃

- **Competitive Analysis** (*Business Planning*): Analyzes the capabilities of competitors and the company's strengths and weaknesses, leading to a formulation of the company's competitive strategies. -- S₁A₂
- **Cultural Assessment Analysis** (*Change Mgt.*): A study on how the new values and reward structure associated with the redesigned process will affect the balance of relationships needed to maintain or change the organization's culture as embodied in the shared values and beliefs among its members. -- S₁A₁ S₄A₃, S₅A₁
- **Computer Aided Software Engineering** (*IS SAD*): A system of computer-based tools that assist or automate the activities in various stages of the systems development life cycle. -- S₄A₄ S₃A₁ S₃A₂ S₄A₁
- **Cost/Benefit/Risk Analysis** (*Business Planning*): Assesses the expected cost and anticipated benefits of the redesigned process and analyzes risk factors that may prevent the realization of the benefits. -- S₁A₄ S₂A₅
- **Critical Incident Technique** (*Org. Analysis, Change Mgt.*): Experts compile a list of behaviors that represent effective or ineffective performance on the job. The list is then sorted into categories based on different degrees of critical importance to performance. -- S₄A₃, S₅A₁
- **Cognitive Mapping** (*Prob. Solving*): Graphically represents the causal relationships which are perceived by the decision makers to exist among the elements of a given environment. -- S₃A₂ S₄A₁
- **Conversion Techniques** (*IS SAD*): Include "burning bridge", parallel operation and other methods for cutting the current system over to a new system -- S₅A₄
- **Core Process Analysis** (*Business Planning*): A technique developed by Ostroff and Smith (1992) of McKinsey Co., Inc. for identifying the few cross-functional business processes that determine the competitive success of the firm. -- S₁A₂
- **Critical Success Factors** (*Business Planning*): A method developed by Jack Rockart (1979) to elicit from chief executives those factors that must be continuously monitored in order for the firm to succeed. -- S₁A₂ S₁A₄ S₂A₅
- **Database Design** (*IS SAD*): Attempts to specify the logical and physical structures of a database in terms of entities, attributes, relationships, access paths, etc. -- S₄A₄
- **Data Flow Diagramming** (*Capture & Model, IS SAD*): Graphically depicts the flow of data among external entities, internal processing steps and data storage elements. -- S₃A₁ S₄A₁ S₄A₂ S₄A₄
- **Delphi Technique** (*Creative Thinking*): This technique seeks to eliminate the bandwagon effect of majority opinion in group meetings by issuing a sequence of questionnaires to a panel of experts to successively refine their opinions and finally reach a consensus (Couger et al., 1993). -- S₁A₂ S₄A₁
- **Employee and Team Attitude Opinion Assessment** (*Org. Analysis*): Uses psychometric instruments to measure job satisfaction, organization commitment, and employee opinions in connection to newly designed jobs for the reengineered process. -- S₃A₁ S₄A₂ S₆A₁

- **Exploratory Training Method** (*Change Mgt.*): Instead of lecturing, training is accomplished through an exploratory trial-and-error process under the guidance of an instructor. This method may be more appropriate for highly structured procedural tasks -- S₅A₃
- **Fast Cycle Full Participation Change Methods** (*Change Mgt., Creative Thinking*): Rather than relying on the traditional design team with limited membership, this method involves as many people as possible from the affected area in the design process through a combination of search conference and socio-technical systems design methods. Experience has shown that quality of the design as well as the ease of subsequent implementation significantly improve, resulting in much less time spent on the project (Pasmore, 1994). -- S₁A₁, S₂A₁, S₄A₁, S₄A₃
- **Force Field Analysis** (*Creative Thinking, Change Mgt.*): A method for identifying forces that push up as well as push down process performance. A pictorial representation is used to facilitate the analysis. -- S₁A₂, S₄A₁, S₅A₁
- **Focus Group** (*Customer Requirements*): Consists of customers of a businesses process and is formed to collect information on expected and actual process performance. -- S₂A₄ S₆A₁
- **Fishbone Analysis** (*Prob. Solving*): A graphical tool using diagram in the shape of a fishbone for analyzing cause-effect relationships in problem diagnosis. Also termed "Ishikawa" or root-cause diagrams. -- S₃A₂ S₆A₁
- **Hierarchical Colored Petri Nets** (*Capture & Model, Prototype & Sim.*): A colored version of the traditional Petri-Net systems models, well-suited for portraying, simulating and analyzing large systems and processes. -- S₃A₁ S₃A₂ S₄A₁ S₄A₂
- **Information Engineering** (*IS SAD*): Developed by James Martin (1990) to systematically integrate business models in developing a stable architectural foundation for an organization's information systems. These models form the basis for structured information systems development. -- S₄A₄
- **Instruction Based Training** (*Change Mgt.*): This is the traditional lecture oriented training method where an instructor makes organized and detailed presentations to explain materials. This method may be appropriate for factual knowledge. -- S₅A₃
- **Information Control Net** (*Capture & Model*): A graphical tool for analyzing communication pattern and control structures associated with office procedures (Cook 1981). -- S₃A₁ S₄A₃, S₃A₂
- **IDEF 0, 3, 6** (*Capture & Model*): A systems analysis and design methodology established by U.S. Air Force as a result of its Integrated Computer and Manufacturing (ICAM) program IDEF₀ is an activity modeling module for capturing functional requirements ("identify what I need to do"). IDEF₃ incorporates the time dimension to capture the behavior of objects in the enterprise through state transition diagrams. IDEF₆ captures "meta" designs, i.e., the knowledge and thinking that went into framing the other IDEF modules. (Mayer et al. ,1995) -- S₃A₁ S₃A₂ S₄A₁ S₄A₂

