

Preface

ACHIEVING COMPETITIVE ADVANTAGES IN A DIGITAL WORLD: VIRTUAL ORGANIZATIONS AND DISTRIBUTED PROCESS IMPROVEMENT THROUGH E-COLLABORATION TECHNOLOGIES

Abstract

Can organization processes be improved quickly enough to cope with competition and the drive for change facing virtual organizations today? Will a high degree of virtuality hinder organizations from rapidly adapting to their environment? These questions are examined in this preface chapter, based on a field study of thirty-eight process improvement groups in three organizations: an advertising company based in Brazil, a semi-autonomous branch of the New Zealand Government, and a tertiary education establishment in New Zealand. The findings suggest that organizations where a large amount of communication is carried out through computer networks, and hence where a high degree of virtuality is present, can derive attractive benefits from computer-supported group PI efforts. This is true particularly in incremental process improvement groups.

Introduction

We are living in a historical moment, which from a business perspective can be characterized by a few major global trends. There has been a rapid spread of capitalism around the world, particularly since the end of the Cold War in 1990, which has been accompanied by a sharp increase in the amount of competition facing global businesses. There have also been many advances in computer technologies in the same period, especially those aimed at computer networking through the Internet in organizations. Many organizations today exist where networks of collaborating experts design, produce, market, sell, and deliver a variety of goods and services. In such environment, most organizations, irrespective of industry or sector of the economy, will increasingly have to face two types of external pressures: the pressure to produce and deliver better quality and cheaper products (and/or services) than their industry competitors, and the pressure to adapt to a fast pace of technological change.

A number of organizational development approaches, including total quality management (TQM) and business process re-engineering (BPR), have taught us that one of the best ways to cope with these pressures is to look into organizational processes (i.e., sequences of interrelated activities) and to improve them in incremental and radical ways. Although there are presently already a large number of organizations structured around computer networks in a decentralized and geographically disperse

fashion, most of the literature describing successful TQM and BPR projects make little, if any, reference to the possibility of conducting process improvement in a distributed and computer-mediated fashion.

The more recent normative literature on BPR proposes computer technology as an *enabler* of radical process improvement by showing how computer systems can be used to *implement* radically redesigned processes. This literature seldom discusses how computer systems can be used to support the work of *those who redesign processes*. Given this gap in the literature, it is important to ask why should anyone worry about doing process improvement in a computer-mediated way? In my view, there are at least two main reasons. The first is the accelerated diffusion of computer networks, which is dramatically changing the way teams communicate in organizations. The second reason is the increasing globalization of specialized knowledge.

Since the mid-1980s there has been an accelerated increase in the use of computer networks to provide communication links within (through LANs and, more recently, “intranets”) and between organizations (through WANs and, more recently, the Internet and interorganizational computer systems) all over the world. On top of this worldwide diffusion of computer networks, there has been an accelerated increase in the number of knowledge specializations and their globalization. Today it is easy to find people with similar degrees of expertise in specific fields, such as “expert systems design” and “mutual fund management”, living in places as far apart as Australia, Japan, US, New Zealand, or Paraguay. The diffusion of computer networks and the globalization of specialized knowledge have made it possible for a number of organizations to become independent of geographical constraints. This had, in turn, led a number of organizations to structure themselves around communication networks, and move towards organizational paradigms that place emphasis on flexibility, knowledge accumulation and deployment, and distributed teamwork. One such paradigm is that of the “virtual organization” (Davidow and Malone, 1992; Kock, 2008; Mowshowitz, 1997).

The concept of virtual organizations has become one of the hottest management topics of the 1990s, particularly given the possibilities afforded by local and wide area networks of computers. Advantages of moving from physically aggregated organizational units towards electronically linked ones have been highly publicized. Facilities rental and maintenance costs can be considerably reduced or eliminated. Employees can work from their own homes or from distributed offices near their houses. Company offices can spread over large geographical areas, reaching a larger number of customers than physically aggregated offices would. And, operations data can still be monitored in a centralized manner. Outsourcing of various organizations processes can be easily implemented, within or outside an organization’s own based country, allowing organizations to focus on their core competencies. Clients can purchase goods, services, and information irrespective of where they are in the world, without the need to travel long distances.

