A Technological Frames Perspective on Information Technology and Organizational Change

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When information technologies (IT) have a central role in organizational change programs, understanding how organization members make sense of technology is critical to influencing their actions and to achieving planned outcomes. Orlikowski and Gash articulated a theoretic framework centered on technological frames of reference (TFR) to investigate interpretive processes related to IT in organizations. The TFR framework has been cited across a wide range of publications and has formed the basis for a genre of studies on the interpretive aspects of IT and organizational change. In this article, the author assesses these research contributions and argues that further theoretic development is needed for the TFR framework to reach its potential contributions to knowledge. The author outlines the following research strategies that could facilitate TFR theory development: focusing analysis on frame structure, investigating framing as a dynamic interpretive process, and examining the cultural and institutional basis of organizational frames.

Keywords: technological frames of reference; ICTs; organizational change

INTRODUCTION

Organizational change has been characterized as first and foremost an interpretive process (Barr, 1998; Bartunek, 1984; Bartunek, Lacey, & Wood, 1992; Bartunek & Moch, 1987; Daft & Weick, 1984; Gioia, Thomas, Clark, & Chittipeddi, 1994; Isabella, 1990; Weick, 1979). People act on their interpretations of the world (Berger

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& Luckmann, 1967); thus, their understandings must change if their actions are to change substantively. How people make sense of technology is an important component in organizational change in which information technology (IT) plays a central role (Gephart, 2004; Griffith, 1999). Managers may hope for organizational transformation through IT use, but such results are difficult to achieve (Markus, 2004). Inertia or limited application are more common outcomes than significant changes in how people think about and perform work using IT (Orlikowski, 2000). Understanding and guiding interpretive processes could help managers to improve these organizational change outcomes.

Arguing for a systematic theoretic approach to studying interpretation related to IT in organizations, Orlikowski and Gash (1994) articulated a perspective centered on technological frames of reference (TFR). They defined technological frames as the knowledge and expectations that guide actors' interpretations and actions related to IT. They posited that social groups have shared frames and that differences in these groups' frames can inhibit effective deployment of a technology. The TFR framework has been cited across a wide range of research publications; subsequent studies have extended TFR concepts to provide valuable insights on IT-related change.

Broad citation is one measure of a theory's appeal, and the TFR framework has demonstrated value for investigating IT and organizational change. However, brief citations to Orlikowski and Gash's (1994) seminal article far outnumber substantive applications of the theoretic framework (Davidson & Pai, 2004),[1] suggesting what DiMaggio (1995) referred to as "theory as slogan"; that is, simplification of a theory in "ritual citations" has occurred. In this article, I argue that TFR research has much to contribute to theory and to practical knowledge about organizational change, but the promise of this framework has not yet been fully realized. I revisit tenets of the TFR framework in Orlikowski and Gash's article and findings from subsequent studies to highlight research strategies that could stimulate theory development. I consider each area in detail and conclude with implications for practice and further research.

REVISITING TECHNOLOGICAL FRAMES

Orlikowski and Gash (1994) outlined the core tenets of an analytic approach centered on the concept of technological frames of reference to study interpretive processes related to IT in organizations. Their central concern was how organization members make sense of information technologies and how their interpretations influence their actions related to IT. Drawing from the literature on social cognition in organizations,[2] they defined technological frames as

> that subset of members' organizational frames that concern the assumptions, expectations, and knowledge they use to understand technology in organizations. This includes not only the nature and role of the technology itself, but the specific conditions, applications, and consequences of that technology in particular contexts. (p. 178)

They defined frame structure as categories or domains of knowledge and frame content as the specific knowledge within a domain. Frames act as "webs of meaning" that are flexible in structure and content and that shift in salience over time and context.

From sociological studies of technology innovation (Bijker, Hughes, & Pinch, 1987), Orlikowski and Gash (1994) drew the concept of relevant social groups and shared frames. Relevant social groups include individuals whose interactions and experiences with a technology are similar. Group members tend to develop similar frames of reference that guide their understanding and uses of technology in similar ways. To the extent that frames differ among relevant social groups, that is, are incongruent in structure or content, problems such as misaligned expectations, contradictory actions, resistance, skepticism, and poor appropriation of IT may occur (Orlikowski & Gash, 1994). Interventions aimed at overcoming incongruence ideally result in frame alignment and improve organization outcomes.

