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USING A POSITIVIST CASE RESEARCH METHODOLOGY TO TEST A THEORY ABOUT IT-ENABLED BUSINESS PROCESS REDESIGN

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Abstract

We derive a process theory, the “technology-oriented theory of business process redesign,” from the business process reengineering (BPR) literature and test it in a positivist case study of a corporation that implemented BPR. Our evidence refutes the theory. The future direction we suggest for researchers and practitioners is to adopt, *from the beginning*, an orientation that is not technocentric or overly technological, but gives equal consideration to social dimensions and the interactions between the social and the technological.

Keywords: Business process redesign, business process reengineering, case study, IS management, positivist perspective, research methodology.

1. INTRODUCTION

Now that the excitement over business process reengineering (BPR) is waning, the time is ripe to begin evaluating what BPR has wrought. In this study, we take a first step in this direction. Our objectives are both substantive and methodological: (1) the former is to contribute to business process redesign¹ by scientifically testing formal propositions (derived from the existing BPR literature) pertaining to “a technology-oriented theory of business process redesign,” where the empirical testing involves observations of a major information-technology (IT) enabled reengineering initiative at an actual company, and (2) the latter is to contribute to information systems (IS) research methodology by proposing a way to specify propositions in a form that allows them to be empirically tested with a positivist case study methodology derived from Lee (1989) and Yin (1984, 1989).

Specifically, we will provide a *process theory* formulation of business process redesign (an important component of BPR to which we will simply refer as “redesign”) for the reason that formal propositions about redesign, when derived from the existing BPR literature, end up taking the form of a process theory rather than a variance theory (Mohr 1982; Soh and Markus 1995). Our reason for using case-research methodology is that the evidence in this study comes from the real-life setting of a single site where a company attempted to implement concepts of BPR.

¹We view BPR as consisting of two analytically separable phases: *business process redesign* or “redesign” (which is the focus of this paper), and *the implementation of the redesigned business processes*.

In the following sections of this paper, we propose a structure for stating process-theory propositions; we derive the “technology-oriented theory of business process redesign” from the BPR literature; we discuss our positivist case-research methodology; we present the evidence from our case and test the theory deductively; we review how our case study meets the standards of positivist rigor; and we discuss the contributions of this study.

2. PROCESS THEORIES

Unlike variance theories, which we characterize as seeking to establish cross-sectional statements about a phenomenon assumed to occur within a “black-box,” process theories tell “a little story about how something comes about”—that is, they involve investigating what is happening in the “black box” or the longitudinal process itself; however, “in order to qualify as a theoretical explanation of recurrent behavior, the manner of story-telling must conform to narrow specifications” (Mohr 1982 p. 44). Numerous IS scholars (e.g., Ginzberg 1978; Markus and Robey 1988; Orlikowski 1993; Sabherwal and Robey 1995; Shaw and Jarvenpaa 1997; Walsham 1992) have offered a diversity of views on what those specifications must be.

Our specifications for “storytelling” are fundamentally consistent with those of Mohr, where we add a refinement: our proposed approach encourages the specification of not only *necessary conditions* (as in Mohr’s formulation) but also *sufficient conditions*² and *moderating conditions*, which are logical extensions that do not contradict, but are supplemental to, Mohr’s necessary conditions. The validity of our formulation of process theory (and indeed, of any positivist formulation of a scientific theory) rests in fact that (as we will later examine) it recognizes that propositions must be falsifiable, must be logically consistent, must survive empirical testing, and must provide a better explanation than any competing theory.

A common form for a process theory proposition is:

Y can happen only if X happens.

This implies that X is a *necessary but not sufficient condition* for Y.³ If Y happens without the occurrence of precursor X, the proposition is falsified.

Another form is:

Y must happen if X happens.

This implies that X is a *sufficient but not a necessary condition* for Y.⁴ If X happens but Y does not, the proposition is falsified. The third form of stating propositions is used to specify “moderating conditions,” as opposed to necessary or sufficient conditions, for an outcome:

Where the necessary (or sufficient) condition(s) {Y,...} for Z are satisfied and Z occurs to some extent, X’s happening will have an influence on the extent to which Z occurs, through X’s moderating or interactive impact on at least one of the necessary (or sufficient) conditions {Y,.....}.

²See Van de Ven and Poole (1990).

³When such a necessary condition appears in a process theory, the empirical referent of X would be specified to *occur chronologically prior* to the empirical referent of Y. This is an important distinction between necessary conditions in process theories and necessary conditions in cross-sectional variance theories.