- **IDEF 1,1X, 4, 5, (IS SAD):** IDEF₁ is the data modeling module using the entity relationship diagramming method. IDEF_{1X} is a version of IDEF specifically aimed at designing traditional relational databases. IDEF₄ deals with object-oriented data modeling. IDEF₅ provides a repository for large analysis and design information. (Mayer et al., 1995) -- S₄A₄
- **IDEF₂ (Prototype & Sim):** This is the IDEF module that provides simulation of the process to depict its dynamic behavior and how information and resources in the organization are used (Mayer et al., 1995) -- S₄A₁ S₄A₂
- **Information Technology Analysis (Business Planning):** Based on the work of Davenport and Short (1990), this technique is used to match IT capabilities to a certain process' reengineering requirements (see Appendix 7). -- S₁A₃
- **Job Analysis (Org. Analysis):** A systematic process for collecting task data, behavioral data, and ability data in analyzing the nature of a specific job. -- S₃A₁ S₄A₃
- **Joint Application Development/Rapid Application Development (IS SAD):** JAD requires formal assignment of users as members of the development team to speed up the analysis and design process. RAD may be used in conjunction with JAD through application of 4GL, CASE and extensive prototyping. -- S₄A₄
- **Job Design (Org. Analysis):** A technique to integrate work content, qualifications and rewards for each job in a way that achieves an effective fit between people, technology and process. New opportunities for job design such as empowering employees with more decision making responsibilities are typically associated with process reengineering. -- S₄A₁ S₄A₃
- **Nominal Group Technique (Creative Thinking):** A structured process for reaching group consensus through anonymous idea generation by individual group members, followed by discussion and voting (Couger et al., 1993). -- S₁A₂ S₄A₁
- **Out of the Box Thinking (Creative Thinking):** A creativity technique proposed by Michael Hammer that advocates the rethinking of the norm of business operation at the outset. It challenges the designers to set "stretch goals" for the process and re-examine basic assumptions underlying current operations (Hammer & Champy, 1993) -- S₁A₂ S₂A₅ S₄A₁ S₄A₃
- **Pareto Diagramming (Prob. Solving):** Based on the Pareto principle that a few causes often account for most of the effect. The diagram graphically represents problem causes which are ranked in descending order of destructiveness and indicates which causes should be targeted. -- S₃A₂ S₆A₁
- **Persuasion technique (Change Mgt.):** Based on the "elaboration likelihood model" and "appropriateness-consistency-effectiveness model" from organizational behavior, these techniques articulate strategies of influence which can be used in situations where individuals publicly or privately resist BPR implementation. Specific persuasion techniques include "rejection-then-retreat," "the commitment and consistency rule," social proof," "liking," and "artificial scarcity" (Melone, 1995). -- S₁A₁ S₂A₁ S₅A₁

- **Process Flowcharting** (*Capture & Model*): Typical flow charting symbols and methods are applied to depict the logic and flow of activities in a business process. -- S₃A₁ S₄A₁ S₄A₂
- **Process Prioritization Matrix** (*Business Planning*): The matrix relates a set of candidate processes for BPR to the firms' critical success factors. A cell is marked with E (the process is essential to the CSF) or D (the process is desirable) (Kettinger, Teng and Guha, 1996). -- S₁A₄
- **Project Scheduling Techniques** (*Proj. Mgt.*): These include widely used techniques such as PERT, CPM and Gantt Charting for scheduling, controlling and managing a project. -- S₂A₃
- **IS Prototyping** (*IS SAD*): A technique involving the development of simplified trial versions of an information system to be presented to users for the purpose of fine tuning their information requirements. -- S₄A₄
- **Quality Function Deployment** (*Customer Requirements*): A method for reliably translating customer requirements into actual product specifications. The technique is centered around an analysis tool called "House of Quality." A sequence of such "houses" can be applied to translate customer requirements into process performance measures (Akao, 1990). -- S₂A₄ S₃A₂ S₆A₁
- **Reframing** (*Change Mgt.*): A technique for gaining acceptance of new ideas by attempting to change the way a person internally frames and understands events in order to change the meaning. When the meaning change, the person's responses and behaviors also change (Watzlavick, Weakland and Fisch, 1974). -- S₂A₁ S₅A₁
- **Role Activity Diagramming** (*Capture & Model*): The technique represents the concepts of role, action, interaction, event, state, case, decision and parallelism in easy-to-understand diagrammatic notations. (Spurr et al., 1994) -- S₃A₁ S₄A₁
- **Role Playing** (*Prototype & Sim, Change Mgt.*): A method for simulating human aspects of a process by having the employee assume a particular role (e.g., the Customer) in a spontaneous rehearsal of the business process. -- S₄A₂ S₅A₁ S₅A₃
- **Search Conference** (*Business Plan., Change, Mgt.*): Search conferences bring all stakeholders into the same room to participate in a process of defining both the need for change and how changes should be achieved. All levels and functions related to a process are typically represented including customers, shareholders and suppliers. (Pasmore, 1994). -- S₁A₁ S₂A₁
- **Skills Inventory Analysis** (*Org. Analysis*): A skills inventory keeps track of an employee's job qualification, education and experience. On-going analysis of this inventory is critical to the success of human resource management. -- S₄A₃
- **Simulation** (*Prototype & Sim.*): Simulation of the dynamic behaviors of a process with mathematical-logical models can facilitate the design of new processes. -- S₄A₁ S₄A₂
- **Statistical Process Control** (*Prob. Solving, Measurement*): This technique involves the application of statistical sampling theory in order to detect malfunctions and defects faster than is possible with final inspection. -- S₃A₂ S₆A₁

- **Speech Interaction Modeling** (*Capture & Model*): A technique developed by T. Winograd and F. Flores (1986) to model organizational workflow using the metaphor of speech-action. Instead of viewing coordination as tasks or information flows between tasks, coordination is defined by the language acts through which people coordinate. For business processes, implementation commitments are the basis for communications in customer-supplier relationships. Examples of speech-acts include request, offer, agreement, withdraw, counteroffer, report completion, etc. --S₃A₁ S₄A₃ S₄A₁ S₄A₄
- **Software Reengineering** (*IS SAD*): A technique for salvaging old legacy systems through reverse engineering to recover processing logic and data structure in existing systems. This is followed by forward engineering where "new" systems can be quickly generated with DBMS and CASE tools. -- S₄A₄
- **Soft System Method** (*Capture & Model, Org. Analysis*): Originally developed by Peter Checkland (1981) for structuring unstructured problems and defining user requirements, the technique requires a high degree of participation in first painting a detailed or "rich picture" of a real world problem. Next, using system thinking, disengaged analysis requires the development of alternative conceptual models of "should be" processes. Finally, the comparison and integration of these real world and imaginary processes are discussed to discover a new course of action. -- S₄A₁ S₄A₃ S₅A₁
- **Structured Interview** (*Customer Requirements, Prob. Solving*): This interview technique is used when an interviewer's questions and their sequence are prepared in advance, typically on a form. -- S₂A₄ S₃A₁ S₆A₁
- **Socio-Tech System Design** (*Capture & Model, Change Mgt., Org. Analysis*): Emphasizing the humanistic principles of participation, learning and empowerment, this technique views an organization as made up of people (the social system) using tools, techniques and knowledge (the technical system) to produce goods or services. The two systems must be effectively fit to one another to achieve optimal functioning (Pava, 1983). A typical design technique using this approach is the 9-step ETHICS method developed by Mumford (1994). -- S₄A₁ S₄A₃ S₅A₁
- **Survey** (*Customer Requirements, Measurement*): A technique for collecting standardized responses from a group. A survey instrument should be constructed to elicit unbiased responses. -- S₂A₄ S₃A₁ S₆A₁
- **IS System Walk-through** (*IS SAD*): Involves formal design review by a group of managers, analysts, programmers to determine completeness, accuracy, and quality of the design. -- S₄A₄
- **System Testing Techniques** (*IS SAD*): A technique for testing information systems in terms of individual program (unit testing), the entire systems of programs (systems testing), the application with a large amount of data (volume testing) all related systems together (integration testing), and any tests required by users (acceptance testing). -- S₅A₂