Given the large business proliferation of computer networks, one can quite reasonably assume that the amount of distributed (as opposed to co-located) work in organizations is likely to strongly correlate with the amount of distributed computer-mediated communication in organizations, which can in turn be used as a simple measure of “how virtual” an organization is. That is, the higher the proportion of distributed computer-mediated communication within the organization, and between its members and the outside, the higher is likely to be the *degree of virtuality* of the organization. In this sense, most organizations today where computers are used in a non stand-alone way can be said as having at least a certain degree of virtuality. This includes the vast majority of organizations, including small businesses.

Therefore the questions: Can processes be improved quickly enough to cope with competition and the drive for change facing virtual organizations today? Will a high degree of virtuality hinder organi-

zations from rapidly adapting to their environment? Or will it perhaps be even easier for organizations to improve their processes in a distributed, computer-mediated fashion? These issues are examined in this preface chapter, based on a field study of thirty-eight process improvement groups in three organizations. Twenty-six groups were conducted in an advertising company based in Brazil; six groups in a semi-autonomous branch of the New Zealand Government; and six groups in a tertiary education establishment in New Zealand. Groups lasted from less than a week to several months each. While some of the groups interacted only face-to-face, the majority interacted mostly through an e-mail conferencing system. Some of the groups radically redesigned organizational processes; others generated modest and incremental process improvements. Given such group communication media heterogeneity I believe I can draw some interesting conclusions from the comparison of different groups and provide at least partial answers to these questions.

Process Improvement Groups

Process-based improvement has been the basis on which approaches such as TQM and BPR have been developed. These approaches assume that process-related change, whether it is incremental or radical, can lead to increases in organizational efficiency and effectiveness. An analysis of these approaches strongly suggests that their primary change instrument is what I shall refer to here as the process improvement (PI) group.

Most PI groups share some characteristics, whether they search for incremental or radical change. Among these are three that I see as particularly relevant for our discussion: (a) PI groups are typically small, having usually from three to twenty members; (b) PI groups generally have well-defined group stages; (c) PI groups almost invariably have defined roles that are played by certain group members. Two typical instances of PI groups that illustrate these common characteristics are *quality circles*, widely used in TQM in Japan (Hutchins, 1985; Kock, 2006; Robson, 1988), and *BPR groups* (Hammer and Stanton, 1995; Kock, 2006).

Quality circles were originally developed in the early 1960s in Japan, as small groups of workers from the same area who, using statistical control methods, identified and developed solutions for problems affecting the quality of manufactured products. These early versions of quality circles were used as a basis for the development of several similar group-based organizational change approaches that have underpinned the total quality management (TQM) movement in the 1980s (Deming, 1986).

BPR groups, differently from quality circles, usually involve line staff and managers from different areas of the organization, and use non-statistical process modeling tools. Moreover, BPR groups are usually temporary. BPR groups may, for example, be dissolved as soon as one or more processes are redesigned. Quality circles, on the other hand, have a longer lifetime and are usually composed of workers from the same organizational area. Quality circles meet typically once a week over several months or years. Finally, while BPR groups search for radical process improvement, the degree of improvement sought by quality circles is usually incremental (Davenport, 1993; Kock, 2006).

Stages of a PI Group

Most PI efforts encompass a messy and complex array of interactions involving PI group members and others outside the group. Nevertheless, an analysis of published PI projects suggests a common high-level structure in these projects. This structure can be described in terms of steps, which in turn can be