⁴When such a sufficient condition appears in a process theory, the empirical referent of X would be specified to *occur chronologically prior* to the empirical referent of Y. This is an important distinction between sufficient conditions in process theories and sufficient conditions in cross-sectional variance theories.

The researcher rejects this proposition if: either (1) the presence of the moderating condition (X) in addition to the necessary (or sufficient) condition (Y) results in the outcome (Z) that is no different from the situation where Y is present but X is not; or (2) Y does influence Z, but in a direction opposite to that theorized.

3. A TECHNOLOGY-ORIENTED THEORY OF BUSINESS PROCESS REDESIGN

Business process redesign involves a reformulation of the way an organization conducts its business. It involves *the envisioning of broad cross-functional business processes and other related aspects of the organization* with the aid of information technology (IT) enablers and/or organizational enablers in order to obtain significant performance improvements. An effective redesign of business processes provides a solid foundation for the implementation of the redesigned processes and thus has a strong potential for contributing significantly to the success of an entire business process reengineering (BPR) initiative (Jones 1994). Surprisingly, few studies have focused on developing/testing theories of effective *redesign*, and thus practitioners have little theoretical guidance on conducting or managing the redesign of business processes. In our review of literature as well as interviews with practitioners, we discerned⁵ three underlying theories about the redesign process in any organization's BPR initiative. These theories, which we call the technology-oriented, the socially-oriented, and the sociotechnical theories of business process design, are similar to, but broader interpretations of, the three causal agencies (technology imperative, organizational imperative, and emergent) discussed by Markus and Robey (1988). It is important to note that, in the larger research project on which we base this paper, the first author had derived and tested propositions on *business process redesign* as well as *redesigned business process implementation* discerned from *each of the three (competing) theories*: the technologically-oriented, the socially-oriented, and the sociotechnical theories. However, in this paper, we attempt the more modest substantive contribution of just testing propositions on *business process redesign* drawn from the *technologically-oriented theory*, which we believe has been the dominant theory in the BPR literature as well as in actual practice. We expand on the technology-oriented theory of business process redesign below.

An important aspect of the technology-oriented theory is that it views IT as necessary for the *creation of efficient business process configurations* (proposition P1, below). For example, Venkatraman (1991) suggests that managers must be able to visualize and choose from the different process designs that are made possible by the capabilities of IT. Along similar lines, Hammer and Champy (1993, pp. 84-85) forcefully argue for the need to redesign business processes using a technology-driven methodology:

To recognize the power inherent in modern information technology and to visualize its applications requires that companies use a form of thinking that business-people usually don't learn....Most executives and managers... are good at defining a problem... then seeking and evaluating different solutions to it. But applying information technology to business reengineering demands inductive thinking⁶—the ability to first recognize a powerful solution (IT) and then seek the problems it may solve.

To summarize, those authors espousing the technology-oriented perspective argue that process designers involved in redesign must, first, identify new technologies and, second, actively and creatively find problems to solve and opportunities to take advantage of their understanding of the capabilities of the new technologies identified. They advocate this approach as superior to the *traditional approach* of acquiring information technology (i.e., an approach that involves the design and implementation of IT based on *pre-determined* organizational requirements) since the traditional "problems or requirements driven redesign" initiative is constrained by the state of affairs in the organization prior to reengineering (Hammer and Stanton 1995).

⁵We purposely say that we "discerned" the theories, because the literature has rarely stated them in the form of formal propositions, particularly in those portions of the BPR literature from the "popular" press.

⁶Hammer and Champy use the term "inductive thinking" in a way that is different from the use of the term in the academic community, where the meaning would be generalization from the observation of specific cases.

Within the technology-oriented theory of redesign, there is also a view that *IT is the central object of redesign in the redesign process*—i.e., an effective (re)design of the IT is taken to be a sufficient condition for effective redesign of business processes (proposition P2 below). The following accurately captures this idea (Lucas and Baroudi 1994, pp. 18-22):

Traditional organizations are using technology to make changes in structure without making major modifications to the entire organizations....The traditional organization may call its redesign efforts “reengineering”.... We believe that the design of information technology is the design of organizations. [Emphasis added]

The technology-oriented theory (or, at least in the instance of the immediately preceding quotation, this *technocentric* theory) also views *computerized BPR tools as having a positive moderating effect on the development of effective business process redesigns* (proposition P3, below). For example, Davenport (1993, p. 216) points out three “paramount” dangers associated with the failure to pursue opportunities provided by advanced technological tools. Consistent with this point of view, Carr and Johansson (1995) explain and illustrate the importance of using such tools and propose the following “prospective best practice” for BPR initiatives: “Take advantage of modeling and simulation tools” (p. 150). Claims by vendors and consultants in the trade literature also reinforce this perspective.