- **Team Building Techniques** (*Org. Analysis*): These techniques involve four typical stages: forming (remove initial communication inhibition), storming (resolving turbulence related to hidden agenda), norming (develop trust, consensus, free flow of feedback) and performing (members now are honest, creative, reliable, and supportive of each other). -- S₂A₂ S₅A₁
- **Time Motion Study** (*Measurement*): A technique of establishing an allowed time standard to perform a given task based upon measurement of work content of the prescribed method, with due allowance for fatigue and unavoidable delays. Motion study is used to analyze the various body motions employed in doing a job for the purpose of eliminating ineffective movements and speeding effective movements. -- S₃A₁ S₃A₂ S₆A₁
- **Team-based Organizational Design** (*Org. Analysis*): This is based on the premise that a sense of work accomplishment is derived from group commitment which is developed by member interdependence based on a common organizational purpose that leads to trust and respect. Techniques for team-based management refer broadly to a wide variety of techniques that enhance team performance. Examples include participatory decision making, self-managed teams, etc. -- S₄A₃ S₅A₁
- **Total Quality Management Program**: A class of (rather than a specific) techniques for achieving overall success in quality management, including techniques such as Quality Function Deployment, Statistical Quality Control and Fishbone Analysis. -- S₆A₂
- **Value Analysis** (*Measurement*): This technique is based on the theory that white collar workers perform activities which have different intrinsic value to the organization. The approach focuses on how IT and process improvement can be used to increase efficiency and effectiveness of white collar workers, by allowing them to perform higher value work more frequently. (Kanevsky & Housel, 1995) -- S₃A₂ S₆A₁
- **Value-Chain Analysis** (*Business Planning*): As proposed by Porter & Millar (1985), this technique involves a systematic evaluation of the flow of a company's activities in terms of "value" (the extent to which buyers are willing to pay for a product or service). There are nine generic categories of a company's value activities. These can be classified as primary activities (inbound logistics, operation, marketing, etc.) and support activities (human resource, technology management, etc.). -- S₁A₂
- **Visioning** (*Creative Thinking*): A method for developing images of possible future conditions of an organization. When applied in BPR, visions of new processes are developed by identifying and progressively removing sacred cow assumptions or unsubstantiated constraints (Hammer & Champy, 1993) -- S₁A₁ S₄A₁
- **Workflow Design** (*Capture & Model, IS SAD*): The notion of workflow is rooted in the idea that business processes are sets of tasks done in prescribed order that incorporate information from various sources. There are three types of workflows: case-based, general, and ad hoc. The goal of workflow design is to make the relationships between people, procedures, information, tasks, and management explicit. -- S₄A₁ S₄A₄

Appendix 5: BPR Tools Description & Mapping

TOOL	DESCRIPTION	TECHNIQUES SUPPORTED
ABC Flow Charter 4.0 (Micrografx Inc.)	A dynamic flowcharting packages for process modeling.	Process Flowcharting
ABC Graphics Suite (Micrografx Inc.)	An integrated package of diagramming, flowcharting, illustration, clip art management, 3D rendering and image design.	Process Flowcharting
ABT Project Workbench (ABT Inc.)	A PC-based planning and control system for managing projects with both dependency and resource constraints. Features include interactive queries and extensive report customization; integrated Gantt Charts, Resource Spreadsheets, CPM Networks, variable resource assignment to projects, multiple tracking levels, etc.	Project Scheduling Techniques
APACHE (EDS)	Supports process modeling & automation.	Process Flowcharting
Applying Benchmarking (APQC)	Applying Benchmarking is based on the four phase model from the International Benchmarking Clearinghouse. Studies have found that this model is the easiest and most effective guide for benchmarking.	Benchmarking
ARIS-Tools (IDS GmbH)	A CASE tool set.	Data Flow Diagramming
ATI Workflow Manager (ATI)	Workflow engine for routing and tracking information in work groups.	Speech Interaction Modeling, Workflow Design
Bachman Analyst	Captures data and process models from KnowledgeWare Application Development Workbench into the Model Driven Development paradigm.	Software Reengineering
Best Practice Database (Arthur-Andersen)	CD-ROM application containing "best in class" process configurations for benchmarking purposes	Benchmarking
BIS Process Manager (BIS)	A program for developing, documenting, and implementing business process.	Process Flowcharting.
BONAPART (UBIS GmbH)	Supports process modeling and information modeling (DFD with Simulation) with Siemens Nixdorf's workflow product-Work Party	Data Flow Diagramming, Simulation
BPWin (Logic Works)	Supports process modeling with graphic process visualization (IDEF ₀ based)	IDEF _{0, 2, 3}
Business Improvement Facility (Virtual Software Factory)	An I-CASE tool for process modeling, IT requirements, people/resource requirements and interface to ProcessWise.	Computer Aided Soft. Eng. Data Flow Diagramming Job Analysis, Job Design, Process Flowcharting
Business Insight (Business Resource Software)	Business Insight is a software product in a new genre known as "management software". It is an expert system that includes a knowledge base.	Value Chain Analysis, Competitive Analysis

Appendix 5: BPR Tools Description & Mapping (continued)

Business Process Benchmarking Solution	A new software product brings benchmarking experts to your desktop. Business Process Benchmarking was developed with Dr. Robert Camp.	Benchmarking
CABRE – Witness (AT&T)	For dynamic process modeling using simulation; and cost/benefit analysis of business processes.	IDEF _{0, 2, 3} , Process Flowcharting Simulation
CADDIE (Logica Cambridge Ltd.)	Research tool for consultancy support. Includes object oriented decision process modeling, strategy analysis and business gaming.	Value-Chain Analysis
CaseWise (CSC Index)	A CASE tool for process modeling	Computer Aided Soft. Eng. Data Flow Diagramming
Computer Based Training	A set of software tools for employee training.	Behavioral modeling training Exploratory training method Instruction based training
Design/Leverage (D. Appleton)	For IDEF and simulation modeling. Defines the business rules and semantics of the enterprise by identifying entities within the business enterprise, their unique attributes or properties, and the interdependencies between entities.	IDEF _{0, 2, 3}
DesignCPN (Meta Software)	Hierarchical Petri Net based simulation.	Hierarchical Colored Petri Nets Simulation
DesignIDEF Design/IDEF/ABC (Meta Software)	A structured analysis design technique for systems modeling. Delivers advanced interactive graphical support for Systems Requirements modeling (IDEF ₀ and SADT), Data Modeling (IDEF _{1X}) and Behavioral Modeling (IDEF/CPN)	Activity Based Costing IDEF
DPL	DPL supports the development of models using decision trees or influence diagrams.	Cost/Benefit/Risk Analysis
Easy ABC Plus (ABC Technology)	Defines and sets up drivers and allocation paths for cost center structures, bills of activities, and cost objects <ul style="list-style-type: none"> · Imports accounting data by time period · Analyzes unit costs and performance measures · Provides interactive ABC analysis and produces comprehensive reports 	Activity Based Costing, Cost/Benefit/Risk Analysis Value Analysis
Easy ABC Quick (ABC Technology)	You can use this tool for any combination of up to 250 accounts (resources, activities or products and services). Models created by Easy ABC Quick have full upward compatibility to Easy ABC Plus.	Activity Based Costing
ETQ 9000 Maps (ETQ)	This product is available from ETQ, a full service ISO/QS-9000 consulting firm dedicated to providing services and technology/software for total quality management.	Total Quality Management Program.

