Winter 1993

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Recommended Citation
Griffith, T.L., & Northcraft, G.B. (1993). Promises, pitfalls, and paradox: Cognitive elements in the implementation of new technology. Journal of Managerial Issues, 5, 465-482.

*JOURNAL OF MANAGERIAL ISSUES*
*Vol. V Number 4 Winter 1993 :465-482*

# Promises, Pitfalls, And Paradox: Cognitive Elements In The Implementation of New Technology*

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Technologies are the tools that people use to get things done, but the promise of new technology is limited by its successful implementation in organizations. Visits to any technology fair or convention cannot but help to instill a sense of wonder and anticipation given the breadth of the possibilities. The 1992 Fall Comdex scheduled over 2,000 vendors and 140,000 visitors (Dvorak, 1993; Malloy, 1993). However, the vision is often different if the exhibited products are followed into an organization. Marzchzak suggested in 1988 that most new production technology implementations fail. Similarly, Bikson and Gutek (1984) found that 40% of 2,000 surveyed U.S. companies had not achieved the intended benefits from implementing new office technology. There is little to suggest that this deplorable situation is changing. A large proportion of implementation attempts continue to fail to accomplish their stated goals and potential adopters are beginning to question the real value of new office technologies (Bowen, 1986). This paper offers an elaborated model of new technology implementation. This model explains two important paradoxes of new technology introductions by emphasizing the critical role of adopters' **cognitions** including adopters' thoughts, perceptions, and constructed understandings of the new technology (e.g., Barley, 1986; Goodman and Griffith, 1991; Orlikowski, 1992; Sproull and Hofmeister, 1986).

Although there are many definitions of technology, here we will use "technology" to refer to any system of components that act on

* The authors would like to thank Dorothy Leonard-Barton for her comments on an earlier draft.

or change an object from one state to another (Goodman and Griffith, 1991). Specific examples of new technologies include (but are not limited to): computer-aided manufacturing, computerized group decision support tools (software and hardware), and electronic mail. The focus of our model is the implementation of new technology. Implementation includes any processes undertaken to institutionalize a new technology as a stable part of the organization (Tornatzky and Johnson, 1982; Ettlie, 1984; Lucas, 1986). Users and implementers are the major actors during new technology implementation, and are also the focus of the model presented here. Implementers are the agents for new technology introduction, including those individuals who train and support new users. Users are the individuals who use the new technology to get work done.

## Traditional Models of Implementation

Successful implementation efforts can be characterized in terms of the stages, processes, and goals described in Figure 1. This review focuses specifically on the cognitive aspects of new technology implementation. (For a comprehensive review of new technology implementation see, Goodman and Griffith, 1991; Zammuto and O'Connor, 1992.)

### Stages

Lewin's (1951) classic model of change in organizations suggests three critical **stages** in the implementation of a new technology: unfreezing, movement, and refreezing. Over the years, researchers have modified Lewin's model in a number of ways (e.g., Lippitt et al., 1958), primarily by adding a fourth stage in the change process: diagnosis. Diagnosis is generally a prerequisite to the implementation of a new technology. Diagnosis entails identifying the problem or opportunity that invokes a change, identifying the features of the problem or opportunity, and then selecting an appropriate action plan (for instance, a new technology!) that appears to solve the problem or address the opportunity (Northcraft and Neale, 1994). In the technology literature, diagnosis is referred to as the adoption decision (e.g., Dean, 1987).

Unfreezing follows diagnosis. The primary purpose of the unfreezing stage is for implementers to build a successful foundation on which the actual change to a new technology can take place. During unfreezing, implementers of a new technology must break down the resistance of prospective users. That may entail selling prospective users on the appropriateness of the diagnosis, so that the change seems meaningful and sensible. Unfreezing certainly entails making sure that prospective users understand the new technology, and are prepared for the consequences of changing over to the new technology (e.g., decreased performance during the "breaking in" period). Following unfreezing is the movement stage of implementation, when the new technology is brought on line and prospective users become users. The final stage of implementation is refreezing.

