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AN EXAMINATION OF SELECTED BUSINESS PROCESS REENGINEERING SOFTWARE USING THE INTEGRATED DEFINITION METHODOLOGY

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Abstract

Currently, there are more than 50 Business Process Reengineering (BPR) tools available. The existence of such a wide variety of BPR software choices can be a major problem to new users when selecting an appropriate BPR package. The primary objective of this research is to identify major BPR software features that support missions critical functions. Specifically, the Integrated Definition (IDEF) family of methods is used as the basis because it views reengineering as an enterprise perspective. It is also the standard modeling method used by the United States Military. Therefore, this study should be of value to government project contractors and analysts involved with the reengineering of legacy systems using the IDEF methodology.

Introduction

Business process reengineering (BPR) deals with the radical transformation of organizational processes through the optimal use of information technologies (IT) to achieve major improvements in quality, performance, and productivity (Gunasekaran & Nath 1997). The concept of BPR originated in the early 1950s as large firms began to explore the potential impact of computers on the efficiency and effectiveness of their business processes. As early as 1993, some 88 percent of large firms in North America reported implementing BPR. These large firms were using BPR to re-engineer their legacy systems at an average rate of four projects each. Since then interest in BPR has been growing. Among firms that have adopted BPR, the following benefits were reported: (1) cost reductions, (2) increases in productivity, (3) higher quality of goods and services offered< and (4) simplified organizational approach (Teng et al. 1998).

There are many BPR methods, techniques, and tools available in the market place (Alter 2000; Barrett 1996; Grover & Malhotra 1997; Kettinger at el. 1997; Klein 1994). Based on systems development methodologies, the more popular methods include Integrated Definition (IDEF), Strucutured Systems Analysis and Design (SSAD), GRAI Integrated Method (GIM), and Information Engineering (IE). OSSAD, C-S and Chain Protocol are more recent additions to the list (Grover 1999). However, Integrated Definition (IDEF) is the only standard modeling technique developed by the United States Military to model their activities for the purpose of developing technology support. The family of methods in IDEF facilitates reliable and effective completion of specific tasks in the development process. Each IDEF method addresses a unique aspect of enterprise engineering. Individual IDEF methods, when integrated, can help to improve product quality by way of process re-design. The achievement of this key goal facilitates the downstream benefits of increased enterprise integration, flexibility, and responsiveness. When combined with other enterprise engineering techniques such as discrete event simulation and workflow analysis, it represents a comprehensive approach for the structured capture of knowledge.

Statement of the Problem

At the time of this research, there are more than 50 BPR tools available in the market. They range from sophisticated functions that support simulation and dynamic modeling analysis to low-end packages that merely support flowcharting (Barrett 1996). Depending on the functionality it supports, the price of the software may range from a high of $15,000 to a low of $600. However, there is no single product available that can deliver all the BPR tools users now want (Barrett 1996).

The existence of such a wide variety of BPR software choices can be a major problem to new users when selecting BPR software packages. With the discrepancy between user needs and available tools, there is a need for research on those BPR software features that supports critical functions since there have been only a few studies about BPR tools (Im et al. 1997). The results would also be invaluable to existing users who want to expand their integration capabilities.

Objectives of Research

The primary objective of this research is to identify and classify the functions and features offered in major BPR software. Specifically, the IDEF family of methods is used as the basis for examining and classifying the features because it views reengineering as an enterprise perspective. It is also the standard modeling method used by the Department of Defense. In this research, five IDEF modeling methods are used to provide the set of modeling syntax and steps for describing the respective particular perspective of BPR. They are: (1) Function modeling (IDEF0), (2) Data modeling (IDEF1X), (3) Simulation modeling (IDEF2), (4) Process modeling (IDEF3), and (5) Object-oriented modeling (IDEF4).

The results of this study should be of interest to software developers, and project managers. In particular, this study should be of value to government project contractors and analysts involved with the reengineering of legacy systems using the IDEF methodology.

Data Gathering and Analysis

Seventy-two software developers were identified to market packages containing BPR capabilities. Each of the vendors supporting IDEF methodologies was then further selected for inclusion in this research. The data gathering of this research are outlined below:

1. Identification of BPR packages: All the BPR packages, methods, and techniques that support the reengineering efforts from the vendor descriptions were identified first. Then, the software that supported the IDEF methods was selected for inclusion in this research.
2. Identification of IDEF tools: From the portfolio of selected software tools that support reengineering efforts, the next step was to identify the list of tools that fit the IDEF structure. Then the selected tools were classified in terms of their areas of application and functions.
3. Identification of the functions and features contained in the software selected: Each area of application has a variety of functions or capabilities. The common capabilities within each application areas were identified and classified into established, maturing, or unique functions and features.