Appendix 5: BPR Tools Description & Mapping (continued)

Expert Choice (Thomas L. Saaty)	Supports the Analytical Hierarchy Process (AHP) method for multi-criteria decision making in project selection and monitoring.	Analytical Hierarchy Process
Extend+BPR (Imagine That Inc.)	Supports process modeling, ABC, workflow analysis, human process engineering and strategic planning.	Critical Success Factors Process Flowcharting
FileNet WorkFlow (FileNet Corp.)	An Industrial-strength high-end workflow systems for enterprise workflow modeling and automation.	Workflow Design
FlowPath (Bull)	FlowPath coordinates, defines and monitors work flows within the organization. It allows the proper definition of process procedures through the use of a high-level modeling formalism to define 'objects' reflecting human interactions.	Information Control Net Workflow Design
FocusReports	FocusReports is an easy-to-use tool for conducting focus groups.	Focus Group
Forecast Pro (Hoare Research Software)	Forecasting for those who want to use sophisticated techniques, but have insufficient knowledge or time to do it with less powerful programs.	Statistical Process Control
GRADE (SNI)	Provides upper and lower CASE tool for data modeling and information modeling (DFD with simulation)	Computer Aided Soft. Eng. Data Flow Diagramming, Simulation
Graphics Toll	A generic class of software tools for preparing graphics	Affinity diagramming Cognitive Mapping Data flow diagramming Fishbone diagramming Force Field Analysis Process Flowcharting
Group Decision Support Systems (GDSS)	Group decision support systems (GDSS) are interactive systems for a group engaged in decision making based on the basic principles of decision support systems. The system provides support for various techniques such as NGT, brainstorming, voting, anonymity, etc.	10x Technique, Assumption Surfacing Affinity Diagramming Brainstorming, Cognitive Mapping Delphi Technique, Focus Group Nominal Group Technique Out of the Box Thinking, Search conference, Visioning
GroupSystems (Ventura Corp)	A powerful line of group-enabled group decision support software products that can cut decision time while improving the quality of your decisions	Team Building Techniques, Team-Based Organizational Design
GroupSystems Survey (Ventura Corp)	GroupSystems Survey provides an automated, fast and efficient means of collecting information from a large number of respondents.	Survey
HOCUS (P-E International)	A simulation tool.	Simulation

Appendix 5: BPR Tools Description & Mapping (continued)

IEW Planning Workstation (KnowledgeWare)	A module of KnowledgeWare's IEW (Information Engineering Workstation) providing support for planning activities such as BSP, critical success factors ,etc.	Business Systems Planning Critical success factors
INCOME (Promatis Informatik GmbH & Co. KG)	Provides upper and lower CASE tool based on semantic data modeling & petri nets	Computer Aided Soft. Eng. Hierarchical Colored Petri Nets
Inspiration Software	Inspiration is a brainstorming tool based on human thought process.	Brainstorming, Visioning, Out of the Box Thinking
Intelliwriter (PersuesDevelopment)	A professional interviewing system from Persues Development lets you design and implement computer-based surveys	Structured Interview, Survey
Ingenium (Meliora Systems)	Ingenium is designed as a tool to take companies beyond basic training administration to meet all of their changing and challenging training needs.	Skills Inventory Analysis
ISO Flow-Pro II (ISO Software Solutions)	A flow charting software package designed for ISO 9000 implementation.	Process Flowcharting
ISOxpert Manager's Edition (Management Software International)	A tool for helping you to achieve ISO 9000 or QS 9000 certification with less time and resource commitment.	Total Quality Management Program
IThink (HPS)	iThink is a powerful and flexible package for building and simulating business and organizational processes.	Process Flowcharting, Value Analysis, Simulation
KnowledgeWare IEW	IEW (Information Engineering Workstation is an integrated set of CASE tools.	Computer Aided Soft. Eng Data flow diagramming
LBMS Project/Process Engineer (LBMS, Inc.)	Supports the critical cross life-cycle area of process management: <ul style="list-style-type: none"> • Automation of an organization's development process and methods; • Integration of the functions of process management, project management and applications development; • Support for implementing a Total Quality Approach; • Improvement in estimating accuracy by collecting and analyzing metrics. 	Project Scheduling Techniques
LBMS Systems Engineer (LBMS Inc.)	A life cycle toolset based on I-CASE. Supports data modeling, data flow diagrams, problems requirements and solutions; functional decomposition; JAD, prototyping, screen mapping; screen dialog linking, menu hierarchy design, modules, and configurable pseudocode.	Computer Aided Soft. Eng. Data Flow Diagramming
Learnfirst Benchmarking	This software provides an attractive graphical interface to guide you through Dr. Harrington's 19 benchmarking activities	Benchmarking

Appendix 5: BPR Tools Description & Mapping (continued)

Learnfirst how to implement ISO 9000	This software guides you through the implementation of ISO 9000 using a question-and-answer approach.	Total Quality Management Program
Meetingkits for Windows	A software that helps a face-to-face meeting to achieve the ideal without requiring complex equipment or special training.	Team Building Techniques, Cost/Benefit/Risk Analysis
Micro SAINT (Micro Analysis and Design, Inc.)	Provides simulation and cost/benefit analysis	Simulation
MicroMentor Tools of Quality	An interactive program that uses image, animation and sound for training.	Instruction Based Training
Microsoft Project	A Microsoft Windows based project management software for managing time and resource allocation using techniques such as PERT and GANTT charting.	Project Scheduling Techniques
Milestones, Etc. 4.5 (Kidasa Software)	A tool to create simple Gantt charts, detailed master schedules, employee schedules, manufacturing machine schedules, construction schedules, line-of-balance schedules, etc.	Project Scheduling Techniques
Mosaik (Sietec consulting GmbH Co. OHG)	Supports process/organizational modeling, and capturing communications structure.	Information Control Net
Oracle Process Manager (Oracle Corp)	Supports enterprise wide process modeling, graphic simulation, time and resource management.	Process Flowcharting Project Scheduling Techniques Simulation
PACE (Grossenbacher Elektronik AG)	Includes Petri Net tool plus simulation.	Hierarchical Colored Petri Nets Simulation
Performance Mentor	A software supporting skills assessment activities.	Skills Inventory Analysis
Performance Now (Knowledge Point)	Performance Now is an easy-to-use tool for managing your organization's performance review process	Job Analysis
Popkins Systems Architect (Popkins Software & Systems, Inc.)	A front-end CASE tool with data dictionary for structured analysis and design (data flow, DeMarco/Yourdon, Gane Sarson, Ward & Melor, E-R, flow charts, IDEF _{1x, 0, IE,}).	Computer Aided Software Engineering
Powerproject (Asta Development, Inc.)	Powerproject is designed to work visually as you draw activities on screen and establish dependency by dragging the mouse.	Project Scheduling Techniques
ProCAP, ProSIM (AT&T CABRE)	IDEF _{0, 1x} and IDEF _{2, 3} modeling based on AI0, AI3 modules developed by KBSI Inc.	Computer Aided Soft. Eng. IDEF
Procedure Writer 9000 (Powerway Inc.)	Procedure Writer 9000 comes with 42 pre-written procedures, technically correct and ready for edit. Procedure Writer 9000 also is a full relational database so you may cross reference and list procedures by Job Titles, or by associations with other policies and procedures	Total Quality Management Program

