A CONCEPTUAL MODELING APPROACH TO BUSINESS PROCESS REENGINEERING

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ABSTRACT

The paper proposes an approach to understand the business process dynamics by exposing the interdependencies among organizational variables. This is achieved by supporting the business process reengineering task by facilitating a shared understanding of the problem domain, underlying assumptions and the strategic interests. The approach facilitates understanding the dependencies among business processes as well as the identification of key processes to be reengineered. Moreover, this representation supports the argumentation process with the help of a language that facilitates debating of issues including alternative designs, and the ramifications of process changes. The approach rests on identifying the qualitative elements of a problem and the relationships among them in attaining a mutually agreed upon definition of the problem. In addition, the role of emerging technologies such as DSS (decision support systems), ES (expert systems), AI (artificial intelligence) in furthering the improvements can also be assessed as part of the reengineering task.

Keywords: Business Process Reengineering, Conceptual Modeling, Mental Models, Argumentation Language, Action-Resource Model.

INTRODUCTION

Reengineering involves rethinking the business processes and their radical redesign in order to improve performance (9). The main challenge in redesigning processes is to understand the current practice and its shortcomings prior to taking any measure in improving the existing processes including a radical redesign. In the literature, researchers suggested the help of graphical system design techniques, such as Data Flow Diagrams (DFDs) as a tool to understand the current system and the dependencies among processes (5 and 11). However, though DFDs are valuable tools in depicting the current system and ways in which old mostly sequential tasks (manual or computerized) can be automated, for the purposes of business process reengineering, they need to be augmented with additional techniques. Furthermore, a casual use of DFDs may result in automating the current processes. This can be remedied by explicating the implicit assumptions dominating the existing processes and by critically challenging the underlying models. This would lead to generating alternatives that can focus on leverage points where major change can be achieved with less effort. Furthermore, the merits of each design alternative can be evaluated from a strategic perspective. In addition, recognizing that the relationships among processes need to be captured and that the reengineering team needs to be able to reason about these processes suggest the need to employ an argumentation language (4, 15).

In this study, we view business process reengineering as a problem structuring task, where the team members need to understand the relationships and dependencies among processes as well as be able to suggest alternative views, and be able to link them to strategic company goals. In particular, we view the task as a debate, which first focuses on agreeing on a shared problem space, given that initially members may have differing views for current shortcomings or future effectiveness. Next, the team members can

generate alternative designs and reason about their merits from a strategic perspective by analyzing the process dependencies in terms of actions and resources that are involved. The approach recognizes the need to support presentation of viewpoints and proposes a model, which facilitates problem understanding and structuring. This is achieved with an argumentation language, which facilitates purposeful goal-oriented discussions. The approach structures discussions by identifying linkages among processes, resource interdependencies, perceived likely outcomes including new process designs.

The paper is organized as follows. First, we discuss the role of mental models in understanding the problem. Next, the paper emphasizes the need to debate the implications of various assumptions and alternatives when assessing their effect on resource creation and utilization. This is achieved by action-resource based argumentation language. Finally, we present how the proposed approach can facilitate identifying areas where system performance can be significantly enhanced with the help of emerging technologies such as DSS and ES. We illustrate the proposed approach using an example reengineering case.

PROPOSED APPROACH TO PROBLEM STRUCTURING

As part of reengineering task, the development team needs to understand the organizational decision processes. It is important to identify redundant processes, especially the ones that were traditionally carried out sequentially due to the constraints imposed by outdated information technologies, such as file management (8). The reengineering efforts envision new ways to carry out the business, which results in changes in existing processes as well as establishing new processes. The new ways to execute business processes are guided by the goals deliberated by the design team.

Alternative business process designs are to be generated and debated by the members of the design team in order to configure the best design that suits the measures such as cost, quality, service and speed. However, proper evaluation of the design alternatives can be possible only if the problem which necessitated the business process redesign efforts is well-understood by all parties. It is important to note that usually members of the design team implicitly assume that they all understand what the problem is, and proceed to solve disparate versions based on their view of the problem. This lack of common understanding has the potential to hamper the success in reengineering efforts. The proposed approach attempts to remedy the shortcomings by first focusing on agreeing on a common problem definition by explicitly surfacing the underlying assumptions hold by team members. In this view, it is more important to define the problem by initiating a debate rather than debating the merits of each alternative design. Once the consensus is obtained on what the problem is, naturally alternatives can be generated that could address the problem. This argument is also consistent with the Japanese approach to decision making.