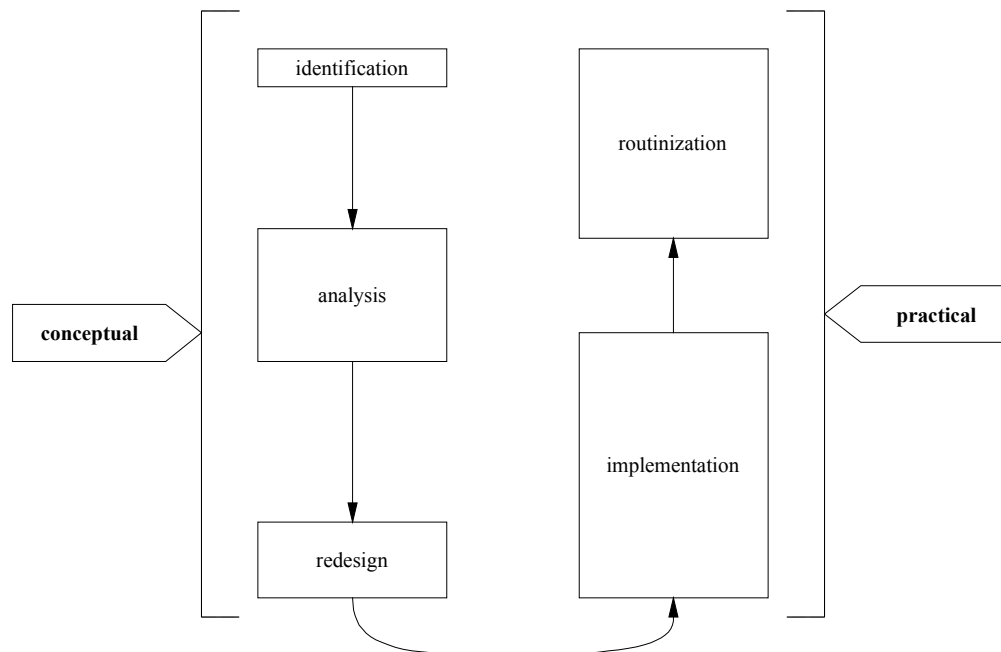
grouped into stages. PI efforts are typically composed of five main steps. These five steps can be split into two main stages: (1) The *conceptual* stage; and (2) The *practical* stage.

In the conceptual stage, a process will be *conceptually* redesigned. This stage comprises three main steps: (i) Identification, where an opportunity of improvement is identified and a process (or more than one process) is selected for redesign; (ii) Analysis, where the selected process is modeled and analyzed; and (iii) Redesign, where process changes are proposed.

In the practical stage the conceptual redesign generated in the previous stage will be implemented, and subsequently undergo incremental changes until it is incorporated into the organization's routine operations. This stage comprises two main steps: (i) Implementation, where redesign proposals generated in the conceptual stage are put into practice; and (ii) Routinization, where the process changes implemented in the previous step are consolidated as routine operations of the organization and undergo incremental optimizations. The practical stage is typically much longer than the conceptual stage, particularly when processes are *radically* redesigned (see Gallivan et al., 1994; and Kock, 2006 for illustrations of this point).

Figure 1 shows the two main stages and related steps of a generic PI effort; the vertical dimension of the rectangles provides a general idea of the relative duration of the steps (but is necessarily out-of-scale since the practical stage is much longer than the conceptual stage). I was particularly concerned with the conceptual stage of PI efforts in this study. Therefore, I collected research data about the formation of PI groups, the group identification of processes to be redesigned, the analysis of those processes, and the generation of redesign proposals by the groups. A comparatively small amount of research data was obtained regarding the implementation and routinization of process redesign proposals.

Figure 1. Stages of a generic PI effort



Most of the groups studied voluntarily communicated predominantly through a simple asynchronous computer conferencing system initially developed by me using XPost (Trademark by Lantec Corp.) and later Novell Groupwise (Trademark by Novell Corp.). This system allowed PI group members to post electronic messages to a mailbox that automatically replicated the messages to the other members of the PI group (as in simple e-mail distribution lists). The system also allowed for one-to-one message exchanges between staff within and outside the group. A variety of computer files, including graphs and spreadsheets, could easily be attached to electronic messages and read by group members. The conferencing system also allowed public access to previous PI group discussion archives.