Appendix 5: BPR Tools Description & Mapping (continued)

Process Charter (Scitor Corp)	Includes features for process flowcharting, project scheduling, resource management and dynamic simulation.	Process Flowcharting Project Scheduling Techniques
ProcessModel (Promodel Corp)	With ProcessModel you can recognize bottlenecks, communicate changes, and visually evaluate process changes.	Process Flowcharting
ProcessIT (NCR)	An industrial-strength high-end workflow systems for enterprise workflow modeling and automation.	Workflow Design
ProcessWeaver (Cap Gemini Innovation)	Supports Petri-Nets based process modeling.	Hierarchical Colored Petri Nets
ProcessWise Workbench (ICL)	Provides process modeling and rule-based. Interface to CASE tools.	Computer Aided Soft. Eng. Critical Success Factors Data Flow Diagramming
Project Kickstart for Windows (Experience In Software)	This innovative software program will help you design a strategy for a project within a short time.	Project Scheduling Techniques
Project Scheduler7 (Scitor Corp.)	PS7 starts with user-definable spreadsheet that work in concert with Gantt charts, network diagrams, and tree charts.	Project Scheduling Techniques
ProModel 2.0 (ProModel Corp.)	A tool for process modeling and simulation.	Hierarchical Colored Petri Nets Simulation
Q+ (AT&T)	Q+ is a modeling and performance analysis tool designed to facilitate the building of a queuing network model and the subsequent analysis of its performance.	Simulation
QFD Capture (ITI Corp.)	Applies the Quality Function Deployment techniques to develop a "House of Quality" based on customer "Wants/Needs" and maps to process/product characteristics. Also allows benchmarking and performance analysis.	Quality Function Deployment
QFD Designer (Qualisoft Corp.)	Automates Quality Function Deployment methodology for product/process design with flexible chart sizing, multiple QFD phases.	Quality Function Deployment
QMAP (Pacesetter Software)	QMap (or Quality Map) is both a technique and a software product to facilitate customer/supplier modeling and adherence to customer requirements. Designed to enable users to select and develop customized measures of process performance, this reengineering tool has an interactive database which offers extensive evaluative capabilities.	Benchmarking
RADitor (Co-ordination Systems Ltd.)	Supports role activity diagramming.	Role Activity Diagramming

Appendix 5: BPR Tools Description & Mapping (continued)

RDD-100 (Ascent Logic Corp.)	Supports systems engineering which includes reverse engineering, process modeling and simulation.	Computer Aided Soft. Eng. Data Flow Diagramming Simulation
Revelation HR	Supports human resource work for requisition and candidate tracking and position history.	Job Analysis Job Design
SES/Workbench (Scientific and Engineering Software)	Provides behavioral modeling and simulation of systems and processes. Features include performance and dynamic visualization.	Simulation
SIMAN & ARENA (Systems Modeling Corp.)	A simulation tool.	Simulation
SIMPROCESS (CACI)	A simulation tool.	Simulation
Smarthire (Park City Group)	The SmartHire module is an automated applicant pre-screening product that helps managers make informed, objective placement decisions while saving time spent with unqualified candidates.	Job Analysis Skill Inventory Analysis
SolvingRight	SolvingRight helps your team find solutions to important problems using the fishbone technique.	Brainstorming Fishbone Analysis.
SPARKS (G2) (Coopers & Lybrand)	Supports dynamic process modeling through simulation; workflows analysis, and assessing cost/benefit of business process.	Cost/Benefits/Risk analysis Process Flowcharting Simulation
SPC-PC IV (Quality America, Inc.)	Performs X-Bar, sigma, Pareto and other SPC analysis.	Pareto Diagramming Statistical Process Control
SPCpack for Windows	SPCpack for Windows combines powerful SPC technique with the flexibility and ease of Windows.	Statistical Process Control
Spectrum HR	Supports human resource work in requisition and candidate tracking and position history.	Job Analysis Job Design
Spreadsheet	A generic class of software tool comprised of rows and columns to allow various tabular & graphical analysis using statistical, financial, logical and database functions.	Budgeting Cost/Benefit/Risk Analysis Pareto Diagramming Process Prioritization Matrix Statistical Process Control
Statistical Process Control (Integrated Multimedia Solutions, Inc.)	Provides Statistical Process Control training to enable employees to become involved in the implementation of SPC and quality assurance programs in the workplace.	Pareto Diagramming Statistical Process Control
Supersynch	A software toll to facilitate the team building process.	Team Building Techniques Team-based Organizational Techniques
Surveywin (Raosoft)	Surveywin supports every element of a good research study- from survey design to statistical data analysis.	Survey

Appendix 5: BPR Tools Description & Mapping (continued)

TASC [Plan, FlowSim, Control Station] (TASC, Reading MA)	A simulation tool.	Simulation
Taskey Plus (Key Computer Software)	This product provides the functionality of Taskey plus the ability to facilitate a team planning session to bring the ideas, thoughts and concerns of all team members together so a clear understanding of the plan and the people responsible can be developed.	Project Scheduling Techniques
TeamFlow (CFM)	A complete software package for Macintosh and Microsoft Windows designed to combine the functions of deployment flow charting, organizational charting, Gantt charting and document management into a single tool for team-based project management.	Process Flowcharting
TI BDF (Texas Instruments)	BDF (Business Design Facility) can be used for process modeling, organizational/data modeling, interface to simulation & as ABC tools.	Data Flow Diagramming, IDEF _{0, 2, 3}
TI IEF (Texas Instruments)	IEF (Information Engineering Facility) is an I-CASE toll set. It automates the entire systems development life cycle, from planning, analysis and design, through application generation for multi-vendor platforms (such as DEC, HP, IBM and Tandem).	Data Flow Diagramming
TOP-IX (TOP-IX Ltd.)	Supports process analysis and design, and process management (e.g., ABC, value-analysis).	Activity Based Costing Process Flowcharting Value Analysis
Viewstar Workbench (Viewstar Corp.)	An industrial-strength high-end workflow systems for enterprise workflow modeling and automation.	Workflow Design
Visio 4.1 (Visio Corp.)	Visio includes a set of tools you need to manage and clarify business information through visuals, such as organization charts and block diagrams.	Process Flowcharting
Work Party (Siemens Nixdorf)	Siemens Nixdorf's product for workflow design	Workflow Design

Appendix 6: Hierarchical Mapping of BPR Techniques and Tools to the Stage-Activity Framework

Note -- Names of generic tools (e.g., spreadsheet) from many vendors are underlined
 -- The list of tools is updated as of the date of publication of the MISQ paper.