To summarize, the literature sees computerized BPR tools as having an important *moderating* (rather than *direct*) influence on the redesign effectiveness. This moderating role is reflected in the fact that the use of computerized tools is not portrayed as a necessary or sufficient condition for redesign effectiveness but as a condition that *enhances the redesign speed or the chances of success* of the initiative (Davenport 1993, p. 216).

The above discussion leads us to the following propositions:

- P1:** Effective business process redesign can occur only if the redesigning is IT-driven.
- P2:** Effective business process redesign must occur if effective design of the enabling IT occurs.
- P3:** Where the necessary conditions for effective business process redesign are satisfied, and effective redesign occurs to some extent, the use of computerized tools for facilitating such redesign will have a positive moderating effect on the redesign’s effectiveness.

4. CASE RESEARCH AS A POSITIVIST METHODOLOGY

A case study is “an empirical inquiry that: investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used” (Yin 1984, p. 23). The importance of case studies within the IS and organizational studies disciplines has been well recognized. Case researchers and methodologists have articulated both *positivist* and *interpretivist* approaches to case-research (Lee 1989; Leonard-Barton 1990; Numigami 1998; Paré and Elam 1997; Walsham 1995; Yin 1989). Neither approach is inherently superior to the other, and each is appropriate simply depending on research objectives (Lee 1991). We take the positivist approach in our study, and we group positivist methodological guidelines and criteria for ensuring rigor into two categories:

1. Guidelines for ensuring rigor of the research process

Yin (1989), Lee (1989), and Miles and Huberman (1994) recommend a number of procedures that must be followed *during* the research. Our underlying premise is that by following the recommended procedures, the study will satisfy the following positivist criteria for rigor:

- construct validity
- internal validity
- external validity
- reliability

2. Criteria for evaluating rigor after the case study has been conducted

Lee (1989, 1991) provides the following post-hoc evaluation criteria (based on Popper's ideas of falsifiability, logical consistency, relative explanatory power and survival):

- Does the case study consider any predictions through which the theory of interest could be falsified?
- Are the predictions within each theoretical perspective consistent with each other?
- Does the case study confirm a theory through empirical testing?
- Does the case study rule out rival theories?

Finally, based on Campbell's extension of the concept of "degrees of freedom," Lee (1989) offers three additional criteria that can evaluate the *analytical rigor of a case study*:

- Number of predictions tested
- Number of cases or sites observed
- Number of rival theories tested

We will supply details regarding these criteria when we apply them in section 6.

It is worth noting that most authors of positivist studies write in the third person or the passive voice, but we boldly use the first-person voice in this study in order to call attention to our belief that even a positivist scientific theory cannot exist independently of knowing subjects and, instead, must be part of an on-going social activity. By writing in the first person, we also intend to emphasize that our voice is distinct from the voices of the people whom we interviewed, and that the interview quotations that we are choosing to present therefore necessarily also reflect our own interests as IS researchers, not just the interests of the interviewees themselves. At the same time, by intentionally and extensively exposing our reasoning and evidence, we intend to be enabling our fellow researchers to assess our voice and to conduct subsequent studies to replicate, challenge, or otherwise build upon our study in a cumulative scientific fashion. For instance, another researcher could perform another positivist study, but at a different organizational site, and then present evidence (including interview data) consistent with or contradictory to ours, or another researcher could use our findings of refuted positivist hypotheses as the basis on which to motivate a subsequent interpretive study in the manner explained by Lee (1991). Of course, because we are taking a positivist approach, we will be applying positivist criteria for assessing the validity of our work.

5. TESTING PROPOSITIONS IN THE CONTEXT OF MANCO'S BPR INITIATIVE

5.1 Case Study Description

In Table 1, we summarize important characteristics of MANCO (a prominent US-based corporation in the air-purification industry) and its reengineering initiative. We will supply additional narrative when we present the evidence to test the three propositions posed earlier.

5.2 Criteria for Evaluating Redesign Effectiveness

Evaluation of redesign effectiveness is a complex activity much like the evaluation of IS implementation success, and no universally accepted criteria exist for such evaluations. While several criteria for evaluations have been proposed, we believe, drawing on Lyytinen and Hirschheim's notion of "expectation failure" (1987, p. 264), that *redesign effectiveness can holistically be assessed only by understanding the shared values and evaluations of the various stakeholders of the initiative*. Thus, for the purpose of this study, redesign is considered effective *if different stakeholders state or indicate through actions that such was the case*.