As a side note, it is interesting that, even though there is a wide range of electronic communication and collaboration technologies available, one of the most widely used is still e-mail. This is particularly true in work-related contexts. For social online interaction, a few other tools are arguably equally or more widely used. Examples are tools that enable blogging and microblogging (e.g., Twitter), audio- and video-conferencing tools, video-sharing tools (e.g., YouTube), instant-messaging technologies, and social networking sites. These are frequently referred to as Web 2.0 tools. Still, e-mail is an important component of social online interaction as well. Instant-messaging users often use e-mail for asynchronous interaction, to complement the synchronous interaction enable by instant-messaging tools. Bloggers are constantly notified about new comments on their blogs via e-mail, which allows them to keep track of comments on various (old and new) blog posts. These are just a few examples of the importance that e-mail still carries in modern computer-mediated communication. (The term “computer-mediated” is used broadly here; mobile phones, for example, increasingly incorporated personal computer functionality.)

Returning to the study’s description, the conferencing system was made available to groups together with a printed guide (Kock, 1999, Appendix A; expanded to a book: Kock, 2006) with suggestions on how to conduct PI groups. The decision as to how much use should be made of both the system and the guide was completely left to the group members. I participated in all the PI groups, facilitating the use of the system. This allowed me access to members for direct observation, interviewing, and collection of discussion transcripts. I refrained as much as possible from influencing the content, volume of postings, and duration of different stages in the PI group discussions.

Most of the PI group members had participated in previous similar PI groups where meetings were exclusively face-to-face and whose membership was typically from one department only. This allowed me to draw conclusions based on the analysis of members’ perceptions of the impact that the conferencing system had on their groups in comparison with their previous face-to-face PI groups.

Distributed PI Groups: What Changes?

A number of technology effects have been observed in the PI groups facilitated. Three effects that appear to be particularly relevant for virtual organizations are a decentralization of incremental improvement initiatives, an increase in the possible number of PI groups per unit of time, and a reduction in group cost. These effects combine with an apparent neutral impact on the quality of PI group outcomes - i.e., the conceptual process redesigns - to form a picture that warrants a strong recommendation. The recommendation is that organizations should make extensive use of distributed group support technologies for PI projects in virtual organizations. These effects are individually discussed next.

Improvement is Decentralized

Increased use of computer-mediation tended to occur in PI groups concerned with incremental, as opposed to radical, process changes. This study also suggests a remarkably lower reliance of these PI groups on managers (particularly senior managers) to be effectively conducted. That is, incremental PI groups were able to achieve fairly satisfactory outcomes when led by members of comparatively low status relative to the other members in the group.

From the thirty-eight PI groups studied, three were strikingly radical in the process redesigns proposed and implemented, easily meeting two of the classic criteria proposed by Davenport and Stoddard (1994, p. 122) to unequivocally characterize BPR: (i) An orientation to *broad*, cross-functional processes; and (ii) The need for, and possibility of, *radical* change in process performance. These three groups were led by their company's CEO. The members of these three PI groups unanimously refused to conduct any part of their group discussions through the computer conferencing system. The main reason was the higher perceived risk associated with contributing electronic postings in comparison with making oral contributions. As a PI group member who was also a manager remarked:

The problem with [an electronic message] is that it is very easy to think of it as a form of conversation, and yet it is also a written record, and people can easily write something down in [an electronic message] that they later regret. In a verbal situation, an oral situation, people tend to be a bit more accepting of people saying something inappropriate, and if they say something inappropriate often the cues of everyone else will protect them.

When I analyzed more incremental PI groups (i.e., the majority of the computer-supported PI groups) and looked at the groups from a group leader seniority perspective, one interesting pattern started to emerge. The asynchronous and distributed nature of PI groups appeared to have led to a considerable reduction in the demand for group leadership seniority. This apparently led to a decentralization of PI initiatives in the three organizations studied. For example, in the organization studied in Brazil, no known face-to-face PI group had ever been led by junior staff when the CEO or one of the directors was a member of the group. With just a few exceptions, face-to-face PI groups had previously been led by managers, who typically were the highest status members of the group. After the conferencing system was made available, however, some PI groups led by junior staff also included the CEO and one of the company's directors as ordinary members.