Stage-Activity	Techniques	Tools
Stage 1: ENVISION		
Stage 1 - Activity 1 <i>Establish Management Commitment & Vision</i>	Fast Cycle Full Participation Change Methods	
	Search Conference	<u>Group Decision Support Systems</u>
	Persuasion Technique	
	Visioning	Inspiration Software <u>Group Decision Support Systems</u>
Stage 1 - Activity 2 <i>Discover Reengineering Opportunities</i>	Assumption Surfacing	<u>Group Decision Support Systems</u>
	Brainstorming	Inspiration Software, SolvingRight <u>Group Decision Support Systems</u>
	Business Systems Planning	IEW Planning Workstation
	Competitive Analysis	Business Insight
	Core Process Analysis	
	Critical Success Factors	Extend+BPR, IEW Planning Workstation, ProcessWise.
	Cultural Assessment Analysis	
	Delphi Technique	<u>Group Decision Support Systems</u>
	Force Field Analysis	<u>Graphics tool</u>
	Nominal Group Technique	<u>Group Decision Support Systems</u>
	Out of the Box Thinking	Inspiration Software <u>Group Decision Support Systems</u>
	Value-Chain Analysis	Business Insight, CADDIE
Stage 1 - Activity 3 <i>Identify IT Levers</i>	Brainstorming	Inspiration Software, SolvingRight <u>Group Decision Support Systems</u>
	Business Systems Planning	IEW Planning Workstation
	Information Technology Analysis	
Stage 1 - Activity 4 <i>Select Process</i>	Analytical Hierarchical Process	Expert Choice
	Cost/Benefit/Risk Analysis	DPL, Easy ABC Plus, Meetingkits for Windows SPARKS, <u>Spreadsheet</u>
	Critical Success Factors	Extend+BPR, IEW Planning Workstation, ProcessWise.
	Process Prioritization Matrix	<u>Spreadsheet</u>

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 2: INITIATE		
Stage 2 - Activity 1 <i>Inform Stakeholders</i>	Fast Cycle Full Participation Change Method	
	Persuasion Technique	
	Reframing	
	Search Conference	<u>Group Decision Support Systems</u>
Stage 2 - Activity 2 <i>Organize Reengineering Teams</i>	Team Building Techniques	GroupSystems Meetingkits for Windows Supersynch
Stage 2 - Activity 3 <i>Conduct Project Planning</i>	Budgeting	<u>Spreadsheet</u>
	Project Scheduling Techniques	ABT Project Workbench LBMS Project/Process Engineer Microsoft Project, Milestones Etc. 4.5 Oracle Process Manager, Poweproject Process Charter, Project Kickstart for Windows Project Scheduler7 Tasky Plus
Stage 2 - Activity 4 <i>Determine External Process Customer Requirements</i>	Benchmarking	Applying Benchmarking Best Practice Database (Arthur-Andersen) Business Process Benchmarking Solution Learnfirst Benchmarking, QMAP
	Focus Group	FocusReports <u>Group Decision Support Systems</u>
	Quality Function Deployment	QFD Capture, QFD Designer
	Structured Interview	Intelliwriter
	Survey	Intelliwriter, GroupSystems Survey Surveywin
Stage 2 - Activity 5 <i>Set Performance Goals</i>	Benchmarking	Applying Benchmarking Best Practice Database (Authur-Andersen) Business Process Benchmarking Solution Learnfirst Benchmarking, QMAP
	Cost/Benefit/Risk Analysis	DPL, Easy ABC Plus, Meetingkits for Windows SPARKS, <u>Spreadsheet</u>
	Critical Success Factors	Extend+BPR, IEW Planning Workstation, ProcessWise.
	Out of the Box Thinking	Inspiration Software <u>Group Decision Support Systems</u>
	10X Technique	<u>Group Decision Support Systems</u>

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 3: DIAGNOSE		
Stage 3 - Activity 1 <i>Document Existing Process</i>	Activity Based Costing	Easy ABC Plus, Easy ABC Quick Design IDEF/ABC, TOP-1X
	Computer Aided Software Engineering	<u>CASE Tool</u> (ProcessWise, CaseWise Business Improvement Facility INCOME, GRADE , Knowledgeware IEW LBMS Systems Engineer, TI IEF, etc.)
	Data Flow Diagramming	ARIS -Tools, BONAPART <u>CASE Tool</u> (Business Improvement Facility, CaseWise, GRADE, INCOME, Knowledgeware IEW LBMS Systems Engineer, ProcessWise, TI IEF, etc.) <u>Graphics Tool</u> , RDD 100, TI BDF, etc
	Employee and Team Attitude Assessment	
	Hierarchical Colored Petri Nets	INCOME, PACE, ProModel 2.0 Process Weaver, DesignCPN
	Information Control Net	FlowPath, Mosaik
	IDEF _{0,3}	Design IDEF, TI BDF, BPWin Design Leverage CABRE - Witness (AT & T)
	Job Analysis	Performance Now Revelation HR, Smarthire Spectrum HR Business Improvement Facility
	Process Flowcharting	ABC Flow Charter, ABC Graphics Suite APACHE, BIS Process Manager Business Improvement Facility, CABRE Extend+BPR, <u>Graphics Tool</u> , ISO Flow-Pro II, iThink, Oracle Process Manager, Process Charter ProcessModel, SPARKS, TeamFlow TOP-1X, Visio 4.1 etc.
	Role Activity Diagramming	RADitor
	Speech Interaction Modeling	ATI Workflow Manager
	Structured Interview	Intelliwriter
	Survey	Intelliwriter, GroupSystems Survey Surveywin
Time Motion Study		