Orlikowski and Gash's (1994) article has been widely cited in a variety of disciplines to point to the importance of interpretive processes related to IT in organizations. Subsequent empirical research has used the TFR framework to identify frame domains and content in different technology and organizational settings (Table 1), typically to examine the consequences of frame incongruence (Table 2). These studies describe the course of IT-related change programs using a "snapshot" of frames to explain sensemaking, managerial decisions, and organizational outcomes; several studies explicitly examined framing as an interpretive process (Table 3).

Despite these developments, the TFR framework has yet to reach its potential as a theoretic perspective on IT-related organizational change. Each TFR study stands more or less alone, providing deep insights on the organizational case studies reported. Such studies produce a theoretically informed interpretation of the research context (Walsham, 1995), which is one form of general knowledge (Lee & Baskerville, 2003), but they are not conducive to building a cumulative base of empirical findings or cross-case comparisons, which could facilitate articulation of general TFR theory. I suggest that with some reorientation, such theory building is feasible and that the TFR framework could produce more general knowledge about IT and organizational change than is currently the case.

A first step would be to shift attention to the characteristics and consequences of frame structure rather than focusing on frame content. Frame content is always context specific, but frame structure could be conceptualized and investigated in ways that facilitate comparative analyses across cases. Increasing research emphasis on framing as an interpretive process could move TFR research beyond the issue of frame incongruence to questions related to frame structure and interpretive power. Investigating the cultural and institutional foundations of TFRs would provide a broader contextual basis for organizational studies of IT-related organizational change (Chiasson & Davidson, 2005).

In the next sections, I consider each of these areas and discuss how TFR research might proceed. This discussion focuses on the TFR framework as outlined by Orlikowski and Gash (1994) and refined or substantively applied in subsequent studies. My goal is to provide a more nuanced, richer appreciation of how TFR research could inform understanding of IT-related organizational change and to suggest paths

forward to do so. Other streams of interpretive research addressing organizational change and sociological studies of technology innovation are beyond the scope of this article. In particular, I did not include research based on Bijker's (1995) theory of technological frames. Research in this stream shares ontological assumptions with TFR research but differs in its focus on technology innovation rather than applications of IT within organizations and in theorizing technological frames as a social rather than a sociocognitive phenomena.[3] I do however consider aspects of Bijker's theory relevant to further development of TFR theory.

IN SEARCH OF STRUCTURE

The assumption that technological frames are specific to particular users, technologies, and organizational contexts is a core premise of the TFR framework and is consistent with theoretic perspectives of knowledge as socially situated within communities of practice (Lave & Wenger, 1991; Wenger, 1998). Thus, TFR analysis requires researchers to elicit the deeply held assumptions and knowledge about a specific IT application in its organizational context. The result is a contextually bounded enumeration of frame domains and content for one or more groups in the organizations studied. Each study provides deep insights on interpretive processes and outcomes in that organization (Walsham, 1995). However, continued enumeration of frames in different organizational settings does not further the development of TFR theory per se. An analytic strategy that could help researchers to further develop the theoretic framework for TFR research is to focus on structural aspects of technological frames rather than frame content.

Similarities in Frame Domains Across Cases

Although the content of frames is context specific, some similarities in frame domains have developed across organizational case studies (see Table 1). The following three frame domains appear to be widely applicable: (a) frames related to information technology features and attributes, (b) frames related to organizational applications of IT, and (c) frames related to incorporating IT into work practices. Orlikowski and Gash (1994) identified the nature of technology, technology strategy, and technology-in-use as frame domains that influenced organization members' understanding of a groupware technology and their appropriation of it. Subsequent TFR studies have used these categories to examine frame content related to other technologies in a variety of organizational settings (Iivari & Abrahamsson, 2002; McGovern & Hicks, 2004; Shaw, Lee-Partridge, & Ang, 1997; Yoshioka, Yates, & Orlikowski, 2002).