**Figure 1**

**Implementation Characteristics**

| STAGES | PROCESSES | GOALS |
|---|---|---|
| Diagnosis | Socialization | Knowledge |
| Unfreezing | Commitment | Attitudes |
| Movement | Reward Allocation | Use |
| Refreezing | Feedback-and-Redesign | Group Norms |
| | Diffusion | |

During refreezing, implementers must follow-up even apparently successful new technology introductions to insure that favorable changes attained during introduction of the new technology become institutionalized in the organization. Refreezing during a new technology implementation may include adjustments to the organization as well as to the technology (Leonard-Barton, 1988).

Perhaps the greatest roadblock to successful new technology implementation is that unfreezing and refreezing—preparing the organization for a new technology and insuring that the technology has been accepted—typically command far less organizational attention than diagnosis and movement. Diagnosis and movement have clear, concrete, and definable goals, namely, find the best technology for the purpose (diagnosis) and get it in the hands of prospective users (movement). In contrast, unfreezing and refreezing of prospective users—breaking down their resistance and gaining their acceptance and use of the new technology—are ambiguous processes with no visible end (Goodman and Griffith, 1991). In fact, refreezing might be thought of as a continuance of the fine-tuning of users' acceptance which was initiated during unfreezing. Unfortunately, adoption decision makers often incorrectly assume that what has become clear to them after many hours of diagnosis deliberations will, of course, be self-evident to users during movement (Rogers and Shoemaker, 1971).

### Processes

Goodman and Griffith (1991) suggest that successful implementation requires that five critical dynamic processes occur: socialization, commitment, reward allocation, feedback-and-redesign, and diffusion. These processes will be differentially important depending on the stage of the implementation and the particular setting. Socialization involves having users come to understand the new technology, in particular seeing it as an integral part of the accomplishment of their work tasks, rather than something separate or extra. Socialization begins during unfreezing when implementers begin to sell prospective users on the appropriateness of the new technology. Socialization continues for as long as there are new users and/or adaptations to the technology. Commitment occurs when users have accepted the technology to the point that they are willing to work at making it successful. The successful commitment of users to a new technology can begin as early as diagnosis, if prospective users are involved in the selection of the new techology (Huse and Cummings, 1985). Reward allocation refers to users coming to see the value (and/or costs) of using the new technology. Reward allocations may be direct incentives for using the technology (e.g., monetary bonuses for use) or rewards that accrue because the technology makes users' work easier or better. Convincing prospective users of the rewards of a new technology is imperative during unfreezing, though additional rewards (and costs) often are revealed during movement and refreezing. Feedback-and-redesign occurs when users develop a sufficient understanding of a new technology to adjust it, or the organization around the new technology, to new and better uses. Leonard-Barton (1988) has noted that implementation success is critically dependent upon users attaining an adaptive fit between new technology and the organization to achieve a synergistic result. Diffusion refers to the spread of the new technology through the organization. Diffusion and feedback-and-redesign are critical components of the movement and refreezing stages of a new technology implementation. To the extent that diffusion and feedback-and-redesign are more successful, commitment and socialization are more likely to occur. On the other hand, diffusion and feedback-and-redesign are more likely to occur once a new technology has been accepted (socialization) and users are committed to its success.

### Goals

The success of a new technology implementation can be measured by four implementation goals: users' knowledge of the system, their attitudes toward the new technology, their actual use of the technology, and finally group norms concerning the acceptance and value of the new technology in the organization (Goodman and Griffith, 1991). These goals also may vary in importance, depending upon the stage of the implementation and the technology (Goodman and Griffith, 1991). For instance, users' attitudes would be a primary concern during unfreezing, since a positive attitude might be a necessary prerequisite to acquiring knowledge about using the system. Actual use and group norms, on the other hand, would seem to be more critical measures during refreezing where they would define the long-term success of the implementation.

## A Frame-Based Model of Implementation

Within these stages, processes, and goals of new technology implementation, several researchers (e.g., Barley, 1986; Goodman and Griffith, 1991; Sproull and Hofmeister, 1986) have emphasized the critical role of **cognitions.** Cognitions are what goes on in people's minds, including thoughts, beliefs, and understandings. These cognitions include beliefs held by users (and implementers) about the roles, relationships, goals, and processes of the new technology. However, there has been little empirical work focusing on the socialization and/or commitment processes in new technology implementation (Goodman and Griffith, 1991; Sproull and Hofmeister, 1986) where implementers would be expected to develop favorable cognitions in users. This seems a puzzling oversight, since only 10% of implementation failures appear to be the result of technical problems (i.e., poor diagnosis). Most implementation failures stem from "human and organizational" problems (Turnage, 1990), that is, poor management by implementers of the unfreezing, movement, and refreezing of a new technology.