In the New Zealand organizations, several staff members whose organizational statuses were comparatively much lower than other members of their PI groups were able to lead their groups. They led those groups through successful analyses and incremental redesigns of processes, which were later implemented. The implementations led to actual improvements in process productivity and outcome quality. Those group leaders were unanimous in their perception that distributed computer mediation had made it much easier for them to lead their groups.

An observed consequence of the decrease in the demand for leadership seniority caused by computer support was that PI initiatives became more decentralized. PI groups could now be quickly formed to eliminate process imperfections that were known to those involved in the execution of the processes, but about which their managers often had little knowledge. This effect was clear in all of the three organizations studied. In the two New Zealand organizations, previous face-to-face PI initiatives had almost invariably been initiated by managers, whereas several of the computer-mediated PI groups were initiated

by non-managers. It was interesting to note the surprise of some managers when serious interdepartmental process-related issues were brought up, discussed and pragmatically solved in computer-mediated PI groups, without these managers having to coach the group members into doing so.

At the organization in Brazil, the CEO and a number of senior managers reported great satisfaction with the outcome of computer-mediated PI groups in general. Again, in this organization several groups tackled process-related problems of which some managers were not fully aware. A few managers reported being impressed by the awareness of workers about the problems of the company and their willingness to find solutions, which became clear to them when they browsed through records of computer-supported PI group discussions. Most managers previously thought that this awareness was nonexistent because only a few employees used to speak out about those problems in face-to-face situations.

The computer-supported PI groups also demonstrated that there had previously been a lack of communication between managers and their subordinates. This often caused simple process-related problems to go initially unnoticed, later escalating to more serious problems. Those problems in many cases led to conflict among organizational members, but frequently without the real source of the problems being made explicit to those in conflict. PI groups were seen as having contributed to ease existing tensions between managers and line staff; tensions which were perceived by both managers and line staff as having been detrimental to cooperation in inter-level PI efforts.

More Groups can be Conducted Simultaneously

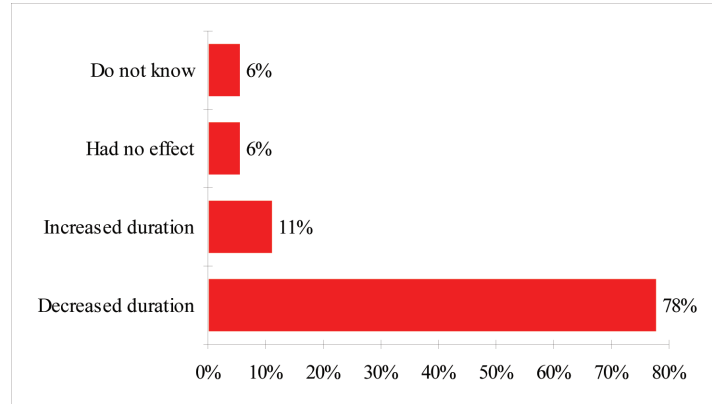
Initially, in the Brazilian organization, PI groups had to meet exclusively face-to-face for about three months while the local area network was being set up and the computer conferencing system installed. In the quarter immediately after the conferencing system was made available to the PI groups, the number of completed PI groups nearly doubled in comparison with the previous quarter (when PI groups were conducted only face-to-face), having gone up from eight (during the face-to-face period) to fifteen groups. While this increase in the number of groups per quarter may be assigned to a “novelty effect” in the Brazilian organization, the same cannot be said of the two New Zealand organizations.

I believe that the “novelty effect” of the technology used was minimal at both New Zealand organizations, because the conferencing system was seen by most participants in these organizations as an extension of e-mail, a tool that most group members used everyday in both companies. This conclusion emerged from the analysis of in-depth interviews, where nearly all of the respondents had referred to the conferencing system as “the e-mail system”. The majority of the respondents declared having been involved in departmental face-to-face PI groups before. These personal experiences were used as a basis for comparison when providing their perceptions.