Table 1. MANCO Case Summary

ORGANIZATION CHARACTERISTICS	
Age as of 1996	30 years approximately
Industry	Air purification equipment
Size (before engineering)	250 approximately
Culture (before reengineering)	Fragmented, inter-functional hostility, politically charged, task-oriented, narrow compartmentalized thinking, sluggish action
Size/Revenue (after reengineering)	Same headcount; revenue increased considerably
Culture (after reengineering)	Agile, cheerful, cross-functional cooperation
REENGINEERING	
The “definition-in-use” of reengineering	“Organizational reform” for excellence <i>using common-sense and IT</i>
Reason for reengineering	To avoid “extended mediocrity”
Goals of the initiative	To excel and take advantage of market opportunities
Nature of the reengineering process	Radical, structural reorganization, followed by IT-enabled process change, followed by incremental adjustments of the social organization and technology
Definition of success	Cross-functional integration, creation of useable information for effective management
Whether stakeholders considered the reengineering initiative successful	Yes
PROCESS REDESIGN	
Nature of the redesign process	Autocratic changes in the structure, followed by participative, iterative redesign
Nature of the vision (redesign)	<i>Organizational agility</i> was the broad vision articulated by the top management; vision for specific processes evolved through interactions of different social/functional options with different technical options. The redesigned processes were not formally represented on paper, but shared in the minds of the team and close associates.
Primary role of top management in the redesign	Created structural and cultural context for effective cross-functional processes; complete support provided to reengineering team throughout
Role of the redesign team	To discover the organization and redesign suitable for the company. Also responsible for implementation.
Role of IT envisaged	Providing a set of tools, accelerated information sharing, detailed management information
Role of IT tools	Limited; use of tools discontinued during redesign
Whether redesign was seen by stakeholders as effective	Yes, although one department saw one aspect of the vision as unrealistic
IMPLEMENTATION	
Nature of the implementation process	Extremely planned; three pilots
Nature of communication	Superficial (sometimes misleading) formal communication
Nature of IT implementation management	Very systematic
Nature of preexisting IT infrastructure	Poor
Role of top management	Complete support; senior VP had hands-on involvement
Main problems faced in implementation	Moving to a more sophisticated IT infrastructure
Morale during implementation	High overall
Degree to which the “redesign” was implemented	Fairly large
Whether the implementation was seen as successful by stakeholders	Yes

5.3 The Evaluation

The *first phase* of the reengineering initiative at MANCO involved the recognition of territorial walls in the organization, and the dismantling of them by implementing envisioned changes in the organizational structure, the reward systems, and the organizational culture. The CEO realized through experience that the primary cause for territorial walls and their dysfunctional impact on business processes was that the vice presidents (VPs) had been involved in turf-battles among each other. He decided not only to replace three VPs responsible for institutionalizing the inter-functional feuds but also to institute changes in organizational structure that would prevent the resurgence of territorial sentiments among employees at any level. In addition, he promoted one of the (surviving) VPs to the position of Senior VP of Operations and put him in-charge of the core cross-functional business process of the company: order-processing. Soon after his appointment, the Senior VP initiated: (1) the redesign of the factory which involved (among other changes) “taking out” a layer of foremen; (2) a quality assurance program; and (3) profit-sharing and other incentives for encouraging honest communication, cooperation, and trust across functions. The success of this phase of redesign and implementation⁷ was attested by stakeholders at different levels in the organization. For example, the *plant manager* explained:

Even though the process is the same...the culture and value systems changed remarkably. We started focusing on global goals, that being serving the customer.

A person, whose job title was *Production facilitator*, felt that the reorganization provided a strong foundation for the IT-enabled change phase of the initiative:

It is very important that before you undertake a project on the information systems side that you have good working relationship between heads of all the departments...which we now have...and have not had in the past.

The *Senior Vice President* was also visibly pleased with the results of the structural and cultural changes, and said the following during an interview:

In the fiscal year that just ended... we said, let us ship the sales forecast and let us try to under-spend the operating budget, which we did, and we were able to have a record year.

The sense of teamwork and cooperation across functions was evident to all organization members. Informal communication channels across functional areas had opened up, and it was not uncommon to see the *Engineering manager* walking down to the Production Planning area for a “chat” with the *planners*, or the *Production Planning manager* visiting the *Purchasing agent* to informally negotiate the purchase delivery date.⁸ Territorialism had disappeared among the *shop-floor workers* as well, and the HR manager⁹ estimated that over 50% of the shop floor workers were positively affected by the recent changes.