One cognition of particular interest in new technology implementation is the **frame** (e.g., Goffman, 1974). Frames are the perceptual sets that individuals bring to or develop during implementation. Frames direct an individual's critical perception processes (Pinkley, 1991), including what to attend to, what to make of something, and how to interpret it. Frames invoke selective perception processes (e.g., Dearborn and Simon, 1958) and thus play a role in how users make sense of a new technology in its organizational setting (e.g., Louis, 1980). Frames are related to the knowledge structures (including schemas and scripts) that help individuals understand what things are when they look at them (Taylor and Crocker, 1980). However, frames are pre-schematic and help individuals decide what knowledge structures (e.g., schema or scripts) apply to a given situation. In implementation, the users' frames will limit both what they hear in implementers' introductions and training, as well as how users interpret the new technology when they experience it.

The model of new technology implementation that follows in this paper elaborates the critical role that implementer and user frames play in successful implementation (as shown in Figure 2). The focus of this model is the user, the target of the implementation effort. This model has four important elements: (1) **implementer frames** and the information these frames lead implementers to provide users during implementation, (2) **user frames** and the information they lead users to seek during implementation, (3) **user experiences** with the new technology when they work with it, and finally (4) **users' social constructions** (e.g., Barley, 1986) of the technology. Users' social constructions of a new technology are the understandings (what it is, what it can do) that users come to believe. Users' social constructions are the outcome of interest in the model because users' social constructions subsume three of the four goals of implementation noted above (knowledge, attitudes, and group norms), all of which together should drive the real goal of implementation—effective use of the technology. In this model, users' social constructions are a consequence of the interaction of user and implementer frames and user experiences with the technology during implementation. This model builds on Sproull and Hofmeister's (1986) work and links it with March's (1971) ideas of the technology of foolishness. The model predicts both promises and pitfalls. Some managerial implications are identified which may improve successful implementation.

The basic argument of the model is that users come to implementation with a frame that affects the information they search for, while implementers enter implementation with a frame that affects the information that they provide to users. As shown in Figure 2, users construct an understanding of the technology—how to use it and whether it is worth using—based upon the information they are provided by implementers and the experiences they have with the technology. Users' constructed understandings guide their interpretation of subsequent experiences with the technology, and those subsequent experiences with the technology in turn provide users opportunities to test and modify their constructions. The contrast between the information users naturally seek and the information implementers provide creates two important paradoxes: The two paradoxes represent the pitfalls and promise of new technology implementation.