Some TFR researchers developed unique frame domains grounded in contextual data that were similar to these generic categories. The nature of technological change (Barrett, 1999) and business value of IT (Davidson, 2002) frame domains were concerned with organization members' understanding of how IT could be used to alter business processes and relationships. The requirements for the system (Lin & Cornford, 2000; Lin & Silva, 2005) and IT capabilities and design (Davidson, 2002)

TABLE 1
Categories of Frame Domains Used in Technological Frames of Reference (TFR) Studies

Generic Frame Categories	*Frame Domains Identified in TFR Studies*
Frames related to information technology (IT) features or attributes	IT capabilities and design (Davidson, 2002); Nature of technology (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw, Lee-Partridge, & Ang, 1997); Nature of user-centered systems development (Iivari & Abrahamsson, 2002); Requirements (Lin & Silva, 2005); Solution to the problem (Lin & Silva, 2005); The nature of problems (Lin & Cornford, 2000); Understanding of the problem (Lin & Silva, 2005); View of technology (Yoshioka, Yates, & Orlikowski, 2002)
Frames related to potential organizational applications of IT	Business value of IT (Davidson, 2002); Motivation and criteria for success (Iivari & Abrahamsson, 2002); Nature of technological change (Barrett, 1999); Rationale for technology (Yoshioka et al., 2002); Requirements for the system (Lin & Cornford, 2000); Technology strategy (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw et al., 1997)
Frames related to incorporating IT into work practices	Issues around use (Lin & Cornford, 2000); IT-enabled work practices (Davidson, 2002); Nature of business transactions (Barrett, 1999); Technology-in-use (McGovern & Hicks, 2004; Orlikowski & Gash, 1994; Shaw et al., 1997); Use of technology (Yoshioka et al., 2002); Use of user-centered systems development (Iivari & Abrahamsson, 2002)
Frames related to developing IT applications in organizations	Business value of systems development (Ovaska, Rossi, & Smolander, 2005); Images of implementation (Lin & Cornford, 2000); IT delivery strategies (Davidson, 2002); Systems development capability (Ovaska et al., 2005); Systems development resource allocation (Ovaska et al., 2005); Systems development strategy (Ovaska et al., 2005); Type of partnership (McGovern & Hicks, 2004); Understanding of the project (Lin & Silva, 2005)
Other frame categories	Importance of market institutions (Barrett, 1999); Ownership of technology (Shaw et al., 1997); Vision of reskilling/type of change (Gallivan, 2001)
Unidimensional, social frame	Frame in the social construction of technology sense (Khoo, 2001; McLoughlin, Badham, & Couchman, 2000)

frame domains concerned knowledge of IT features and attributes. Similar to Orlikowski and Gash's (1994) technology-in-use category, the nature of business transactions (Barrett, 1999), IT-enabled work practices (Davidson, 2002), and issues around use (Lin & Cornford, 2000; Lin & Silva, 2005) domains centered on how organization members' expected work practices would change with IT use.

Knowledge and expectations about how change occurs is an important component of organizational discourse (Grant, Michelson, Oswick, & Wailes, 2005). Frames related to the technical change process are evident when the scope of a research study

includes IT development or implementation. Davidson (2002) identified IT delivery strategies as a salient domain category during the requirements determination phase; team members' ideas about how to develop a new information system influenced their ideas about what features and functions to develop. Ovaska, Rossi, and Smolander (2005) focused on how frames about technology development influenced decisions about system requirements, identifying four related domains (business value of systems development, system development strategy, capability, and resource allocation). McGovern and Hicks (2004) identified type of partnership as a frame domain in an action research project; differing ideas about the respective roles of project participants and purposes for the project affected the direction of the change program. Lin and Cornford (2000) described images of implementation as technologists' approach to selecting an electronic mail system. Moving beyond the systems development process, Gallivan (2001) analyzed visions of reskilling: Members of a technology department had different ideas about the magnitude of change (first, second, or third order) intended in a reeducation program.

Structural Properties of Frames

Despite some similarities in frame domains identified across cases, TFR researchers continue to develop unique descriptions of frame content. The use of standardized instruments to identify or measure frames is not consistent with the ideographic assumptions of the TFR framework. However, structural properties of frames could be assessed in more general, analytic terms; doing so could facilitate cross-cases comparisons and articulation of a more general interpretive theory of IT and organizational change.

Walsh (1995) made a similar observation about social cognitive research and suggested that studies of structure may be more fruitful for theory development than studies of content. For example, in open-ended strategy setting activities, Fiol (1994) found that consensus in both content and structure was not required for organizational learning and action. Defining frame structure as the way individuals construct arguments, the breadth of issues considered, and the rigidity or fixedness of framing, she found a broad, flexible structure accommodated managers' diverse ideas and facilitated their joint actions. Walsh, Henderson, and Deighton (1988) identified coverage, that is, the breadth of content, and consensus, or the extent to which individuals working in groups share content in a frame domain, as key structural properties of a group's knowledge structure. They hypothesized that broad knowledge coverage and low consensus would contribute to idea generation and decision making but found that low coverage and high consensus were associated with decision-making efficiency for well-defined problems. Similarly Kilduff, Angelmar, and Mehra (2000) found that cognitive diversity was important in open-ended planning stages but that integrated, focused cognition during implementation improved organizational performance.