The *second phase* of reengineering involved the redesign of internal business processes and the acquisition and implementation of IT that would enable the processes. Most stakeholders appeared to be excited about *the process as well as the product* of the redesign. For example, the *Exports coordinator* appeared very enthusiastic about the envisioned IT-enabled changes:

I can't express how excited I am about it because it will free me up to do more proactive things....I will have (information) at my finger-tips... it is going to allow me to focus in on really new exciting and challenging things that we have been planning for a while... and it is going to change my entire position for the positive.

⁷In this phase, redesign and implementation occurred simultaneously, and thus, the *redesign* could not be *separately* evaluated.

⁸Interviewees described these actions as unimaginable prior to the reorganization.

⁹The HR manager enjoyed close working relationships with many factory workers and was thus, in our view, in a realistic position to evaluate the impact of the changes on the workers.

The *Engineering manager* was of the opinion that:

The redesign was hugely successful in that it will greatly impact the way the engineering and the manufacturing side will work together... however, one problem is that the sales side is not willing to change their commission structure...which will result in some implementation difficulties.

The *Production Planning manager* also attested the effectiveness of the redesign:

I believe that the redesign was effective because we got a detailed understanding of the organization...and determined what to do...in order to make it more efficient...and to have the different departments to work together without conflict.

Based on the views of these and other stakeholders, we conclude that the redesign of business processes was **effective**.

5.4 Testing the Propositions

P1: *Effective business process redesign can occur only if the redesigning is IT-driven.*

The redesign process at MANCO started with different departments proposing functional requirements and other changes that were necessary to make their business processes more effective. Most of the change requests *did not originate from MANCO employees' awareness of capabilities of new information technologies* but instead from their effort of addressing difficulties that they were experiencing in their own work.

Based on these change requests and outcomes of several meetings of the business process redesign team, a requirements list for the process-enabling IT was created, and some IT vendors were invited to present software products that could satisfy MANCO's requirements. One of the reengineering team members described how the IT requirements and, consequently, the vision of the new business processes evolved:

It was a series of meetings.... We met... weekly and you just began to interact... and Judith (the MIS Manager)... controlled how the meetings were to go... and that helped you define everything... and when companies (the IT vendors) came in to give their presentation, that is when you started getting into the nuts and bolts of it.... So it is a process... it is something that you just don't go in and (say)... OK, I am going to want this, this, this... you had to think about what was needed [regarding the business processes], and you brainstormed, then.. you talked about what is definitely needed. You went back to your bosses... ask them what they were looking for... you would brainstorm with that and then go back to the meetings.

As the team learned about different features available in different ITs, the redesign team-members modified their view of how any particular business process should function. With this modified vision, they then sought other features in the systems that they had not thought of previously. MANCO's redesigners utilized their evolving understanding of the capabilities and limitations of different IT *along with*, not prior to, their understanding of their business process designs. Iterative thinking informed by technological and functional/social issues is also evident, although initially, the redesigners appeared to have a tendency to make IT fit their current business processes.

We showed, in section 5.3, that MANCO's redesign was effective. Based on the evidence in this section, it is also clear that the redesign process *was not IT-driven*. Instead, the redesign started as *problem-requirements (or function) driven*, and eventually involved the recursive interaction of technological and functional images in the redesigners' minds consistent with the *sociotechnical theory of redesign* (Davenport and Short 1992; Markus and Robey 1995; Mumford 1995). This evidence allows us to reject **P1**.

P2: *Effective process redesign must occur if effective design of the enabling IT occurs.*

The redesign started with the functional requirements that MANCO employees from different departments brought to the redesigners' attention. The redesign team then attempted, in an iterative fashion, to identify the IT that would fit the evolving redesign. At no point did the redesign team members focus on designing the *enabling IT itself*. This evidence by itself, however, is insufficient to falsify the proposition (since the "effective design of the enabling IT" is a sufficient, but not necessary, condition). On the other hand, we also examined historical evidence, which pertained to MANCO's order-processing, and we observed that MANCO had, in the two preceding years, *unsuccessfully attempted* to streamline/reengineer order-processing using a software that had already been *successfully customized* in-house to suit MANCO's needs.¹⁰ Reflecting on the "failed project," the *Production facilitator* stated:

It all goes back to trust and honesty and truthful communications...if you don't have this foundation, whatever system you have will not work.