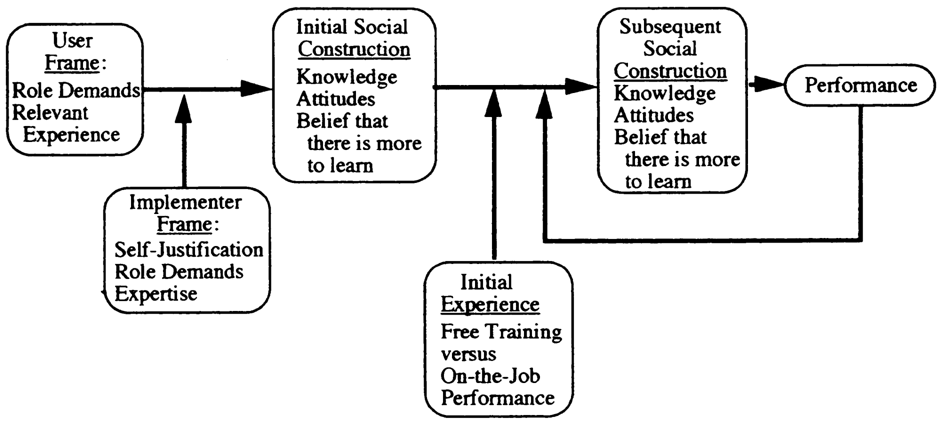
## PARADOX 1:
## The Paradox of Value

Sproull and Hofmeister (1986) present one of the few studies focused on users' frames during new technology implementation, and conclude that new technology implementation contains a "**paradox of value.**" Sproull and Hofmeister studied a superintendent's implementation attempt of an accountability program (focusing on teaching materials and testing) in a large city school district. They found that the superintendent (as implementer) emphasized the program's positive features because they were salient to him and in order to encourage people to try the system. "But, as is inevitably the case, things did not go perfectly with.." the program and the users decreased their positive regard for the program (Sproull and Hofmeister, 1986:57). The paradox is that had the superintendent promised less, the users might have been less discouraged with the program's faults.

Sproull and Hofmeister (1986) show that the frames of implementers diverge significantly from the frames of the prospective users, as shown in Figure 3. We characterize these two dimensions as Positive/Negative and Description/Operation (Griffith and Northcraft, 1991). Implementers focus on a view of the new technology that is positively biased, more favorable than it should be (e.g., Baier et al., 1986). The source of this positive

**Figure 2**

**Frame-Based Model of the Social Construction of a New Technology**

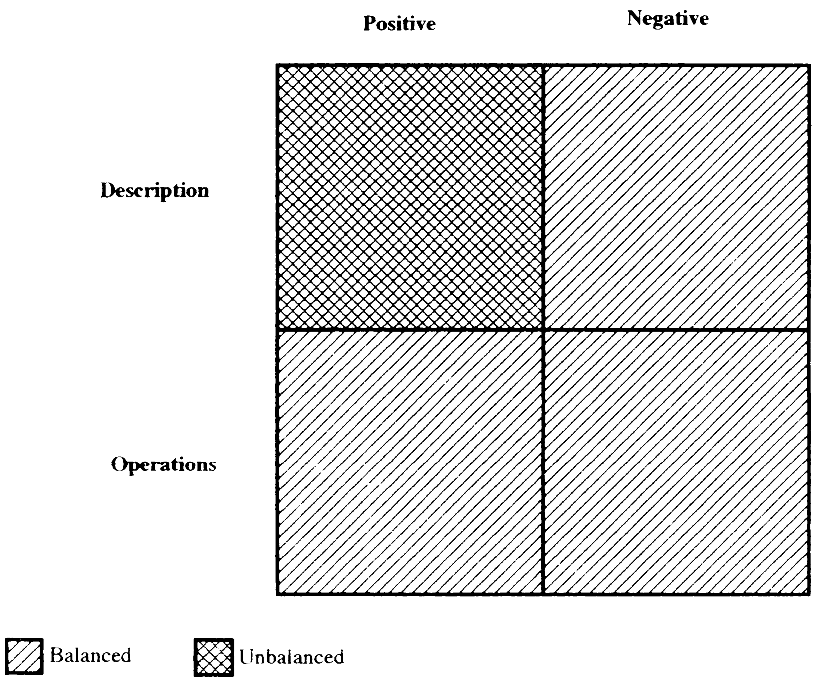



bias may be role demands. Implementers may focus on the positive aspects of the new technology because of their role as advocates for the technolgy; that is, implementers may feel that it is their job to present the new technology in the best light. These role demands might elicit self-justification processes (e.g., Staw and Ross, 1979). Implementers may come to espouse only positive views of the technology because their role forces them to publicly voice such opinions, and it is easier to present such views publicly when one believes in them. Finally, implementers' great exposure to and expertise with the new technology no doubt allows them to adjust to the limitations or costs of a new technology, making those limitations or costs less frustrating or annoying than they might be to someone encountering the technology for the first time. The natural frames of users, on the other hand, tend to be more balanced, focusing on both positive and negative aspects of the new technology (Griffith and Northcraft, 1991). Without any prior introduction, experience, or a vested interest in the success of the technology, users are likely to have a much more objective view of the new technology, one that sees (or at least searches for) both the positive and negative aspects.