As Peter Drucker notes:

> "In the West, all the emphasis is on the *answer* to the question. Indeed, our books on decision making try to develop systematic approaches to giving an answer. To the Japanese, however, the important element in decision making is *defining the question*. The important and critical steps are to decide whether there is a need for a decision and what the decision is about. And it is in that step that the Japanese aim at attaining consensus. Indeed, it is that step that, to the Japanese, is the essence of the decision." (Original source: (7, pages 466-467) ; cited in: (6, page. 138)).

Accordingly, in a cooperative setting, attaining a consensus when defining the problem is essential to achieving a solution that would address the problem. In other words, the problem is essentially solved, when it is successively redefined till all participants reach a mutual agreement on what the problem is.

Solving the problem via problem redefinitions is also the basis of evolutionary approach to conflict resolution (14), which had been successfully applied to diverse problem settings (1). According to evolutionary approach, solution to a problem is reached by redefining problem elements including values, goals, constraints and decision variables. In this view, problem is solved when the conflict that arises from the difference between what participants want and what they get, i.e., between target (values, goals --the desired region) and performance (the feasible region) is essentially reduced or eliminated.

The evolutionary approach to conflict resolution is applicable in business process reengineering tasks. Once the problem definition is obtained through evolutionary process by continually redefining the problem, the solution to the problem is obtained as a by-product of the problem redefinition. Depending on the task, the solution may require an incremental (evolutionary) change in existing processes or a radical (revolutionary) change. Thus, once the team members can freely communicate assumptions and viewpoints, the process of exchanging ideas would result in a solution. The extent the solution is regarded as revolutionary would depend on the nature of the case in question along with the goals the team members set to accomplish.

The Role of Assumptions

Senge and Sterman (13) identify three stages in improving manager's abilities to view situations systematically and dynamically (from (13, pages 139-140)):

First stage, *Mapping Mental Models* involves explicating and structuring assumptions via systems models. Mapping tools assist in generating issues, capturing and framing knowledge, sharing concepts, focusing discussion, and reaching consensus. Also, time delays, long-term effects, and multiple impacts of decisions are considered at this time. Most importantly, at this stage critical assumptions are uncovered, which are to be challenged at the next stage.

Second stage, *Challenging Mental Models*, focuses on discovering internal inconsistencies and contradictions with data and others' knowledge. At this stage, the possible interactions among system components are considered along with their likely consequences. This happens to be a delicate process since managers' beliefs and inconsistencies are exposed.

The third and last stage is *Improving Mental Models* involves the process of continually explicating, testing, and revising managerial assumptions including feedback dynamics, exogenous factors, such as linkages with other functions in the organization and with other organizations in the environment.

The above processes serve to explicate the assumptions behind new initiative, which are to be continually tested and improved. Since a business process reengineering task affects many organizational units and involves many managers, it is crucial to communicate and comprehend the underlying assumptions behind new initiatives. The importance of implicit assumptions is also pointed out in the literature (16). Accordingly, consistent with evolutionary research (14) and its application to problem structuring and group decision support (1, 4) we view the business process reengineering task as:

- Shared problem definition agreed by all parties involved
- Revising the problem continually till all parties can agree on goals, and resource constraints.

The above tasks include assessing the ramifications including feedback loops, second order effects and time delays. This process can be supported by a language tool, which facilitates the communication of goals, resource constraints, and likely impacts. In the following section, we will illustrate the approach with the help of a reengineering case in insurance industry.

Illustrative Example: Process Design Alternatives

In this subsection we illustrate typical business processes and likely reengineering alternatives with the help of a fictitious but representative auto insurance company from Hammer and Champy (9). This case is also discussed in (5 and 16). Furthermore, additional insights about the task domain, namely, insurance industry crisis of a presumably different company is given in (13).

"The company, Imperial Insurance, believes that it is paying out more than it should in settling auto accident claims since settlements in covering both injury to people and damage to automobiles are increasing. The latter trend was unexpected given that customers were recently buying policies with higher collision deductibles, which made the industry assume that collision damage claims would go down. However, customers were purchasing policies with higher deductibles to cut the premium costs, but once an accident occurs they persuade the body shop to make its estimates high enough to cover the full cost of repair anyhow. In addition to fraud related costs, internal cost problems also develop for the company. For every $7 it pays out to settle a claim, the company spends $1 for processing. It takes an average of forty days to process claims. Moreover, the longer it takes to settle a claim, the probability that the claimant will choose to litigate also increases. Litigation significantly increases the settlement cost and may drag on forever" (from Binbasioglu et al. (5), and Hammer and Champy, (9)).