The method of analysis in this study is built upon the findings of an earlier study reported by Klein (1994). According to the author, the whole BPR process consists of three components. These components include planning, execution, and project management. However, two of the components, planning and project management, are not part of the IDEF family of methods. As a result, this study included only those elements that are part of the execution component. The elements examined under this component are then based on the works of Im, Sway, and Hars (1997). They are: (1) Visualization and Mapping, (2) Modeling and Measuring, (3) Data Compatibility, and (4) Project Management.

Based on the definitions of the first two elements that were analyzed by Im, Sway and Hars (1997), the IDEF family of methods can be mapped to the first two elements. Visualization and mapping is actually IDEF0 in the IDEF family of methods because the techniques and tools are based on combining graphics and text to present outcomes in an organized and systematic graphic manner. Similarly, the second element can be mapped to other levels in the IDEF family of methods. IDEF1X (data modeling), IDEF2 (simulation modeling), IDEF3 (process modeling), and IDEF4 (object-oriented modeling) are actually modeling and measuring elements.

To be included in this study, the software must indicate that the package supports the IDEF family of methods. This evidence was based on the disclosure statement provided by the vendors on their Web sites or on their product description. To verify for accuracy, this information was further checked against the findings of Kettinger, Teng, and Guha (1997) as well as the listing provided by the United States General Services Administration (GSA). In the case of IDEF2, there are a large variety of tools in the market that have simulation capabilities. However, none is IDEF compliant. To resolve this situation, the approved list of GSA software packages that support simulation and other advanced IDEF family of methods was used in this research. This is the reason why SimProcess, a proprietary product of CACI, was included as an IDEF support tool in this study.

The major characteristics examined in this study are based on the works of Dr. Jay Bal (1997), a distinguished professor at the University of Warwick, United Kingdom. According to his research that is available from the Business Processes Resource Center, there are six major BPR software characteristics. Each of these characteristics has also a number of features that support those characteristics.

Eight tables were used to present the findings of this research. Characteristics that were found in at least 75 percent of the IDEF family of methods were classified as established functions. This group represented the fundamental IDEF characteristics that every user must purchase and master and every developer must offer in the software. Characteristics found in less than fifty percent of the IDEF characteristics will be classified as niche or specialty functions. This group represented the new and extra or industry specific characteristics that can meet the needs of the expert users. All the remaining characteristics were classified as maturing functions. This group represented the maturing characteristics that are important and should be included for mature or skillful users. The features within each of the functional characteristics were also examined and classified using the same rule.

Findings

The initial list of BPR software providers obtained from the Internet search and published research consists of 72 software vendors and 105 tools. The standard list of software vendors approved by the Government Supporting Agency (GSA) consists of 32 contractors. Using the two listings, the proportion of vendors approved by the GSA to the total number of BRP vendors was about 43 percent or 28 vendors. Eleven software products were found to support the IDEF family of methods. The proportion of tools supporting the IDEF family of methods to the total number of approved GSA vendors was about 39 percent.

Of the 11 IDEF tools, three products belong to the same software vendor, Computer Associates. One of the products, AT&T Cabre, is internal to the company and the data could not be gathered on this product. One product belongs to a consulting company that provides design and leverages BPR projects; hence there is no product data available. The last one was TI BDF that was supported by Texas Instruments and it is obsolete. Complete data on the remaining eight products were obtained and included in this research. With the exception of three vendors, the rest of the developers are Fortune 500 companies and are based throughout the United States of America. The eight software packages and their abbreviations used in this study were:

1. ERwin (ER)
2. BPwin (BP)
3. Paradigm Plus (PP)
4. Procap / Prosim (PS)
5. Rational Rose (RR)
6. System Architect 2001 (SA)
7. Simprocess (SP)
8. Workflow Analyzer (WA)

The seven BPR characteristics identified are presented in Table 1. Four characteristics were found in 100 percent of the software and can be classified as established characteristics. They were Hardware & software features, User features, Modeling capabilities, and Integration capabilities. None of the software examined has all the characteristics. The remaining information is presented in Table 1 below.

There were two other major observations found in Table 1. First, only three software products have object-oriented capabilities. The products are Rational Rose, Paradigm Plus, and Systems Architect 2001. The software vendors are Rational, Computer Associates, and Popkin Software. This feature was classified as a niche or specialty feature because it was contained in less than 50 percent of the software. Three of the software vendors provide simulation capabilities. The software that supports simulation is Simprocess, Workflow Analyzer, and PROSIM. The vendors are CACI, Meta Software, and KBSI Inc. Based on the minimum 50 percent rule used in this research, this feature was also classified as a niche or specialty feature.