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 3 - Activity 2 <i>Analyze Existing Process</i>	Activity Based Costing	Easy ABC Plus, Easy ABC Quick Design IDEF/ABC, TOP-1X
	Benchmarking	Applying Benchmarking Best Practice Database (Authur-Andersen) Business Process Benchmarking Solution Learnfirst Benchmarking, QMAP
	Cognitive Mapping	<u>Graphics Tool</u> <u>Group Decision Support Systems</u>
	Computer Aided Software Engineering	<u>CASE Tool</u> (ProcessWise, CaseWise Business Improvement Facility INCOME, GRADE , Knowledgeware IEW LBMS Systems Engineer, TI IEF, etc.)
	Fishbone Analysis	SolvingRight, <u>Graphics Tool</u>
	Hierarchical Colored Petri Nets	INCOME, PACE, ProModel 2.0 Process Weaver, DesignCPN
	IDEF _{0,3}	Design IDEF, TI BDF, BPWin Design Leverage CABRE - Witness (AT & T)
	Information Control Net	FlowPath, Mosaik
	Pareto Diagramming	SPC - PC IV, Statistical Process Control <u>Spreadsheet</u>
	Quality Function Deployment	QFD Capture, QFD Designer
	Statistical Process Control	Forecast Pro, SPCpack SPC - PC IV, Statistical Process Control <u>Spreadsheet</u>
	Value Analysis	TOP-1X, Easy ABC Plus, iThink

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 4: REDESIGN		
Stage 4 - Activity 1 <i>Define and Analyze</i> <i>New Process Concepts</i>	Affinity Diagramming	<u>Graphics Tool</u> <u>Group Decision Support Systems</u>
	Assumption Surfacing	<u>Group Decision Support Systems</u>
	Brainstorming	Inspiration Software, SolvingRight <u>Group Decision Support Systems</u>
	Cognitive Mapping	<u>Graphics Tool</u> <u>Group Decision Support Systems</u>
	Computer Aided Software Engineering	<u>CASE Tool</u> (ProcessWise, CaseWise Business Improvement Facility INCOME, GRADE , Knowledgware IEW LBMS Systems Engineer, TI IEF, etc.)
	Cost/Benefit/Risk Analysis	DPL, Easy ABC Plus, Meetingkits for Windows SPARKS, <u>Spreadsheet</u>
	Data Flow Diagramming	ARIS -Tools, BONAPART <u>CASE Tool</u> (Business Improvement Facility, CaseWise, GRADE, INCOME, Knowledgware IEW LBMS Systems Engineer, ProcessWise, TI IEF, etc.) <u>Graphics Tool</u> , RDD 100, TI BDF, etc
	Delphi Technique	<u>Group Decision Support Systems</u>
	Fast Cycle Full Participation Change Method	
	Force Field Analysis	<u>Graphics tool</u>
	Hierarchical Colored Petri Nets	INCOME, PACE, ProModel 2.0 Process Weaver, DesignCPN
	IDEF _{0,3}	Design IDEF, TI BDF, BPWin Design Leverage CABRE - Witness (AT & T)
	IDEF ₂	ProCAP, ProSIM (AT & T CABRE)
	Job Design	Business Improvement Facility Revelation HR, Spectrum HR
	Nominal Group Technique	<u>Group Decision Support Systems</u>
Out of the Box Thinking	Inspiration Software <u>Group Decision Support Systems</u>	

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

	Process Flowcharting	ABC Flow Charter, ABC Graphics Suite APACHE, BIS Process Manager Business Improvement Facility, CABRE Extend+BPR, <u>Graphics Tool</u> , ISO Flow-Pro II, iThink, Oracle Process Manager, Process Charter ProcessModel, SPARKS, TeamFlow TOP-1X, Visio 4.1 etc.
	Role Activity Diagramming	RADitor
	Simulation	BONAPART, CABRE - Witness (AT & T), DesignCPN, GRADE, HOCUS, iThink, Micro SAINT, Oracle Process Manager, PACE, ProModel 2.0, Q+, RDD-1000, SES/Workbench, SIMAN & ARENA, SIMProcess, SPARKS, TASC (Plan, FlowSim, Control Station), etc.
	Socio-Tech Systems Design	
	Soft System Method	
	Speech Interaction Modeling	ATI Workflow Manager
	Visioning	Inspiration Software <u>Group Decision Support Systems</u>
	Workflow Design	ATI Workflow Manager FileNet Workflow, FlowPath ProcessIT, Viewstar Workbench Work Party
Stage 4 - Activity 2 <i>Prototype and Detailed Design of a New Process</i>	Activity Based Costing	Easy ABC Plus, Easy ABC Quick Design IDEF/ABC, TOP-1X
	Data Flow Diagramming	ARIS -Tools, BONAPART <u>CASE Tool</u> (Business Improvement Facility, CaseWise, GRADE, INCOME, Knowledgeware IEW LBMS Systems Engineer, ProcessWise, TI IEF, etc.) <u>Graphics Tool</u> , RDD 100, TI BDF, etc
	Hierarchical Colored Petri Nets	INCOME, PACE, ProModel 2.0 Process Weaver, DesignCPN
	IDEF _{0, 2, 3}	Design IDEF TI BDF IDEF Leverage CABRE Witness (AT & T) BPWin

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

	Process Flowcharting	ABC Flow Charter, ABC Graphics Suite APACHE, BIS Process Manager Business Improvement Facility, CABRE Extend+BPR, <u>Graphics Tool</u> , ISO Flow-Pro II, iThink, Oracle Process Manager, Process Charter ProcessModel, SPARKS, TeamFlow TOP-1X, Visio 4.1 etc.
	Simulation	BONAPART, CABRE - Witness (AT & T), DesignCPN, GRADE, HOCUS, iThink, Micro SAINT, Oracle Process Manager, PACE, ProModel 2.0, Q+, RDD-1000, SES/Workbench, SIMAN & ARENA, SIMProcess, SPARKS, TASC (Plan, FlowSim, Control Station), etc.
	Role Playing	
Stage 4 - Activity 3 <i>Design Human Resource Structure</i>	Brainstorming	Inspiration Software, SolvingRight <u>Group Decision Support Systems</u>
	Critical Incident Technique	
	Cultural Assessment Analysis	
	Employee and Team Attitude Assessment	
	Fast Cycle Full Participation Change Method	
	Information Control Net	FlowPath, Mosaik
	Job Analysis	Performance Now Revelation HR, Smarthire Spectrum HR Business Improvement Facility
	Job Design	Business Improvement Facility Revelation HR, Spectrum HR
	Out of the Box Thinking	Inspiration Software <u>Group Decision Support Systems</u>
	Skills Inventory Analysis	Ingenium, Performance Mentor, Smarthire
	Socio-technical Systems Design	
	Soft System Method	
	Speech Interaction Modeling	ATI Workflow Manager
	Team-based Organizational Design	GroupSystems, Supersynch