Implementers also tend to be more focused on why to use the new technology (its benefits and uses). Users, in contrast, also want to know how to use the technology. For example, Griffith and Northcraft (1991) asked novice users of a group support system (electronic meeting hardware and software) to list the five most important things they would tell new users of the system. Although Positive/Description information dominated, novice

**Figure 3**

**Balanced and Unbalanced Implementation Frames**




Note: Balanced frames (often held by Users) represent cognitions that include information from all four quadrants. Unbalanced frames (often held by Implementers) represent cognitions that only include information from the Positive/Description quadrant. Surprises during implementation are more likely for users provided with Unbalanced implementation frames.

users listed comments from each of the four quadrants described above: (1) Positive/Description—"The system lets you concentrate on one problem at a time," (2) Negative/Description—"Some people are intimidated in a computer facility," (3) Positive/Operation—"You should practice using all the keys," and (4) Negative/Operation—"Do not read other people's comments before writing your own." The distribution of this information was significantly less biased than was the information the implementers said they would provide to new users.

Again, implementers' greater exposure to and experience with the new technology no doubt has lowered the salience of operational concerns; for an expert user, those things are well learned and assumed. Thus, implementers probably underestimate the complexity or difficulty that prospective users perceive when they are first introduced to a new technology. In such situations, novice users will have a strong need to reduce uncertainty (Lester, 1986) and gain control (Falcione and Wilson, 1988).

Of course, the quadrants in Figure 3 hold different levels of importance in implementation. In particular, without Positive Descriptions (e.g., descriptions of the benefits of adopting the new technology), prospective users are unlikely to get very interested in the new technology. This suggests that implementers have an advocacy role, a responsibility to sell the technology to prospective users. It also emphasizes the critical role that implementers play as the starting point for users' interpretations of their initial experiences with the technology.

The "paradox of value" is that implementers present users an unrealistically positive and insufficiently practical view of a new technology (represented in Figure 3 as the Unbalanced/Implementer frame). As a consequence, users' first experiences with a new technology will be frustrating. Although users may discover some positive surprises (benefits of the technology that they were not aware of), for the most part users will encounter "negative surprises" (Louis, 1980). These negative surprises will be of two different sorts. First, users will encounter negatives of the technology—things the technology cannot do that users expected it could. Second, users will encounter operational difficulties—users will be unable to make the technology work correctly because implementers did not provide enough practical information to insure operational success. Users' initial experiences with the technology will be negative, and their attitudes toward and subsequent use of the new technology will suffer accordingly.

The paradox here is that implementers face a dilemma. If implementers present a balanced view of the technology (a balanced view of the technology's positives and negatives), they are abdicating their advocacy role and risk losing initial user interest. If implementers present an advocacy view of the technology (a view biased toward positive descriptions), they risk losing long-term user interest via negative surprises encountered during initial experiences with the technology. Significantly, this dilemma may be a false one because of a second paradox in new technology implementation: the paradox of experience.

## PARADOX 2: The Paradox of Experience

A central issue in the cognitively elaborated model shown in Figure 2 is the timing of user experience with the new technology. In fact, the "paradox of value" rests on two subtle but critical assumptions: (1) that negative surprises are costly, and (2) that negative surprises have no benefits. Both of these assumptions are premised on a traditional model of implementation in which implementers present a new technology to users during unfreezing, and then users first use the new technology during movement. But is this traditional model a necessary premise?

In his classic article on the "technology of foolishness," March

(1971) suggests that there is value when organizations institutionalize a way for members to challenge the organization's operational rules and cultural assumptions—to be "foolish." The organizational value of foolishness, of course, is that an individual's challenges force the organization to evaluate the wisdom of its rules and assumptions. If an organization's assumptions and rules are never challenged, they may become obsolete and dysfunctional without anyone knowing it. Foolishness allows an organization to validate or modify its rules and assumptions, to evolve and thereby to remain viable. Of course, an organization can learn and adapt from foolishness only if foolishness can be accomplished at low cost. Costly foolishness may be no better for the organization than costly adherence to outdated or dysfunctional rules and assumptions.

The analog to March's foolishness in new technology implementation is the opportunity for users to test and modify their social constructions of a new technology. If implementers have led users to construct unrealistic and impractical preliminary understandings of a new technology, as shown in Figure 2, experiences with the new technology will provide opportunities to test and modify those understandings. There remains, however, the caution offered by March that the foolishness must not itself prove more costly than holding an incorrect construction. While cost in March's technology of foolishness is cost to the organization, in new technology implementation the cost is also personal cost to the user.