In the branch of the New Zealand government, structured interviews indicated that approximately seventy-eight percent of the respondents thought that computer-supported PI groups had been completed in less time, measured in number of days, than face-to-face PI groups. This is illustrated in Figure 2, where the frequency distribution of responses indicates a statistically strong trend ($p < .001$) towards the perception that computer support leads to a reduction in group duration. And, a reduction in group duration clearly contributes to an increase the number of possible PI groups per unit of time.

The chi-squared test used to assess the strength of the perception trend compared the actual distribution of perceptions with the expected distribution of perceptions, where the expected distribution reflected the absence of an effect. That is, the test compared the actual distribution with a chance distribution. The number of degrees of freedom used ($df = 2$) was calculated as the number of possible answers, after

Figure 2. Distribution of perceptions about computer support impact on group duration ($N = 18$, $\chi^2 = 17.5$, $df = 2$, $p < .001$)



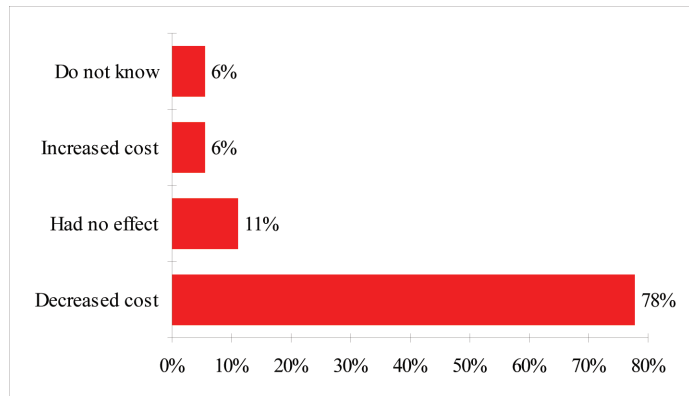
exclusion of the “Do not know” answer, minus 1. That is: $4 - 1 - 1 = 2$. The reason why answers in the “Do not know” category were not used in the chi-squared test is that they were expected to always be low. That is, only a small number of participants would give a “Do not know” answer, and that number was unlikely to be related to any possible effect of relevance for the analysis. Using “Do not know” answers would have artificially distorted the perception trend, and thus artificially increased the value of the chi-squared statistic, making it less credible. The same approach is used elsewhere in this preface chapter for perception trends strength analysis.

The main reason given by the respondents for the reduction in PI group duration in the New Zealand government organization was a reduction in group set up time (i.e., the time necessarily to bring group members physically together). This effect was seen as caused by the computer support to the group, particularly in groups involving employees from different sites (e.g., offices located in different cities, or dispersed campuses in the same metropolitan area).

In the tertiary education institution in New Zealand an even more interesting effect was observed regarding the possible number of PI groups per unit of time. This institution had established “official PI days” in which staff and faculty were expected to engage in PI group discussions full-time. Groups would analyze current processes and organizational policies, and then propose actions to improve the organization by changing those processes and policies. Although these PI group efforts were typically seen as very successful by most, their frequency was very low, usually twice in a year.

As soon as the conferencing system was made available to staff and faculty, five groups were conducted over less than a quarter (an effect similar to that observed in the Brazilian organization). Several PI group members pointed out in in-depth interviews that the availability of the conferencing system had made it much easier for them to start and conduct their PI discussions with a minimum of disruption for PI group members, and that this had been the main reason why they had participated in the computer-supported PI groups. Similarly to those in the New Zealand government branch, several of these interviewees spontaneously mentioned a reduction in time required to set up a PI group as an explanation for their perceptions.

Figure 3. Distribution of perceptions about computer support impact on group cost ($N = 18$, $\chi^2 = 17.5$, $df = 2$, $p < .001$)



The Cost of Groups is Reduced

PI group members in the Brazilian organization perceived a reduction in the organizational cost of groups as having been associated with computer support. The main explanations provided by members for this perception were related to the easier access to information generated by previous groups, and to generic process-related information, both available through the conferencing system. According to these perceptions, the public access to the archives of previous PI group discussions allowed new groups to replicate some of their solutions in a way that reduced time spent in process analysis and redesign; though this might also have led to a decrease in creativity in the PI groups. In addition, public access to such process-related information as customer satisfaction, throughput, and lead-time, was reported by members as having been useful in the identification of PI opportunities and, in consequence, reducing information gathering costs in PI groups. The remarks of one events manager at the Brazilian organization are illustrative:

Before we started using [the computer conferencing system] we had to spend hours analyzing a pile of paper to find out some information about our main operations. Even so I couldn't tell you whether there was something wrong with them or not.