To summarize, historical observations of MANCO indicate that effective design and implementation of IT alone did not automatically result in effectiveness of redesign of a business process. This evidence allows us to reject **P2**.

P3: *Where the necessary conditions for effective business process redesign are satisfied, and effective redesign occurs to some extent, the use of computerized tools for facilitating such redesign will have a positive moderating effect on the redesign's effectiveness.*

The MIS manager at MANCO had acquired a computer-aided flowcharting tool specifically for use during the reengineering initiative, and this tool was used in the early stages of the IT-enabled process redesign phase. However, the use of this tool ceased soon after the reengineering team started meeting to envision how (IT-enabled) MANCO business processes should work. The business process redesign at MANCO was accomplished through an iterative process lasting several months in which the redesign team brainstormed, discussed, and agreed upon different aspects of the future processes and organization around them. Since the use of flowcharting tools had already ceased, the evolving redesign primarily existed in the minds of the redesigners in the form of a shared body of unwritten knowledge that each one of them objectively experienced. On some occasions, especially for clarification purposes, flowcharts were spontaneously hand-drawn in redesign sessions, but *at no point was there any conscious attempt to create computer-drawn process diagrams representing the team's then current view of any business process, even though MANCO had flow-charting software readily available*. Toward the end of the redesign effort, the first author had asked the MIS manager why the process redesigns were not being represented/ documented using the flowcharting package. She said the following:

I had tried to do that...it just worked out to be an exercise for me...basically. If you look in my book that I put together before the project started, I had...two chapters... "business as it is" and "business as it will be," and the "will be" is still blank. The vision that we have right now is kind of a high level and it hasn't really come to fruition yet....we will write (draw) it after we do it.

Overall, she was convinced that the use of computerized flowcharting tools would not contribute to a more effective redesign, especially in light of the iterative approach to process redesign that the reengineering team had adopted. According to the MIS manager, one advantage of this approach was that the design remained very flexible, and could be continuously challenged and modified by the team members, who thought of different concerns, as they learned more about the envisioned process and process-enabling software options. When asked if she would use the computerized tools in a larger company, the *MIS manager* indicated that she probably would, though not because such tools would *inherently* enhance the effectiveness of the process redesigns, but because they could help generate the "professional documents" and contribute to the legitimacy of the redesigners in larger organizations:

¹⁰Multiple stakeholders of the "failed project" indicated that there was nothing wrong with the software implemented in the project.

In a larger company you have to justify things a lot more....And you have to get sign-offs and go through the levels of approval and all this stuff...but here, it's not like that.

Of the members of the redesign team interviewed, all indicated that using computerized tools would not have enhanced redesign effectiveness, although the *Production facilitator* made the following observation:

It would have provided us with some guidance...initially. Now whether we would have...followed them is another question.

Our observation during the redesign sessions also supported the team-members' shared view that the absence of computerized graphical tools helped the team operate flexibly without getting bogged down on details and diagramming conventions.¹¹

Based on the evidence in this section, **we reject P3.**

6. A DISCUSSION ON THE RIGOR OF THE STUDY

In this section, we discuss how our case study satisfies the requirements of positivist case-study method set forth by methodologists such as Lee (1989) and Yin (1989).

6.1 Rigor of the Research Process

6.1.1 Construct Validity

Yin (1989) suggests three tactics to improve construct validity:

(a) *Using multiple sources of evidence:* According to Yin (1989), the use of multiple data sources can contribute to a high degree of construct validity, since "multiple sources of evidence essentially provide multiple measures of the same phenomenon."

Specifically, for the MANCO case study, we interviewed 17 key stakeholders of the reengineering initiative (Table 2), attended several meetings such as redesign sessions, "conference-room pilot meetings" and "Monday-morning meetings," and informally interacted with several stakeholders. In addition, the MIS manager gave us access to several documents, which related to (1) the company background and its products; (2) the current reengineering project; and (3) a smaller version of the current project undertaken approximately two years ago.

(b) *Having key informants review the case study report:* Yin (1984, p. 139) discusses such a review:

the corrections made through this process will enhance the accuracy of the case study, hence increasing the construct validity of the study....In addition, where no objective truth may exist...the procedure should help to identify the various perspectives, which can then be represented in the case study report.

Two individuals—the MIS manager and an academic consultant, both of whom had an overall understanding of the project—agreed to review the entire case study draft. The MIS manager wrote the following memo (dated 9/18/97) to the first author of this study after carefully examining the case study:

I think this is excellent. You have captured the overall spirit of what has happened here over the last several years. The changes I've indicated are mostly to "disguise" some of the players' names.