Table 1. Characteristics of BPR Software

Characteristics	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Hardware and Software features	X	X	X	X	X	X	X	X	100.00
User features	X	X	X	X	X	X	X	X	100.00
Modeling capabilities	X	X	X	X	X	X	X	X	100.00
Object-Orientation capabilities	NA	NA	X	NA	X	X	NA	NA	42.85
Simulation capabilities	NA	NA	NA	X	NA	NA	X	X	42.85
Analysis capabilities	NA	X	X	X	X	X	X	X	85.75
Integration capabilities	X	X	X	X	X	X	X	X	100.00
Total	4	5	6	6	6	6	6	6	

Individual characteristics and their associated features were examined during the second stage of this study. The results of the individual characteristics and the features examined were presented in Tables 2 to 8.

Table 2. Hardware and Software Features

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Multiple platforms and operating systems	X	X	X	X	X	X	X	X	100.0
Database repository and Client-server feature	X	X	X	X	X	X	X	X	100.0
Export/Import features	X	X	X	X	X	X	X	X	100.0
Tool Integration	X	X	X	X	X	X	X	X	100.0
Total	4	4	4	4	4	4	4	4	

The common hardware and software features are presented in Table 2. The main observation in Table 2 is that 100 percent of the software selected for this study had all four features. These features were all classified as established features because they were found in all the software.

Table 3. User Features

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
User friendly	X	X	X	X	X	X	X	X	100.0
Graphical User Interface (GUI)	X	X	X	X	X	X	X	X	100.0
On-line documentation and help	X	X	X	X	X	X	X	X	100.0
Other special features	X	X	X	X	X	X	X	X	100.0
Total	4	4	4	4	4	4	4	4	

The user features were presented in Table 3. Like hardware and software features, all the features in Table 3 were included in 100 percent of the software examined. These features were also classified as established features. Details about those features are presented in Table 3.

Table 4. Modeling Capabilities

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Determine the process or reengineering goals	X	X	X	X	X	X	X	X	100.0
Identify the different roles in the process	NA	X	X	X	X	X	X	X	87.5
Data flow diagramming capabilities	X	X	X	NA	X	X	NA	X	75.0
Model syntax & logic enforcement	X	X	X	X	X	X	X	NA	87.5
Ease of modeling	X	X	X	X	X	X	X	X	100.0
Level of detail	X	X	X	X	X	X	X	X	100.0
Concurrence and interdependency	NA	X	X	X	X	X	X	X	87.5
Total	5	7	7	6	7	7	6	6	

Seven features are examined in Table 4. These features were related to the phases of business, data, and process modeling. The results were mixed. A summary of major observations is presented below:

- Three of the BPR features were found in all the eight software packages.
- Only three software packages have all the features defined.
- All the features fall into the established criteria because all the computed percentages were at least 75 percent.

Table 5. Object-Oriented Modeling Capabilities

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Activity diagrams	NA	NA	X	X	X	X	NA	NA	50.0
Sequence diagrams	NA	NA	X	NA	X	X	NA	NA	37.5
Collaboration diagrams	NA	NA	X	NA	X	X	NA	NA	37.5
Code Reuse (C++/Java)	NA	NA	X	X	X	X	NA	NA	50.0
Enterprise Scalability	NA	NA	X	NA	X	X	NA	NA	37.5
Concurrence and interdependency	NA	NA	X	NA	X	X	NA	NA	37.5
Total	0	0	6	2	6	6	0	0	

Six features that exclusively support object-oriented modeling capabilities were examined in Table 5. There were again mixed results. Some of the major observations of the features in this characteristic include:

- Only four of the software vendors provide object-oriented capabilities for their software. The software that supports object-orientation is Rational Rose, ParadigmPlus, Simprocess, and System Architect 2001. The vendors are Rationale, Computer Associates, CACI, and Popkin Software.
- Four of the features were found in less than 50 percent. These features were classified as niche or specialty feature.

Two of the features were found in fifty percent of the software. They were classified as maturing features.

Table 6. Simulation Capabilities

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Time	NA	NA	NA	X	NA	NA	X	X	37.5
Cost	NA	NA	NA	X	NA	NA	X	X	37.5
Statistical Distribution	NA	NA	NA	X	NA	NA	NA	X	25.0
Graphical	NA	NA	NA	X	NA	NA	X	X	37.5
Discrete Event Modeling	NA	NA	NA	X	NA	NA	NA	X	25.0
Total	0	0	0	5	0	0	3	5	

Five features that were related to simulation capabilities were presented in Table 6. All of them were contained in less than 50 percent of the software and were therefore classified as niche or specialty features. There were two other major observations:

- Two of the software companies are providing support for all the features in this characteristic. The packages are Simprocess by CACI and Prosim by KBSI Inc.
- One vendor is providing the capability for 65 percent of these features. The software package is Systems Architect 2001 and the vendor is Meta Software.