Such findings suggest interesting possibilities for TFR research. For instance, effective frame structure may differ during early planning, requirements determination, implementation, and operation of a new IT application: If a simplified but inclusive frame develops among diverse stakeholders as a project moves from early planning

TABLE 2
Areas of Focus in Technological Frames of Reference (TFR) Studies

Implications of Frames	*TFR Publications*
Incongruence (problematic or negotiated)	Barrett (1999); Gallivan (2001); Iivari and Abrahamsson (2002); Khoo (2001); McGovern and Hicks (2004); McLoughlin, Badham, and Couchman (2000); Lin and Cornford (2000); Lin and Silva (2005); Orlikowski and Gash (1994); Ovaska, Rossi, and Smolander (2005); Shaw, Lee-Partridge, and Ang (1997); Yoshioka, Yates, and Orlikowski (2002)
Political processes (dominant frames)	Barrett (1999); Davidson (2002); Lin and Cornford (2000); Lin and Silva (2005); McGovern and Hicks (2004); McLoughlin et al. (2000)
Structural assessment of frames	Cognitive maps of factors influencing knowledge sharing and knowledge acquisition/capture (Law & Lee-Partridge, 2003); Multidimensional scale analysis of frames related to a geographic information system (Sahay, Palit, & Robey, 1994)

stages to implementation, their interpretive burden may be lightened, their actions clarified, and the change process facilitated. Comparative studies of frame structure might reveal such patterns or associations between frame structure and organizational outcomes. In this regard, frame incongruence among groups may not always be problematic and may even be beneficial at some points in a change program.

Orlikowski and Gash (1994) provided limited guidance on the question of frame structure. They defined frame structure only as categories or domains of knowledge, suggested structural differences in frame domains across relevant social groups as a source of frame incongruence, and highlighted the structural aspects of incongruence and its consequences as an area of future research. Although several TFR studies have addressed incongruence (Table 2), little attention has been given to its structural aspects. An exception is Khoo's (2001) assessment of digital libraries, which posits that frame difference might exceed incongruence and become an incommensurate level of interaction, that is, "one in which the concepts of one frame cannot be understood in terms of the concepts of the other frame . . . incommensurability stresses that the data are in themselves differently constituted" (p. 158).

Blending Qualitative and Quantitative Approaches

One possible explanation for the lack of research attention to frame structure and structural aspects of frame incongruence is the reliance on qualitative data collection and analytic methods in TFR research. Qualitative methods are well suited to the interpretive, idiographic assumptions of the TFR framework, but they provide limited procedures to assess frame structure. Sahay, Palit, and Robey (1994) illustrated a mixed qualitative-quantitative method for TFR identification—multidimensional scaling (MDS)—in which researchers used interviews to solicit dimensions from study participants and then used content coding to develop the frame dimensions. Participants

were asked to assess and order each dimension, and the results were subjected to statistical analysis to assess frame similarities and differences. Repertory grid techniques are another type of quantitative method that involves identifying of elements, constructs, and the links between them to create cognitive maps (Tan & Hunter, 2002). This method could be used to elicit individuals' technological frames (as cognitive maps), evaluate differences between frames, and monitor changes in frames over time. Tan and Hunter (2002) suggested that using the repertory grid technique might also help the practitioners who participate in exercises to recognize their tacit assumptions about IT. One caveat is that such approaches are "method bound" (Walsh, 1995), that is, each defines the elements of frame structure in methodological terms; researchers may tend to equate artifacts of the analytic process such as a cognitive map with the sociocognitive phenomena—a technological frame.

Whether qualitative or quantitative methods are used, moving beyond elicitation of frame content to consideration of frame structure and its consequences could facilitate cross-case comparisons, which in turn could contribute to further articulation of more general TFR theory. I am not suggesting that standard measurement instruments or variance models, common in social cognitive research, are appropriate. TFR research is and should remain an interpretive, process theory (Orlikowski & Gash, 1994). Studies of frame structure, change in frame structure, and related organizational change outcomes could be conducted consistently with the assumptions of the TFR framework yet still produce a more general understanding of IT and organizational change. I consider some of these possibilities in the next section.

