

Framing contests: micro mechanisms of strategy-making in the face of technical change

Sarah Kaplan
MIT Sloan School of Management
50 Memorial Dr., Room E52-511
Cambridge, MA 02142
617-253-4023
sarah.kaplan@sloan.mit.edu

Abstract: How do firms respond to technical change? The role of managerial cognitive frames has not been fully exploited in existing explanations for why firms do or do not make strategic choices to invest in new technologies. Yet, it seems likely that they should play a critical part in determining strategic choices since they shape management's perceptions about the environment and technology and about what action should be taken. This paper reports on a longitudinal field study examining the micro mechanisms of strategic choices about technology in one communications technology firm as it responded to the a radical transformation resulting from the fiber-optics revolution. Drawing on framing theory in the social movements literature, I develop a model of the role of cognitive frames in strategy-making dynamics as they are produced in the course of situated action. I propose that frames and framing strategies are tightly intertwined with interests and political strategies in producing strategic choices about technology investment. Looking at strategy-making in this way opens up the possibility for examining cognition not simply as frames nor even as a situated process of framing but as a politically charged and self-conscious process for negotiating meaning. A close examination of these framing contests sheds light on the tensions between adaptation and inertia that are central to research in the management of technology field.

Job talk working paper, January 2004

Draft. Not to be reproduced or cited without explicit permission of the author. This research was supported by the MIT Microphotonics Center. This paper has benefited from the comments of Robert Gibbons, Rebecca Henderson, Wanda Orlikowski, Scott Stern, Ezra Zuckerman, the HBS Qualitative Methods Research Group and the MIT Organizational Economics seminar. Earlier versions presented at EGOS, Copenhagen, July 2003 and the Conference in Honor of Keith Pavitt, SPRU, Sussex, November 2003.

Framing contests: micro mechanisms of strategy-making in the face of technical change

Much research has sought to understand the effects of technological discontinuities on industries and companies. Discontinuities are difficult for firms to manage because they demand different product architectures, change the economics of the industry, destroy existing firm competences, create new value networks in which to compete and require technology investments with highly uncertain outcomes (Christensen and Rosenbloom 1995; Henderson and Clark 1990; Schumpeter 1934; Schumpeter 1942; Tushman and Anderson 1986; Utterback 1994). This literature has not reached a consensus about why firms have different strategic responses to these challenges, which suggests that there may be a more proximal, but unexplored, explanation. In particular, while scholars in this field acknowledge the uncertainties inherent in technical change, few explicitly model the mechanisms by which firms cope with information ambiguities in order to make strategic choices about technology.

Management's cognitive frames would appear to be a natural mechanism to connect information ambiguities created by discontinuities to strategic choice. Frames filter management's perceptions about what is happening and what action should be taken (Daft and Weick 1984; Hambrick and Mason 1984), a particularly critical function during periods of technical change when the degree of uncertainty is extremely high (Finkelstein and Hambrick 1988). Yet, research in this area has devoted little attention to the role played by managerial cognition. The few studies that have linked top management frames to strategic choice and action in the face of discontinuities (e.g., Garud and Rappa 1994; Kaplan, Murray, and Henderson 2003; Tripsas and Gavetti 2000) have not fully explicated the mechanisms that drive these effects nor exploited the connections between cognition and other organizational dynamics, such as incentives, that might complicate managers' abilities to make strategy under uncertainty.

The problem of technological discontinuities is an extreme example of a broader set of issues around strategic choice. The heart of the problem is informational ambiguities, which, while always present, are particularly extreme during periods of discontinuity. The information environment does not transmit clear and easily recognizable signals. This problem is complicated by two additional factors: multiple actors are involved in making strategic choices and their incentives may not map congruently to the information that they have. These factors

further complicate the acquisition and communication of information necessary to make strategic decisions. Most strategy research takes one or another of these problems individually as its focus. And, while research in cognition suggested that cognitive frames are the means by which managers cope with information ambiguities, little work has attempted to examine how frames relate to the key problems of strategic choice *in combination*. However, it is precisely the combination of these problems that make the task of strategic choice complex. This gap suggests several research questions: What are the cognitive frames related to strategic decisions about technology during discontinuities? Through what process do these frames affect decisions? And, how are these frames connected to interests?

The nature of these questions and the current lack of theorizing about them collectively invite an ethnographic and inductive approach to research that can uncover the micro-processes that connect frames to action. This paper reports on such an ethnographic examination of how members of one firm (which I shall call “EQUIPCO”¹) made strategic choices in the context of the fiber-optic revolution in the communications components and equipment industry. Using evidence from two technology strategy projects examined over a period of several months from their inception to critical junctures in their evolution, I develop a model of the role of cognitive frames in strategy-making dynamics as they are produced in the course of situated action (Suchman 1987). This approach is aimed at joining micro-organizational processes with macro-organizational changes by “bringing work back in” to strategy (Barley and Kunda 2001) in a way that emphasizes day-to-day practices (Hendry 2000; Johnson, Smith, and Codling 2000; Whittington 1996). This field work examining cognition “in the wild” (Hutchins 1995) reveals the micro mechanisms behind the role of frames and framing in shaping strategic choice. Setting the research during the turbulent time of an emerging discontinuity should expose dynamics that would be buried beneath the surface during more stable periods (Meyer 1982).