Initial experience with a technology can be roughly divided into two types, Free Training and On-the-Job Performance. Free Training refers to time taken to learn the technology before users must actually use the technology for required work. Training with the particular technology at the vendor's site, practice in a classroom setting, and free time at work are all examples of Free Training. The "free" in Free Training refers to the cost of mistakes. During training, the cost of making mistakes is relatively free. (For an in-depth discussion of manufacturing technology training and practices, see Goodman and Miller, 1990.) In contrast, On-the-Job Performance is initial experience while the user is doing required work. While users provided Free Training would be expected to continue to learn while on the job, the distinction here is a critical one: Free Training does not require that users perform required work while initially experiencing the technology; On-the-Job Performance does. The importance of this distinction arises from the cost and/or tension incurred by the users when their expectations and understandings do not match the organizational reality of using the technology. Negative surprises will be high cost if encountered when they are reflected on the job in the user's performance. Negative surprises will be low cost for users if they take place before work is required or evaluated. These costs would be expected to affect one of the central goals of implementation—users' attitudes toward using the technology.

March's point is that negative surprises provide important learning opportunities, but learning opportunities that must be managed. Managing a learning opportunity means no cost to the user for being wrong or making mistakes—that learning is not punished, as long as the efforts are made in good faith. In many traditional change efforts, the first real opportunity for users to experiment with the new technology occurs when it "counts," when mistakes are costly to both the individual and the organization. Free Training suggests a costless opportunity for users to encounter negative surprises, when these negatives might not be expected to have such a deleterious effect on user attitudes.

This raises the second assumption made in the "paradox of value"—that surprises have no benefits for users. As noted before, one of the primary goals of new technology implementation is to instill in users appropriate attitudes toward the technology. An important component of appropriate attitudes toward a new technology is the belief that there is more to learn; that there remain, for instance, creative new uses for the new technology or even better ways for it to accomplish its intended purposes. Louis (1980) has noted that people typically test and modify their understandings using a confirmation process. This means that users' constructed understandings will tell them how to interpret their experiences with a new technology, and that users will modify their constructions only if experiences invalidate the expectations.

The confirmation strategy is important because it suggests that users will be motivated to search for additional information during experience with a new technology only if the frame they are provided during implementation leads them to discover that they are missing information. As a result, if implementers present balanced views of a new technology, there is some danger that users will confirm what they have been told and conclude that they understand the technology. An unbalanced (positively biased) presentation by implementers, on the other hand, inevitably will lead users to encounter surprises during implementation. Thus, users will gain a healthy desire to learn more, to explore more, as long as encountering the suprises is not costly! This healthy skepticism about the new technology should contribute to the feedback-and-redesign processes necessary for implementation success (Goodman and Griffith, 1991), as well as greater knowledge of the system. Technologies typically fit organizational and user needs in some ways while needing adjustment in others (Leonard-Barton, 1988). When users have a healthy skepticism about new technology, they will anticipate these issues. The result is that users are given the opportunity to take responsibility for their own learning (e.g., Bowen, 1980), learning by experience rather than by being told. This should encourage more commitment (e.g., Salancik, 1977) and more favorable attitudes toward the technology.

The paradox of experience is that a little failure is good, maybe necessary, to successful implementation, and that disconfirmation is useful as long as it is not costly to users. When combined with the paradox of value, the paradox of experience suggests the implementation outcomes shown in Figure 4.

If users are provided (by implementers) Balanced (Realistic) frames and are then give Free Training time, confirmation should lead users to believe that there is little more to learn about the technology. As long as the accuracy of their frame holds, these users will have been given a costless opportunity to test their expectations against reality. As their expectations are not challenged or disconfirmed (since they started with a realistic frame), they should verify their understanding (construction) of the technology and not be motivated to investigate the technological system further. This prediction is based on the susceptibility of individual decision makers to satisficing (March and Simon, 1958) and confirmation biases (Klayman and Ha, 1987). Users in this situation should be relatively pleased with the technology. They will have encountered no negative surprises and their performance should be satisfactory, up to the level that they understand the technological system. But these users will not continue to explore and adapt the technology.