FROM FRAMES TO FRAMING

A typical TFR study identifies stakeholder groups, analyzes how frames influence organization members' sensemaking, investigates incongruence in their frames, and assesses its consequences. Point-in-time snapshots of frames are used to analyze stakeholders' interpretation and actions related to a new information technology. Orlikowski and Gash's (1994) study illustrated this pattern, as do a number of subsequent TFR studies (Table 3). A more dynamic perspective of frame change as an ongoing interpretive process, triggered by a variety of organizational circumstances, could help move TFR research beyond these well-established tenets of TFR theory.

Environmental and Organizational Triggers for Framing

Change in interpretive processes can be triggered by many circumstances in which incongruence among groups' frames may not be the critical factor. Key actors' interpretations of change in the organizational environment are important triggers for interpretive shifts within the organization (Bartunek, 1984). Interpretive processes may differ depending on whether environmental changes are unfamiliar or familiar to the organization (Barr, 1998). Frame shifts that are triggered by external events can be abrupt and of short duration, but they nonetheless influence organization members' actions for a time (El Sawy & Pauchant, 1988) and can thus affect outcomes. Interpre-

TABLE 3
Frames Versus Framing in Technological Frames of Reference (TFR) Studies

Study Design	*TFR Publications*
Longitudinal; framing process	Davidson (2002); Lin and Cornford (2000); Lin and Silva (2000); McLoughlin, Badham, and Couchman (2000); Ovaska, Rossi, and Smolander (2005)
Longitudinal; static frames	Barrett (1999); McGovern and Hicks (2004)
Point in time; static frames	Gallivan (2001); Iivari and Abrahamsson (2002); Khoo (2001); Law & Lee-Partridge (2003); Orlikowski and Gash (1994); Sahay, Palit, and Robey (1994); Shaw, Lee-Partridge, and Ang (1997); Yoshioka, Yates, and Orlikowski (2002)

tive shifts can also be triggered by changes in a group's membership or individuals' influence within the group (Walsh et al., 1988).

With IT-related change, environmental triggers such as the development of a new technology, market changes, moves by competitors to employ a new information technology, regulatory change, and so on may result in interpretive shifts within an organization. When the executive champion of an IT project changes, a new champion can bring influential new ideas and priorities to the project, triggering interpretive shifts that influence the course of a change program (Newman & Sabherwal, 1996). Investigating the circumstances that trigger such interpretive shifts could broaden TFR research beyond the current emphasis on incongruence to highlight the ongoing process of framing that often occurs in IT change projects.

Davidson's (2002) longitudinal investigation of requirements determination illustrated how organizational turbulence led to frequent frame shifts. In some instances, the project team's frames shifted toward more innovative ideas for IT use as the business applications of IT frame domain became highly salient and toward limited definitions of the project requirements when the IT deliveries strategy domain was more salient to team members. The project team's frames did not stabilize over a series of framing episodes, contributing to the project's failure to move beyond requirements into implementation. Building on this episodic approach to framing, Ovaska et al. (2005) demonstrated how requirements were shaped and interpreted through interpretive social processes of filtering, negotiating, and shifting. When participants drew on incongruent frames, filtering led to differences in project team members' understandings of requirements and difficulties with the project. Incongruence was resolved as frames shifted toward common ground, allowing a shared understanding of requirements to be negotiated.

These studies suggest that structural properties of frames such as rigidity and flexibility can influence the outcomes of interpretive processes during IT change. If frames are overly sensitive to change triggers, shifting frame salience may be disruptive. On the other hand, overly rigid frames could hinder recognition of important environmental cues. The specific course of a framing process in an organization and the environ-

mental, political, or other circumstances that influence this process are specific to the organization studied. Nonetheless, such studies of structural frame change have the potential to contribute to a general process theory of technological framing within organizations. Employing techniques such as qualitative comparative analysis (QCA; Becker, 1998) for cross-case or with-case analysis could facilitate the identification of patterns of frame structure, changes in frame structure, and associated organizational outcomes.