PI group members at the tertiary education institution in New Zealand consistently saw group cost as having been considerably reduced by the use of the conferencing system. Unlike PI group members in the Brazilian organization, the explanation given here was a more direct one, and was related to group communication costs. According to these members, the average time that would have been spent by each ordinary group member (as opposed to a group leader) in a face-to-face PI group discussion would be much higher than that actually spent by them in computer-supported PI groups. However, group leaders in particular believed that there was not much of a reduction in time for them.

In the branch of the New Zealand government, structured interviews indicated that approximately seventy-eight percent of the respondents thought that computer-supported PI groups had cost *much* less to the organization than face-to-face PI groups. This is illustrated in Figure 3, where the distribution of

response frequencies suggests a statistically strong trend ($p < .001$) towards the perception that computer support leads to a reduction in the cost of PI groups.

In the branch of the New Zealand government, the average time that would have to be spent by each ordinary group member in a PI group discussion was estimated, based on members' perceptions, at slightly over twenty hours if the discussions had been carried out exclusively through face-to-face meetings. This time was reduced by computer support to about one hour and thirty minutes, which was the average time spent by ordinary group members in the PI group discussions according to information provided by the group themselves in structured interviews - a reduction of approximately ninety-three percent. The estimated average time reduction for group leaders and the facilitator was from twenty hours to approximately seven hours, according to direct time measurements initially done by the researcher and then matched against figures provided by the group leaders. This amounts to a sixty-five per cent reduction in the group leader and facilitator's participation time.

From an absolute dollar amount perspective, the reduction in cost is also attractive. If we conservatively assume that a group member costs the organization on average fifteen dollars per hour (a low estimate), and that the average number of members in a PI group is nine (averaged based on the PI groups facilitated in this organization), then we could say that computer conferencing support reduced the cost per group to the organization in \$2,415. Note that the cost of the facilitator and possible travel expense savings have been disregarded in the calculation of this savings estimate. Had these extra costs been considered, the cost reduction per group would have been higher; much higher in groups whose membership was widely geographically distributed.

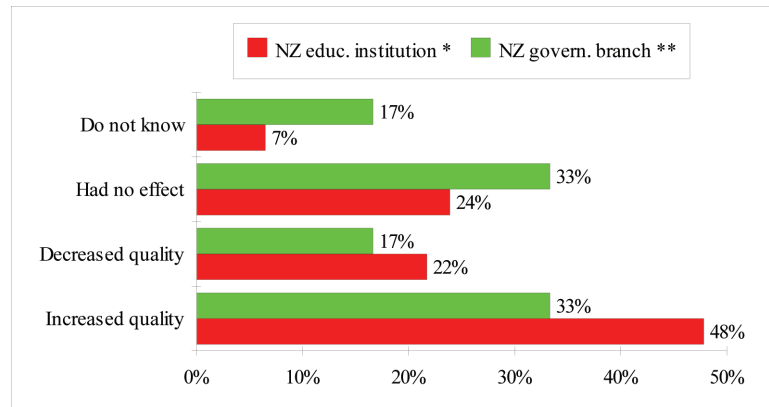
The Quality of Process Redesigns is Unaffected

There was no clear evidence of group technology effects on process redesign quality at the Brazilian organization. Although a trend towards the perception that the conferencing system had had a strong impact on PI group efficiency could be observed among the respondents in in-depth interviews, no significant trend was observed regarding increases or decreases in PI group outcome quality. There was a general satisfaction with the overall results achieved by the PI groups, illustrated by the remarks of a senior manager: "*...we have never been through such a successful motivational endeavor since the firm was founded...*" I believe that if there had been a significantly negative impact on process redesign quality, this would have been noticeable in in-depth interviews. Since this was not the case, it is reasonable to conclude that the overall technology effect on process redesign quality at the Brazilian organization was either positive or neutral.