Table 7. Analysis Capabilities

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Reasoning	NA	NA	X	X	X	X	NA	X	62.5
Output analysis	X	X	X	X	X	X	X	X	100.0
BPR expertise	X	X	X	X	X	X	X	X	100.0
What-if analysis	NA	X	X	X	X	X	X	X	87.5
Top-down, bottom-up, outside-in analysis	NA	X	X	X	X	X	NA	X	75.0
Total	2	4	4	5	5	5	3	5	

There were five features that dealt with analysis capabilities. The observations are presented in Table 7. Mixed results were obtained. The major observations from this table were:

- Four out of the five features examined were contained in at least 75 percent of the software. The features were classified as established features in this characteristic.
- One feature, reasoning, falls into the maturing feature category. This feature is contained in only four of the software packages.
- Four of the eight software packages have all the features.

Table 8. Integration Features

Features	ER	BP	RR	SP	PP	SA	WA	PS	Percentage (%)
Information view	X	NA	X	NA	X	X	X	NA	62.5
Behavioral view	NA	X	X	X	X	X	X	X	87.5
Organizational view	X	X	X	X	X	X	X	X	100.0
Functional view	NA	X	X	X	X	X	X	X	87.5
Total	2	3	4	3	4	4	4	4	

Four features that were related to integration capabilities were examined and presented in Table 8. The results are mixed. Some of the major observations were listed below:

- Three features were classified as established or base line features that are required by all software because they were contained in at least 75 percent of the software packages. These variables were behavioral view, organizational view, and functional view.
- One feature was classified as a maturing feature. It was the information view.

Based on the results generated from Tables 2 through 8, a summary of all the features examined and their classification was presented as follows:

- There were 35 features identified in the 7 characteristics defined in this research.
- There were 22 established or critical features (features contained in at least 75 percent of the software packages).
- Ten features were identified as niche or specialty features (features contained in less than 50 percent of the software packages).
- Three features were classified maturing features.

Conclusions and Implications

This study found that the characteristics and features of BPR software supporting IDEF family of methods could be classified into 5 established characteristics and 2 niche characteristics. Together, these characteristics have 22 established features, 3 maturing features, and 10 niche or specialty features.

The presence of only established and niche characteristics provided evidences to support the notion the BPR software packages were beginning to mature as a class of application software. There were well-defined established characteristics. There are well-defined features in the established characteristics. These characteristics and their elements represent the fundamental features that are critical of BPR software. There were niche features in the niche characteristics. There is a vacuum in the middle indicating that there is a need for developers to begin developing tasks or functions in the maturing group. This conclusion is further supported by the current developments in the IDEF family of methods where developers are in the infant stage of development with IDEF methods 5 through 14.

Finally, all BPR software packages are not created equal because they do not necessarily support all the functionality specified in IDEF family of methods. Even though there were only 8 BPR software packages examined, this study found that the number of characteristics and features included in the BPR software can vary widely. Some software can have 100 percent of all the features in a characteristic. On the other hand, some vendors can offer only about half of the features identified. Furthermore, brand name is not a guarantor of the level of expertise BPR software could offer. ERwin, a BPR product made by CA-Platinum, offers data modeling capabilities, one of the five IDEF methods examined in this research. However, it affords about half of the features examined in this study. On the other hand, BPwin and Rational Rose have all the features examined. This means that first time buyers in particular should carefully examine the features and characteristics before making a purchase decision.

This research attempted to determine the type of features that should be included in BPR software. In particular, this study used a standard methodology that is accepted by the GSA to examine the characteristics and the features. Also, this study is an empirical analysis of existing products to determine essential characteristics and features and there is a need for additional research.

Finally, the conclusion drawn here may be limited by the inclusion of only 8 major BPR software packages that matched the IDEF methodology. Data on three of the IDEF software could not be obtained because they were either sold out to another company, obsolete, or were property of a consulting venture. It must also be pointed out that availability of a function or feature does not necessarily make the software package an industry leader in the market. Moreover, other critical factors involved in the purchase decision such as customer support were not assessed. This is purely an assessment of existing features in the BPR software. Irrespective of the limitations indicated, the findings are not biased. The methodology adopted covers the major elements of BPR. Great care was applied in interpreting the results.

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