Theorizing About Structural Change in Framing

The TFR framework to date offers little guidance on questions related to changing frame structure and its implications for organizational outcomes. However, Bijker's (1995) concepts of frame stabilization and closure could be brought to bear to investigate such questions. Stabilization occurs within a relevant social group when members begin to talk and think about the technology in increasingly uniform and certain terms. That is, group members progress from understanding what a new technology might be used for to what it will be used for to what it is used for, increasing their focus on certain features and applications and simplifying frame content. The result could be increased certainty among group members about the meaning, strategy, and implications for practice of the technology. However, highly stable frames might contribute to escalation of commitment to a failing project (Newman & Sabherwal, 1996) if contextual cues inconsistent with the frame are filtered out of consideration. Alternatively, unstable frames could contribute to deescalation of commitment to a project (Keil & Robey, 1999) if group members are unable to maintain their focus on intended outcomes. Davidson (2002) demonstrated how instability in frames destabilized understanding of intended changes and lowered commitment to the project.

Closure implies that "the interpretive flexibility of an artifact diminishes. Consensus among the different relevant social groups about the dominant meaning of an artifact emerges" (Bijker, 1995, p. 86). Closure and frame congruence are related concepts. When the frames of relevant social groups are congruent (similar in domains and content), they may have reached closure within the organization, at least temporarily. Frame incongruence suggests lack of closure related to IT and organizational change. Although incongruence has generally been viewed as problematic in TFR research, Bijker's (1995) concept of closure does not have this normative implication. However, many organizational IT applications are complex artifacts that require highly coordinated and collaborative uses. In these instances, lack of closure in technological frames among organizational groups is more likely to be problematic.

Interpretive Power in Framing Processes

Orlikowski and Gash (1994) positioned the TFR framework as a complementary perspective to studies of power and politics; however, resolving incongruence to align frames implies that some groups' frames have to change or be changed. Davidson (2002) observed that interpretive power is brought to bear when dominant frames form the basis for others' understanding of technology, for example, when prominent indi-

viduals such as executive champions, project leaders, or lead designers (Heng, Trauth, & Fischer, 1999; Newman & Sabherwal, 1996) take a prominent role in IT-related organizational change programs. In these situations, it becomes difficult to isolate interpretive processes from power and political processes (Markus & Bjørn-Andersen, 1987).

The intertwining of interpretation and power is evident in several TFR studies. McLoughlin, Badham, and Couchman (2000) demonstrated that frame stabilization and closure were the result of political processes within the organizations studied. Davidson's (2002) analysis of a requirements determination project demonstrated how an executive manager stimulated others' thinking about new uses of IT to change the organizational culture, and at various times, his frames dominated others' thinking about the project. McGovern and Hicks (2004) illustrated how the executive director's ideas about IT use became the dominant frame that overrode others' ideas and dictated project decisions. Lin and Cornford (2000) drew on actor-network theory to explain how one group manipulated others' frames to gain support for their own technology selection, and Lin and Silva (2005) posited that framing occurred primarily through the exercise of power.

These TFR studies illustrate how the influence of powerful organizational individuals can affect the content and direction of a framing process, but they do not consider where or how individuals' and groups' frames come to be. To do so, researchers may need to look outside the organization's boundaries to consider the societal and cultural origins of frames.

LOOKING OUTSIDE THE ORGANIZATIONAL "BOX"

TFR researchers have investigated frame content within a number of organizational settings. In doing so, they have shown little interest in how individuals and groups come to have the frames they have. Orlikowski and Gash (1994) noted only that frames arise from education, work experience, and interactions within relevant social groups. This approach may overstate the context specificity of frames. Organization members' interpretations and actions related to IT reflect to some degree the sociocognitive influences that arise within the institutional setting of the organizational environment (Chiasson & Davidson, 2005). Scott (2001) commented, "Individuals do construct and continuously negotiate social reality in everyday life, but they do so within the context of wider, pre-existing cultural systems: symbolic frameworks, perceived to be both objective and external, that provide orientation and guidance" (p. 41). Institutional logics—the organizing principles that underlie practices and belief systems within an institutional setting—play a powerful role in shaping individuals' interpretations and legitimizing their actions (Scott, 2001). Frames that appear to be contextually specific to an organization may be drawn from the organizational field in which the organization operates. An organizational field includes key suppliers, regulatory agencies, and other organizations that produce similar services or products (Powell & DiMaggio, 1991). Institutional logics develop within these networks of organizations and tend to be shared. Bogner and Barr (2000) illustrated how similar interpretive

approaches emerged among organizations experiencing turbulent environments and became self-perpetuating and reinforcing across the industry. Some have argued that industry-level frames exist as a phenomenon that is more than the aggregation of individual or even organizational frames (Porac, Thomas, & Baden-Fuller, 1989).