¹¹In fact, absence of computerized tools appeared to help the team concentrate on a *uniform interpretation* rather than *uniform representation* of the redesign.

Table 2. Interview Statistics

Interviewee	Number of Formal Interviews	Number of Informal Interviews (including telephone interviews/conversations)
1. CEO	1	0
2. Senior Vice President	1	2
3. Plant Manager	2	Few
4. MIS Manager	3	Several
5. Systems Analyst	2	Few
6. Quality Assurance Manager	2	0
7. Production Planning Manager	5	Several
8. HR Manager	1	0
9. Purchasing Agent	2	2
10. Engineering Manager	2	Few
11. Accountant	1	0
12. Manufacturing Engineer	Requested, didn't materialize	1
13. Productivity Facilitator	3	Several
14. Consultant (Vendor)	1	2
15. Consultant (Academic)	0	Several
16. Sales Administrator	1	1
17. Exports Coordinator	1	1

The consultant similarly indicated to us that the case-study was an in-depth and accurate portrayal of the MANCO situation. In addition, throughout the research process, facts presented in the case were corroborated through other forms of “member checking” (Erlandson et al. 1993; Trauth 1997) using tactics such as (1) verifying interpretations and data gathered in earlier interviews in course of the interviews and (2) furnishing copies of various *sections* of the report to various stakeholders and requesting written/oral commentaries.

(c) Maintaining a Chain of Evidence

In order to ensure construct validity and reliability, Yin (1989) recommends that a case study be constructed such that a reader or external observer would be able to trace from conclusions back to the initial research questions or from questions to the conclusions. This concern was addressed by creating a *detailed processual narrative of the case study*,¹² as proposed by Paré and Elam (1997), prior to testing the propositions.

¹²The narrative is available as an unpublished document.

6.1.2 Internal Validity

Only with internal validity may “we infer that a relationship between two variables is causal or that the absence of a relationship implies the absence of cause” (Cook and Campbell 1979, p. 37). According to Yin (1984), *pattern matching* may be used to enhance the internal validity. This technique essentially involves *qualitative but logical deduction* (Lee 1989) wherein an *empirically based* pattern is logically compared against a *predicted pattern derived from rival theoretical perspectives* (technologically-oriented, socially-oriented, and sociotechnical¹³), using Markus (1983) as an exemplar. The theoretical perspectives were sufficiently distinct such that there was little overlap among the “independent variables” in the rival propositions, as required by Yin (1984, p. 105). Finally, in accordance with Lee’s guidelines (1989), the MANCO case study also involved the use of natural controls, although to a limited extent.

6.1.3 External Validity

This type of validity pertains to the *generalizability* of the findings (Light, Singer and Willett 1990). Case studies are commonly misunderstood for a supposed lack of external validity resulting from not satisfying well-accepted “sampling logic.” However, there exists the accepted rationale for the legitimate use of one critical case to test well-formulated theory. Often, a critical case can effectively confirm, challenge or extend a well-articulated theory. As Lee (1989) and Yin (1989) have argued, the use of one case is similar to the use of one experiment, in that one instance of both methods is sufficient to reject or disprove propositions, but several instances of both are required to conclusively prove the correctness of a theory. For this purpose, Yin (1989) suggests the use *theoretical replication logic* rather than *the literal replication logic*.

6.1.4 Reliability

The underlying concern of reliability is “whether the process of study is consistent, reasonably stable over time and across researchers and methods” (Miles and Huberman 1994, p. 278). Yin suggests two tactics to ensure reliability of the study: creation of the case study protocol and development of a case study database.

Case study protocol: This protocol guides the investigator in conducting case study research in a standardized manner. The protocol for the study, created in accordance with Yin’s guidelines (1989), consisted of following documents

1. A one-page pre-proposal outlining the objective of the study and the type of access to data required for completion of the study.
2. A broad description of the envisioned research report with chapter by chapter summaries of the proposed contents.
3. An 80 page proposal consisting of the research question, literature review, derivation of competing theoretical propositions, description of the epistemology and methodology to be adopted, a brief description of case study sites, and a list of relevant readings.
4. An evolving set of questionnaires used to guide interviews.

Development of case study database: Yin recommends that the case study database have the following four components:

1. *Case study notes* primarily consisted of hand-written notes on the margins of the interview transcripts or on the questionnaires used for interviewing. These notes highlighted important points that were relevant to the propositions being tested, and, occasionally, provided cross-references to other interviews referring to the same issues.