In the following, we present the interrelationships among problem components and how alternative processes can be visualized with different performance focus. Given the mission to make the insurance business profitable, the reengineering team contemplates alternative business process redesigns. Redesign efforts aim to streamline the claims processing so that speedy but satisfactory settlement will maintain customer happiness, which in turn will significantly reduce the litigation cost. The possibilities deliberated by the reengineering team involves categorizing the claims and off-loading the processing task for small claims either to insurance agent or to body shop (as discussed in Yu, et al. (16)).

The first design alternative suggests eliminating the appraisers involvement in assessing the damage for small claims, and instead considering the customer offer. Moreover, this alternative suggests a modification of the process, which involves the insurance agent. The task now involves the process of authorizing payments to customers, and any additional information resource required to execute the task need to be available to the insurance agent, such as fraud detection software, customer profiles, etc.

The second design alternative proposes a new process, where the claims will be handled directly by the body shop. Furthermore, proper implementation of this process requires that the insurance company will maintain some control over this process by compiling a list of pre-approved body shop list, which has to be subjected to continuous monitoring by the insurance company as to possibilities of fraud. In addition, customer profiles may need to be maintained and accessed.

The two design alternatives are summarized as follows:

- Reduce insurance company involvement in handling small claims:
  Insurance agent will be in full charge of the small claims including authorization of the payment amount.
  Goal satisfied: Customer happiness, speedy processing.
  Additional resource requirements: Information support to agents including fraud detection support such as access to customer profiles pertaining to past repairs and frequency.

- Let body shop handle the claim:
  Goal satisfied: Customer happiness, very speedy processing.
  Additional resource requirements: Compile an approved body shop list and monitor body shops by analyzing the nature and cost of repairs; fraud detection support for analyzing customer profiles and body shop profiles.

In the literature, the implications of design alternatives on company goals were identified via means-end reasoning (16). In our approach, we employ an action-resource based language in deliberating the hidden assumptions and likely implications of alternative designs on company goals. Thus, assessing the impact of design alternatives on company goals is key in challenging the existing processes, lack of it would result in automating the current processes with cosmetic alterations due to advancement in information technology. The importance of identifying strategic implications of business process redesign efforts was also pointed out in the literature (12).

THE ROLE OF AN ARGUMENTATION LANGUAGE

In this section we illustrate the importance of and need to be able to dynamically change the problem domain and goals in an evolutionary fashion so that incremental or radical changes can be proposed as part of the design team's deliberations of issues and alternatives. This flexibility in envisioning new alternatives appears to be the core issue in business process reengineering efforts, however the literature provides no support in enabling the generation of alternatives and explicating the interdependencies among the processes.

Visual tools, such as DFDs, are valuable aids in depicting relationships among processes including the data sources and the organizational units involved. However, these tools do not provide any support in guiding the user in understanding or questioning the "essence" of the process. Unless the need for a process can be justified within an environment that creatively questions the existence of the process, one would expect very little improvement in redesign efforts. That is, undertaking a redesign project requires spurring a productive debate over the processes by carefully examining each as to their role in realizing company objectives. This critical examination will not only identify the redundant processes but also will prevent reducing the reengineering task to simply automation of existing processes. Thus, visual aids need to be augmented with a language tool that would foster deliberations of issues as well as be able to relate arguments to company goals and objectives.

Toulmin, et al. (15) suggests the use of an argumentation language to convey arguments, reasons, evidence, or assumptions. Hegel's (10) dialectical language also emphasizes the need to debate views where the *thesis* is challenged by the *antithesis* until the *synthesis* is found.

An action-resource based representation language (4) can facilitate the identification and modification of problem elements. The action-resource representation to problem structuring defines the problem by

clarifying the problem components and the ways in which they relate to each other. Such a representation is likely to facilitate the identification of company goals, policies, constraints and likely conflict situations. Most importantly, this representation is likely to provide an appropriate medium to redefine the problem. Shakun's (14) evolutionary approach to conflict resolution is applicable in this context, where problem redefinition is recommended as the solution for conflict resolution.

A simple action-resource representation provides a medium to model the activities in managerial settings (1, 2, and 3). Managerial decision making situations require the decision makers to identify what actions to take on which resources; such as what products to produce; whom to hire, promote, or fire; which equipment to purchase; among others. In this framework, decision making process involves determining the action-resource groups that are likely to remedy the problem. The action-resource combinations that would resolve the problem are the ones that are consistent with the goals and the other restrictions (constraints) of the problem environment. Goals and constraints refer to desired or set levels of resources, respectively. Accordingly, the problem solving process can be viewed as identification of appropriate actions and resources, deliberation of organizational goals, and acknowledgment of constraints that might impede the consideration of certain actions.