Barrett's (1999) study of the London Insurance Market demonstrated how institutional logics can permeate organizational boundaries and influence members' interpretations of and actions toward information technology. He commented, "The meaning structures suggested by the socio-cognitive concept of technological frames needed to be embedded in structured contexts such as norms and relations of power" (p. 9). He linked technological frames of stakeholder groups to cultural assumptions in the organizational field (i.e., the importance of face-to-face interactions to identity and trust) and identified the importance of market institutions as a frame domain within this organizational field.

Heracleous and Barrett (2001) analyzed this case of organizational change as discourse, stating, "We approached deep structures as persistent features of discourse that transcend individual texts, speakers, authors, situational contexts and communicative actions and pervade bodies of communicative action as a whole and over the long term" (p. 758). Examining the structure of discursive arguments over time and across stakeholder groups in this organizational field highlighted common assumptions and expectations about IT-related change within stakeholder groups in the organizational field, differences between groups, and the persistence of some ideas over time. In this case, the market leaders' frames differed significantly from those of brokers and underwriters and conflicted with their long-held values related to face-to-face interaction and professional identity. Eventually, the latter groups prevailed, and IT applications that challenged their cultural expectations were discontinued.

Another discourse-based approach to examining frames and framings in interorganizational settings is Swanson and Ramiller's (1997) organizing vision concept. They defined an organizing vision as "a focal community idea for the application of information technology in organizations . . . a vision for organizing in a way that embeds and utilizes information technology in organizational structures and processes" (p. 460). The community is comprised of developers, suppliers, customers, vendors, regulators, academics, journalists, and pundits who contribute to the discourse related to an innovation. An organizing vision facilitates community members' interpretations of the social and organizational implications of an IT innovation, legitimizes its diffusion and adoption, and mobilizes resources in support of the innovation. Swanson and Ramiller did not suggest that an organizing vision represents a consensus view among stakeholders; competitive views and perspectives are common as various stakeholders attempt to shape the organizing vision to their own advantage. Nonetheless, it would be theoretically interesting to conceptualize an organizing vision as a field-level technological frame and to analyze content and structural changes in the organizing vision that evolve within this broader context as well as to consider how the vision is appropriated and shaped within an organization. Heracleous and Barrett's (2001) approach to discourse analysis would be useful for such inquiries.

Extending research beyond the organizational boundary in these ways would have two important benefits for TFR theory. First, as information technology applications

increasingly involve interorganizational alliances and even whole industries, such studies will become more important and valuable for understanding the implications of IT innovations and related social changes (Crowston & Myers, 2004). Second, findings at the organizational level may prove to have application at a broader institutional level of analysis, that is, the organizational field, than has generally been considered (Chiasson & Davidson, 2005). Such an approach will be particularly important in industry settings in which IT innovation has the potential to challenge or to reshape the institutional logics of the organizational field.

THE RESEARCH CHALLENGES AHEAD

In this article, I argued that the TFR framework has provided a valuable perspective on IT and organizational change and generated useful insights for practice, but TFR research has not yet reached its potential. I also argued that further theoretic development is possible with some reorientation of research strategies. I outlined the following three strategies for TFR theory development: focusing more attention on frame structure in analysis, increasing emphasis on framing as a dynamic process and on the characteristics of this process, and expanding the context for TFR inquiries into the organizational field to include cultural assumptions and institutional logics.

These research strategies offer opportunities and risks. TFR research involves field research, qualitative data collection and analysis, and in-depth case study design. Such research programs are time-consuming for the researcher and do not always produce interesting research findings if the phenomena of interest do not develop at the site. They also rely on retrospective sensemaking to account for change over time when a longitudinal engagement at the field site is not feasible. Retrospectively explaining failure due to a framing process gone awry is less satisfying to the organization members who experience such a program than successfully managing this process. An alternative to traditional research design is action research (Avison, Lau, Myers, & Nielsen, 1999). In action research, the research team attempts to generate the phenomena of interest, such as an interpretive shift, through cooperative interventions with partners in the organization and in doing so, helps the organization achieve desired outcomes. Positive outcomes are not guaranteed however, as several TFR studies that used action research methods demonstrated (e.g., McGovern & Hicks, 2004; McLoughlin et al., 2000).