¹³As mentioned earlier in section 3, in *this* paper, we focus on the *technology-oriented perspective* alone. It may be argued that internal validity in the larger study implies internal validity of the portion of the study reported in this paper.

2. *Case study documents* included the interview questionnaires, interview transcripts, company background information and project-related documents.
3. *Tabular material* included a profile of MANCO's products, summary of all propositions to be tested and the results of the proposition testing.
4. The central component of the case study database was, however, *the case study narrative*, that attempted to synthesize information from all different sources and presented the sequence of events that occurred in the organization with some coherence.

The narrative served as the main data input for the deductive testing, supplemented by some additional quotations from the transcripts.

6.2 Post-hoc Evaluation

Our study also satisfied post-hoc criteria of rigor (discussed in section 5). Our case study considered predictions that could be (and actually were) falsified. We found none of the predictions within the technology-oriented perspective to be inconsistent with each other. The case study was also able to rule out the "theory of interest" (the technology-oriented theory of redesign) and found evidence in favor of the sociotechnical theory of redesign.¹⁴ Finally, a comparison of the degrees of freedom of our study¹⁵ and of the case studies by prominent researchers in the field indicates an acceptable degree of analytical rigor (Table 3 adapted from Lee 1989).

Table 3. A Comparison of Degrees of Freedom

Case Study Authors	Number of Predictions	Number of Organizational Settings	Number of Rival Theories (in addition to the theory of interest)
Markus (1983)	Several	1	1
Kraemer et al. (1987)	30	2	0
Kling and Iacono (1984)	Several	1	3
Laudon (1974)	4	4	0
Kling (1978)	Several	1	1
Kling and Scacchi (1982)	5	2	1
Leonard-Barton (1987)	Several	1	0
Fulk and Dutton (1984)	0	1	0
THIS STUDY	3	One setting examined in this study; one additional setting examined in the larger research project	No rival theories tested in this study; two rival theories tested in the larger research project

¹⁴This aspect of the study was not specifically discussed in this paper.

¹⁵This paper discusses a part of a larger study involving three rival theories, two organizational cases, and several (more than 12) predictions.

7. CONCLUSION

The major ramification of our case study for IS researchers is that the “technology-oriented theory of business process redesign” is wrong. The propositions of this theory are logical (i.e., consistent with one another), but not empirical (i.e., they do not portray the “real world”). For researchers and practitioners wary of the functionalist and instrumental nature of some BPR philosophies, our case study serves the purpose of providing concrete evidence that confirms their suspicions and exposes the invalidity of a technocentric (or, at least, overly technological) orientation to BPR. Indeed, our case study is useful for invoking the following parallel: just as IS researchers interested in information systems development (ISD) have long been moving away from just a functionalist and instrumental view (cf. Hirschheim and Klein 1989), IS researchers interested in BPR should consider doing the same. Specifically, future research on BPR might look to the past and current research on ISD for suggesting analogies of how to proceed.

Along the same lines, the major ramification for practitioners, including consultants and senior management, is that it could turn out that BPR, just as ISD, can be more successful in the situation where interactions between the social and technological dimensions are anticipated, than the situation where the technological dimension receives the bulk of attention and the social dimension is considered secondarily and separately, if at all.

Indeed, for critical researchers and skeptical practitioners, the overarching lesson of our case study could be that BPR is but the latest arena in which researchers and practitioners are re-learning old lessons by repeating past mistakes. For newly emerging arenas, such as “electronic commerce” and “virtual organizations,” this means that it would be prudent for researchers and practitioners to adopt, *from the beginning*, an orientation that is not technocentric or overly technological, but instead gives equal consideration to social dimensions and the interactions between the social and the technological.

Our single case study is analogous to a single experiment. And as for any scientific experiment, we believe that follow up studies (case studies, surveys, ethnographies, action research, and so forth) are in order, whether to replicate, challenge, or otherwise build on our case study. Studies that test socially oriented and sociotechnically oriented theories of BPR are required.¹⁶ Positivist case studies, as our intensive examination of MANCO illustrates, are a viable method for contributing to this research stream, and we believe that the evaluative “walkthrough” provided in this paper could serve as a valuable guide for future researchers interested in testing theories using this method.

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¹⁶The first author has already tested these two other theories and will be reporting the results in future studies. He found that the sociotechnical theory of business process redesign, emphasizing the interaction of the social/functional and the technical design options, offers better explanation and guidance regarding redesign than the technologically oriented theory.

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