Actions and resources relate to each other as follows: Resources are generated or consumed as a result of actions taken, or conversely, actions require input resources and/or generate output resources. In general, the activity is composed of an action that may take many resources as input and/or may generate many output resources. For representation purposes, the activity definition is

[input resources | action | output resources]

This "primitive" activity definition can support more complex activity structures by linking activities.

THE ROLE OF EMERGING TECHNOLOGIES

Emerging technologies such as decision support systems and expert systems can enable the process changes. The following are sample DSS application areas, which can support or improve decision processes in the insurance example (from Binbasioglu, et al. (5)):

- The decision to pay the claim off or to send the auto to one of the preferred body shops to take care of it.
- The decision to approve a body shop list by analyzing the nature and cost of repairs for which the company has paid various body shops (i.e. maintain body shop profiles and constantly monitor their status by statistical audit).
- Analysis of past customer claims, if any, when detecting the probability of fraud (i.e. maintain customer profile).
- Analysis of the speed of processing claims for monitoring company performance.
- Analysis of the tradeoff between fixing the car first or delaying the repairs till who is at fault is determined, or do both. This action has critical implications for the speed of processing metric.

- Analysis of the tradeoff between speedy action and law suit filing.

- Analysis of the decision to help or not to help the party involved in the accident who happens to be a claimant of another insurance company (i.e. assessing the sales opportunity tradeoff).

- Analysis of the decision to allow the claimants to rent replacement autos versus providing cars. The latter might induce additional savings since the company can cut a better deal with a rental agency.

CONCLUDING REMARKS

Recent advancements in information technology are enabling organizations to rethink the way they do business by applying information technology more creatively to achieve efficiency and effectiveness improvements. Organizations feel the pressure of time in decision making more than ever and are investing in technologies such as decision support systems and expert systems applications, in conjunction with business process reengineering efforts.

The paper proposed a conceptual modeling approach to business process reengineering based on action-resource modeling. The approach aims to facilitate shared understanding of the problem domain by supporting the argumentation process with the help of a language. Future extensions of this work may include the development of a knowledge-based system, which can exhibit intelligent behavior. Another interesting study could examine causal relationships including feedback loops to qualitatively assess the consequences of system change initiatives.

REFERENCES

1. Binbasioglu, M. (1999-2000). Problem Structuring Support Tool for Collaboration and Problem Solving. Journal of Computer Information Systems, Winter, 54-63.
2. Binbasioglu, M. (1995). Key Features for Model Building Decision Support Systems, European Journal of Operational Research, (82), 422-437.
3. Binbasioglu, M. (1994). Process-Based Reconstructive Approach to Model Building. Decision Support Systems, (12), 97-113.
4. Binbasioglu, M., Bui T. and Ma, P.C. (1997). An Action-Resource Language for Negotiation Support. Journal of Computer Information Systems, Summer, 89-96.
5. Binbasioglu, M., Zychowicz, E. J., Karagiannis, D. and Marchi, A. (1996). A Synthesizing Framework for Decision Support Systems Applications, Journal of Computer Information Systems, Fall, 12-22.
6. Davenport, T. H. (1997). Information Ecology. Oxford University Press.
7. Drucker, P. (1974). Management, Tasks, Responsibilities, and Practices. New York: Harper & Row.
8. Guha, S., Kettinger W. J. and Teng T.C. (1993). Business Process Reengineering: Building a Comprehensive Methodology, Information Systems Management, Summer, 13-22.
9. Hammer, M. and Champy. J. Reengineering Corporation. (1993). Harper Business.
10. Hegel, G. W. F. 1964. The Phenomenology of Mind (2nd ed.). Translated by J. B. Baillie, George Allen and Unwin, Ltd., London.
11. Lucas, H. C. Jr., Berndt, D. J. and Truman G. (1996). A Reengineering Framework for Evaluating a Financial Imaging System, Communications of the ACM, (39:5), May, 86-96.
12. Schnitt, D. L. (1993) Reengineering the Organization Using Information Technology, Journal of Systems Management, (44:1), january, 14-20, 41-42.

13. Senge, P. M. and Sterman, J. D. (1992). Systems Thinking and Organizational Learning: Acting Locally and Thinking Globally in the Organization of the Future, European Journal of Operational Research, (59), 137-150.
14. Shakun, M.F. 1988. Evolutionary Systems Design, Holden Day.
15. Toulmin, S. E. , Rieke R., and Janik A. (1979). An Introduction to Reasoning, New York: MacMillan.
16. Yu, S. K., Mylopoulos, J. and Lesperance, Y. 1996. AI Models for Business Process Reengineering, IEEE Expert, August, 16-22.