A slight trend towards a perceived increase in process redesign quality was noticed in both New Zealand organizations; more strongly in the New Zealand tertiary education institution. Figure 4 shows the frequency distribution of answers regarding process redesign quality in both organizations. However, the chi-square analysis does not show a statistically significant trend (i.e., with at least a $p < .05$) towards a perceived increase in process redesign quality in either organization.

Looking at the distribution of perceptions from a slightly different perspective, it can be inferred from Figure 4 that there was a general and strong trend towards the perception of a *non-negative* effect on process redesign quality. As it can be seen, seventy-two percent of the respondents in the New Zealand tertiary education institution perceived either an increase or a null effect in process redesign quality; this proportion was about sixty-six percent in the New Zealand government branch.

Figure 4. Distribution of perceptions about computer support impact on process redesign quality (* $N = 46$, $\eta^2 = 5.97$, $df = 2$, $p = .050$; ** $N = 18$, $\eta^2 = 1.50$, $df = 2$, $p = .472$)



The majority of the respondents who perceived an increase in quality explained the increase as likely to have been caused by an improvement in the quality of individual contributions from PI group members interacting through the computer conferencing system. The remarks from a PI group member are illustrative of these explanations:

You think more when you're writing something, so you produce a better quality contribution. Take for example what [member's name - removed] wrote, she wrote a lot and it seemed that she thought a lot about it before she e-mailed it to the group. She wasn't just babbling off the top of her head, she tended to think out what she was writing. I know I did it a lot, specially my first message. I really thought a lot to put it together.

Most of those who perceived a decrease in process redesign quality believed that interacting through the conferencing system increased the ambiguity in the PI group discussion, particularly in the analysis step (see Figure 1), where each group analyzed the target process (or processes) for redesign. In the analysis step, group members had to build a shared understanding of the process being analyzed so they could later effectively contribute process change suggestions. As most groups had a multi-departmental composition, often differences in the technical language used by different members had become obstacles that had to be removed if the discussion was to proceed successfully.

The asynchronous nature of the conferencing system prevents immediate feedback and the use of non-verbal cues (e.g., gestures). This apparently made it more difficult, in the eyes of some members, to remove obstacles to a shared understanding about the process being analyzed. However, the percentage of respondents who were of the opinion that redesign quality had been decreased by the use of group technology was comparatively low, which suggests that the higher ambiguity caused by the electronic medium might have been offset by the also higher quality observed in individual contributions. The combination of these competing effects apparently led to a neutral overall effect on process redesign quality.

Conclusion and Implications

The findings discussed above suggest that organizations where a large amount of communication is carried out through computer networks, and hence where a high degree of virtuality is present, can derive attractive benefits from computer-supported group PI efforts. This is true particularly in incremental PI groups; that is, groups searching for incremental improvements in organizational processes as opposed to radical (or BPR-like) improvements. BPR groups are more likely to have to meet face-to-face for most of their duration, as higher perceived risks are associated with conducting these discussions through written and permanent-record types of electronic media.

Distributed and multi-departmental PI groups searching for incremental quality and productivity improvements can be successfully conducted with computer support. They can be conducted in less time and at a lower cost than equivalent face-to-face groups. They can also occur more often, due to their lower reliance on management leadership, than similar face-to-face groups. And all this can be achieved without any significantly negative impact on the quality of the process improvements generated.

I believe these are good news for organizations with, or moving towards, a high degree of virtuality. This warrants the recommendation for these organizations to try and implement computer-supported PI projects targeted at achieving incremental improvements in process quality and productivity. Although BPR-like projects may not benefit as much from distributed computer support, they can still take advantage of a combination of face-to-face and computer-supported interaction (the key challenge here would be to find the right mix). Moreover, the economic revolution that has taken place in Japan between the end of World War II and the early 1980s shows that a large number of incremental improvement initiatives can lead to firmly founded quantum-leap competitive advantage over the long run.

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