The above argument also largely holds for users who are provided Balanced (Realistic) frames during implementation but are required to first experience the technology during On-the-Job Performance. Even though mistakes are likely to be costly, users are not likely to be surprised because they have a balanced (though perhaps shallow) understanding of the technology.

**Figure 4**

**Critical Outcomes of Four Possible Implementation Techniques**

| | **Balanced Frame (Realistic/User)** | **Unbalanced Frame (Unrealistic/Implementer)** |
|---|---|---|
| **Free Training** | Low Perceived Need to Learn | High Knowledge<br>High Perceived Need to Learn<br>High Performance |
| **On-the-Job Performance** | Low Perceived Need to Learn | Dissatisfaction |

Note: These are the critical outcomes expected given the implementation technique described by the specific quadrant.

Users in this quadrant are also likely to test the technology, find it to be as they expect, and thus suspend their tests (Klayman and Ha, 1987). Therefore, these users are also expected (relative to other quadrants in Figure 4) to not believe that there is much else to learn or that there are more adaptations to make. As in the previous quadrant, these users should be satisfied and able to perform their basic tasks—but, again, are not inquisitive.

The Balanced implementation frame scenarios engender satisfactory but not completely successful implementation. These implementation techniques may result in implementation that is only successful in the short term, a form of implementation failure (Goodman and Griffith, 1991; Leonard-Barton, 1988). More specifically, the users are able to perform the tasks that the implementers have specifically prepared them for; however, balanced implementation frames do not instill in users the need for further discovery, and user knowledge of the system (and its further adaptation and redesign) is likely to stagnate. The users may have the highest satisfaction, since there are no negative surprises in their initial use. A discrepancy model of satisfaction where satisfaction is modeled by the discrepancy between what is desired and the actual state (e.g., Locke, 1969; Katzell, 1964) would certainly not predict dissatisfaction.

Users who are provided Unbalanced frames during implementation are more likely to have volatile implementations. Users with Unbalanced frames are destined to be surprised since technologies and organizations are complex. Users are missing information from three of the four quadrants if they develop unbalanced frames. Given that the bias of their frames is toward Positive Description, challenges to their frames (surprises) are also likely to be negative. The effect of these negative surprises is the basis for the predictions in the last two quadrants.

For users with positively Unbalanced frames, who receive their experience with the technology only during On-the-Job Performance, negative surprises may be very costly. The scenario might be as follows: users have tasks to perform; the implementers build up the technology's capabilities in terms of being able to complete the task; but, because the users only have been given a "sales-pitch" introduction, they may not be actually able to do the task. There also may be some negative aspects of using this technology to perform this task. Consider electronic meeting support systems—such systems may provide benefits of documentation and anonymity, but users should be aware of the possible costs of losing the emphasis of verbal exchanges. Finally, it may be that there are certain things the users should not do in using the technology. An example of this in a computer setting might be, "Do not turn off the computer without first saving your work." To do so and inadvertently destroy the work would certainly provide a very negative surprise on most computer systems.

If the users are required and responsible for completing a task (i.e., real, evaluated on-the-job performance), any of the above scenarios would be likely to invoke disastrous results and subsequently, negative attitudes towards the technology. Initial contacts with a new technology are significant socialization experiences. The results of costly surprises for users (e.g., lost work, incomplete tasks, or simply frustration) during the initial experiences with the technology may be difficult to overcome.

What if these negative surprises were encountered during Free Training? The previously mentioned discrepancy models of satisfaction (Locke, 1969; Katzell, 1964) would still emphasize the difference between the desired and actual level of performance, yet the importance would be much lower. The impact of negative surprises will be less if encountered during Free Training than if encountered during On-the-Job Performance because the cost of mistakes (to users) is less during Free Training. The purpose of Free Training is to give the users costless opportunities to experience the differences between their social construction of the technology and reality. Free Training provides the opportunity to correct users' understandings before they have to use the technology for actual work, before those negative surprises might enter into their individual performance records.