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 4 - Activity 4 <i>Analyze and Design IS</i>	CASE Information Engineering Data Base Design IDEF ₁ , 1x, 4, 5, 6 Data Flow Diagramming IS Prototyping IS Systems Walkthrough Joint Application Development/ Rapid Application Development Software Reengineering	Bachman Analyst, CABRE Witness <u>CASE Tool</u> (Business Improvement Facility, CaseWise, GRADE, INCOME, Knowledgware IEW LBMS Systems Engineer, Popkins Systems Architect, ProcessWise, IEF, etc.), Design IDEF, Design Leverage <u>Graphics Tool</u> , IEW Planning Workstation, RDD 100, TI BDF
	Speech Interaction Modeling	ATI Workflow Manager
	Workflow Design	ATI Workflow Manager FileNet Workflow, FlowPath ProcessIT, Viewstar Workbench Work Party
Stage 5: RECONSTRUCT		
Stage 5 - Activity 1 <i>Reorganize</i>	Assumption Surfacing	<u>Group Decision Support Systems</u>
	Benchmarking	Applying Benchmarking Best Practice Database (Authur-Andersen) Business Process Benchmarking Solution Learnfirst Benchmarking, QMAP
	Force Field Analysis	<u>Graphics tool</u>
	Reframing	
	Role Playing	
	Skills Inventory Analysis	Ingenium, Performance Mentor, Smarthire
	Socio-technical System Design	
	Team Building Techniques	GroupSystems Meetingkits for Windows Supersynch
	Team-based Organizational Design	GroupSystems, Supersynch
Stage 5 - Activity 2 <i>Implement IS</i>	System Testing Techniques	
Stage 5 - Activity 3 <i>Train Users</i>	Behavioral Modeling Training Method	<u>Computer Based Training</u>
	Exploratory Training Method	<u>Computer Based Training</u>
	Instruction Based Training Method	Micromentor Tools of Quality <u>Computer Based Training</u>
	Role Playing	
Stage 5 - Activity 4 <i>Process Cut-Over</i>	Conversion Techniques	

Appendix 6: Hierarchical Mapping of Techniques and Tools (continued)

Stage 6: EVALUATE		
Stage 6 - Activity 1 <i>Evaluate Process Performance</i>	Activity Based Costing	Easy ABC Plus, Easy ABC Quick Design IDEF/ABC, TOP-1X
	Auditing	
	Employee and Team Attitude Assessment	
	Fishbone Analysis	SolvingRight, <u>Graphics Tool</u>
	Focus Group	FocusReports <u>Group Decision Support Systems</u>
	Pareto Diagramming	SPC - PC IV, Statistical Process Control <u>Spreadsheet</u>
	Quality Function Deployment	QFD Capture, QFD Design
	Statistical Process Control	Forecast Pro, SPCpack SPC - PC IV, Statistical Process Control <u>Spreadsheet</u>
	Structured Interview	Intelliwriter
	Survey	Intelliwriter, GroupSystems Survey Surveywin
	Time Motion Study	
	Value Analysis	TOP-1X, Easy ABC Plus, iThink
Stage 6 - Activity 2 <i>Link to Continuous Improvement Programs</i>	Total Quality Management Programs	ETQ 9000 Maps ISOxpert Manager's Edition Learnfirst how to implement ISO 9000 Procedure Writer 9000

Appendix 7: IT/Process Analysis

Process Type	Typical BPR Requirements	Capabilities of the Enabling IT
Interorganizational processes (e.g., ordering from suppliers)	Transform unstructured processes into routinized transactions.	IT such as EDI and shared data bases which lower transaction costs and eliminate intermediaries.
Interfunctional processes (e.g., new product development)	Transfer information rapidly across large distances.	IT such as CAD and WANs that support simultaneous work in different locations.
Interpersonal processes (e.g., approving a bank loan)	Remove intermediary and connect two parties within a process.	IT such as groupware and imaging that facilitate role and task integration.
Physical processes (e.g., manufacturing)	Reduce or replace human labor in a process.	IT such as CAM and robotics which increase outcome flexibility and process control.
Informational processes (e.g., creating a proposal)	Bring vast amounts of information into a process.	IT such as AI, multimedia and the WWW that provide unstructured information and routinize decision logic.
Operational processes (e.g., order processing)	Change the sequence of tasks and allow some tasks to be done simultaneously.	IT such as electronic commerce, workflow systems, and shared data bases that reduce time and cost and increase output quality.
Managerial processes (e.g., budget preparation)	Bring complex analytical methods to bear on a process	IT such as expert systems and EIS that improve analysis and increase participation.

Appendix 8: Categories of BPR Techniques

- 1) **Business Planning**
 - 10x Technique
 - Analytical Hierarchy Process
 - Assumption Surfacing
 - Benchmarking
 - Business Systems Planning
 - Competitive Analysis
 - Core Process Analysis
 - Cost/Benefit/Risk Analysis
 - Critical Success Factors
 - Information Technology Analysis
 - Process Prioritization Matrix
 - Search Conference
 - Value-Chain Analysis
- 2) **Process Capture & Modeling**
 - Activity Based Costing
 - Data Flow Diagramming
 - Hierarchical Colored Petri Nets
 - IDEF 0, 3, 6
 - Information Control Net
 - Process Flowcharting
 - Role Activity Diagramming
 - Socio-Tech System Design
 - Soft Systems Method
 - Speech Interaction Modeling
 - Workflow Design
- 3) **Change Management**
 - Assumption Surfacing
 - Behavioral Modeling Training method
 - Benchmarking
 - Critical Incident Technique
 - Cultural Assessment Analysis
 - Exploratory Training Method
 - Fast Cycle Full Participation Change Methods
 - Force Field Analysis
 - Instruction Based Training
 - Persuasion technique
 - Reframing
 - Role Playing
 - Search Conference
 - Socio-Tech System Design
- 4) **Creative Thinking**
 - Affinity Diagramming
 - Brainstorming
 - Delphi Technique
 - Fast Cycle Full Participation Change Methods
 - Force Field Analysis
 - Nominal Group Technique
 - Out of the Box Thinking
 - Visioning
- 5) **Customer Requirements Analysis**
 - 10x Technique
 - Benchmarking
 - Focus Group
 - Quality Function Deployment
 - Structured Interview
 - Survey
- 6) **IS Systems Analysis and Design**
 - Computer Aided Software Engineering
 - Conversion Techniques
 - Data Base Design
 - Data Flow Diagramming
 - IDEF 1,1X, 4, 5,
 - Information Engineering
 - Joint App. Development /Rapid App. Development
 - IS Prototyping
 - IS System Walk-through
 - Software Reengineering
 - System Testing Techniques
 - Workflow Design
- 7) **Process Measurement**
 - Activity Based Costing
 - Auditing
 - Statistical Process Control
 - Survey
 - Time Motion Study
 - Value Analysis
- 8) **Organizational Analysis**
 - Critical Incident Technique
 - Employee and Team Attitude Opinion Assessment
 - Job Analysis
 - Job Design
 - Skills Inventory Analysis
 - Socio-Tech System Design
 - Soft System Method
 - Team Building Techniques
 - Team-based Organizational Design
- 9) **Problem Solving & Diagnosis**
 - Cognitive Mapping
 - Fishbone Analysis
 - Pareto Diagramming
 - Statistical Process Control
 - Structured Interview
- 10) **Project Management**
 - Budgeting
 - Project Scheduling Techniques
- 11) **Process Prototyping & Simulation**
 - IDEF₂
 - Role Playing
 - Simulation
 - Hierarchical Colored Petri Nets

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