Whether quantitative methods are needed to capture and depict frame structure or to assess framing processes over time is yet to be determined. Although qualitative methods do not easily lend themselves to formal structural analysis, it is not clear whether quantitative methods such as MDS or Rep-Grid are a superior approach for TFR analysis. Experimenting with mixed qualitative-quantitative methods will help TFR researchers to determine their added value over purely qualitative approaches for intraorganizational studies. Quantitative methods are impractical for field-level frame studies where the scope of organizations and participants is broad. Discourse analysis methods (e.g., Heracleous & Barrett, 2001) offer a more likely solution to studies of this scope.

IMPLICATIONS FOR PRACTICE

Information technologies present opportunities for significant organizational transformation, but IT-related change programs are risky and hard to carry out successfully (Markus, 2004). In addition to the technical challenges of selecting, implementing, and adapting business procedures to a new technology are numerous social and organizational challenges. TFR research highlights the importance of interpretive processes related to IT in organizational change programs. It also points to actions that could improve organizational outcomes. Simply communicating about an IT-related change program may be ineffective for bringing about desired outcomes because various groups may have incongruent frames, and thus group members may interpret any communication differently. First steps in a planned change program might include identifying technological frames of key stakeholder groups within the organization, assessing areas of incongruence between groups, and if necessary, undertaking interventions to align frames. Aligning frames ideally would involve surfacing tacit frames within groups and comparing frames across groups so that some common understanding, sufficient for joint action and interaction, emerges. Table 1 summarizes the categories of frame domains that researchers have found useful to identify frames and study framing processes; these domain categories could be used as a starting point for an organization's self-assessment. Change managers might use focus groups, interviews, or surveys to assess frames, paying close attention to metaphors and stories that reflect technological frames (Davidson, 2002).

Aligning frames may involve imposing a dominant frame or manipulating other groups' understanding to align with this frame to meet managerial goals. Such political approaches are risky and often fail, but they are sometimes sufficient to bring about a satisfactory degree of IT implementation and to achieve a level of organization improvement (e.g., Lin & Silva, 2005; McGovern & Hicks, 2004). Moreover, frame incongruence is not always problematic and conceivably could be beneficial if the result is that a broader base of knowledge is brought to bear during a change program and if areas of incongruence are recognized and acknowledged. In such cases, understanding frame structure, such as the breadth, complexity, or rigidity of frames, and assessing whether frame structure can be changed may be more helpful.

Moving beyond issues of incongruence, TFR research suggests that framing is an important and ongoing process during IT-related change programs that should be understood and to the degree possible, directed. Research is needed to characterize patterns of frame structure change and to assess how structural dimensions like rigidity or flexibility influence organizational outcomes. Improved understanding of how stabilization and closure develop and how these framing process outcomes influence organizational outcomes is also needed. In projects of long duration, periodic reassessments of how various groups' frames are changing in content or structure and how frame structure is evolving could help change managers to guide or redirect these processes, for example, through training and communication programs, pilot demonstrations, and so on.

Looking beyond the organizational boundary to the institutional and cultural basis for organizational frames, change managers may come to better understand the chal-

lenges they face when change programs challenge cultural and institutional structures: Information technology applications that challenge deeply held, institutionalized beliefs are likely to be met with a high degree of resistance within the organization.

Although much theoretic work remains to be done, the TFR framework has demonstrated its usefulness for inquiries on organizational change and IT. It is my hope that the suggested research strategies outlined in this article will promote further development of this research perspective and its applications to practice.

NOTES

1. A search of the Web of Science (http://scientific.thomson.com/products/wos/) electronic database in September 2005 identified 70 citations to Orlikowski and Gash's (1994) article among peer-reviewed, academic journal publications in various disciplines; fewer than 10 employed the technological frames of reference (TFR) framework in the study. The ACM digital library (http://portal.acm.org/dl.cfm) uncovered dozens of conference publications that cited the article and a small number that described a TFR analysis.

2. See Walsh (1995) for an extensive review of the social cognitive literature.

3. A difference with Orlikowski and Gash's (1994) definition of technological frames and Bijker's (1995) definition is that Bijker defined technological frames as social rather than sociocognitive structures, noting,

> A technological frame structures the interactions among the actors of a relevant social group. Thus it is not an individual's characteristic, nor a characteristic of systems or institutions; technological frames are located between actors, not in actors or above actors. (p. 123)

In research following Bijker's approach, the technological artifact and practices are included within the frame, whereas these are distinct phenomena in TFR studies.

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