The predicted results are positive with Unbalanced/Free Training implementation. Knowledge should be higher because the users discover the Negative Description and Operational information for themselves. Because this learning takes place without the pressures of On-the-Job Performance, attitudes should not be negative because mistakes are less costly. Performance when working with the technology is finally required should be high, given the greater understanding of the technology from prior experimentation. Besides these users having less risk, they have had more time to practice before beginning the task. Users provided with Free Training and an Unbalanced frame should understand that there is always more to learn. Certainly there was more for users to learn in the beginning and both Klayman and Ha's (1987) and Louis' (1980 and 1989) work lead us to predict that challenges to users' beliefs will provide the impetus for users to continue to look for new ways of understanding the technology.

## Beyond Paradox In New Technology Implementation

The model presented here has elaborated the role of cognitions—specifically user and implementer frames—in new technology implementation. The model reveals two paradoxes: the paradox of value and the paradox of experience. The paradox of value occurs when the divergence between user frames (the balanced information that users need) and implementer frames (the unbalanced information that implementers provide) creates negative surprises for users when they experience a new technology. The paradox of experience is that these negative surprises need not be costly and may be key components of successful implementation.

The distinction between balanced and unbalanced implementer frames is not equivalent to surprises and no surprises for prospective users. Even balanced implementer presentations are likely to produce some user surprises. Implementers cannot avoid users being surprised. Implementers cannot transmit everything because the opportunity to transmit information during unfreezing is limited. Additionally, implementers may not fully understand the setting and/or context themselves. So, for implementers, the question is not whether there are going to be surprises (there are), but how those surprises are going to be managed. Managing implementation surprises such that they are costless is critical to heightening the status of those surprises as learning opportunities.

The frame-based model of implementation offered in this paper stresses the critical role of user experiences with the unfreezing stage of implementation (when users are being introduced to a new technology). There is an interesting parallel here to the emphasis of organizational development approaches to change (e.g., Huse and Cummings, 1985). Organizational development emphasizes the importance of doing diagnosis and adoption with an eye to unfreezing, usually by involving prospective users in adoption decision making. This frame-based model of implementation emphasizes managing unfreezing with an eye to movement, by providing user experience with the technology while mistakes are still relatively costless.

The conflict between expectations and reality inherent in implementation provides the energy and framework for continuous improvement of the organizational and technological system (if this energy is not dampened by the personal necessity of simply getting the work done). The organizational necessity of continuous adaptation parallels the ideas of continuous improvement from Total Quality Management (TQM). By drawing from the more generally understood ideas of TQM, technology implementation may be able to build on some existing social constructions. The social construction of continuous improvement is possibly understood by the general management population through the extensive marketing given TQM and the Malcolm Baldrige quality award.

Continuous mutual adaptation between new technology and the organizational setting is a key process in managing for successful implementation (Leonard-Barton, 1988). However, managers must accept and prepare for the necessary changes through budgeting, design and user/feedback groups, free training time, etc. Tyre and Orlikowski (in press) provide data which suggest that current organizational mechanisms provide limited opportunities for adaptation after implementation. Thus, the interrelated processes of redesign and implementation suggested here first require innovation in the implementation process itself. The idea is to become better at being more flexible and learning to learn.

This article focused on cognitions of the implementers and users which may promote adaptation and deeper understanding of new technologies. The key proposition is that the pitfall of unbalanced implementation frames and the paradoxes of value and experience may be turned into promises of successful implementation. Managers must prepare and accept the costs of the users learning to become experts:

Tell me, and I forget
Show me, and I remember
Involve me, and I understand
(Chinese proverb)

Managers wanting to apply this philosophy to their new technology implementations need only to challenge their users with the technology. First, the technology itself must be designed with adaptation in mind—the technology must be flexible so that users can develop it as their understanding of it and the context develops. This creates the reality that there will always be more to learn and, over time, will enhance the value of the technology in a general organizational sense. Next, users must be provided with problems that challenge them to push the technology and their understanding of it. Most importantly, users must be allowed the time to address these challenges without the burden of required work or the onus of performance appraisal. Finally, managers need to acknowledge that users will need time later on, after they have become comfortable with the technology, to readdress the learning process. Users will need the opportunity to find more difficult problems and the chance to solve these costlessly as well. Using this implementation technique should increase users' knowledge of, positive attitudes toward, and quality use of the technology. These outcomes benefit the organization as well as its members.

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