To explicate the mechanisms linking cognitive frames and strategic choice, I draw on framing theories in the social movements literature that explore interconnections of frames and interests at a community or society level (Benford and Snow 2000; McAdam, McCarthy, and Zald 1996; Snow, Rochford Jr., Worden, and Benford 1986; Snow and Benford 1988; Zald and

¹ The identities of the firm, the projects examined, the individual informants and specific technologies are all disguised.

Berger 1978). In this view, changes in the environment create the space for new interpretations, and social movements coalesce to engage in producing and disputing these new meanings. I suggest that it is possible to apply these notions within the firm to illuminate the dynamics of strategy-making. In the context of EQUIPCO's strategy-making in the uncertain conditions of discontinuity, shifts in political opportunities, such as those generated by the emergence of the optical revolution in the communications technology industry, engendered disputes about meaning. The resolution of these disputes – in the form of framing contests² – in the context of specific projects produced investment choices about technologies.

From my observations at EQUIPCO, I built an inductive model of strategy-making that integrates cognitive frames with political perspectives in order to take into account the key strategic challenges of information ambiguity, multiple players and incongruent incentives. In this model (presented schematically in Figure 1), individuals have a repertoire of potential frames based on their context and experience, elements of which are made salient by the particular decision at hand. Proposers and challengers on a project develop framing strategies intended to increase the resonance of their own frames and therefore influence the investment decision.

This framing process is not an alternative to more interest-based political models. Indeed, in the case of the two projects (and six decisions) that I studied, I find that interests and frames, and their related processes, were strongly intertwined. The dual to the framing process is a parallel political process that emerges from individual interests. Much as individuals have repertoires of frames, they also have several different interests, only some of which are salient in a particular decision context. These interests shaped the salient frames, but reciprocally, people's frames also affected how they perceive their own interests. I observed that the framing strategies of proposers and challengers were often inseparable from the political strategies used to promote their interests. While the outcomes were shaped by those who had the most power at the end of the process, one of the critical ways to gain power was to produce a frame that resonated most strongly with the decision makers. My exploration of the mechanisms associated with frames in one firm's response to technical change suggests that it is the resolution of the internal framing contests that can explain paths towards either adaptation or inertia.

² Ryan (1991) originally coined the term "frame contests" in her work on media strategies for grassroots organizing.

-- Insert Figure 1 about here --

In this paper, I first review the literature about the three problems in understanding strategic choice and show how cognitive perspectives have or could contribute. Next, I describe the ethnographic techniques of my methodology, the research setting and the data collected. In the subsequent sections, I describe the dynamics of the several decisions studied and then use this evidence to derive inductively a more refined model for the framing contests through which decisions were made. I explore the nature of the frames themselves, describe the kinds of framing strategies used to influence decision outcomes, and show how the framing process interacts with a political process in which individuals pursue their interests in attempting to shape decisions. I conclude with implications for the managerial cognition and technology strategy literatures.

Information ambiguity, interests, cognition and strategic choice – a review

Making decisions about technology investment in a period of discontinuity is an extreme case of a broader set of problems about strategic choice highlighted by different camps in the strategy literature, problems of information ambiguity, multiple actors and incongruent incentives. In this section, I briefly review the nature of these problems, show how research on cognition has begun to shed light on the problems individually and look at some emerging clues about how one might begin to investigate the dynamics associated with their intersection.

Three problems in strategy

Problem 1: information ambiguity. Much of the current strategy canon rests on an (often implicit) assumption of the single leader or dominant coalition “deliberately choosing a different set of activities to deliver a unique mix of value” (Porter 1996: 64). For Porter, strategic choice is about positioning the firm by selecting which industries in which to participate and what strategic stance to take (e.g., cost leadership or differentiation). The underlying model is that paying attention to signals leads to more knowledge which improves assumptions and strategic choice (Porter 1980: 198-199). Companies that fail or underperform essentially ‘get it wrong.’ This set of assumptions is not unique to the Porterian positioning camp in strategy but also underlies the resource based view. The stream of research that attribute heterogeneity of firm performance to internal resources or capabilities, starting with Wernerfelt (1984) and Barney (1991), relies on the notion that it is management’s unique insight into an opportunity that drives

competitive advantage and performance. The leader is rational – or boundedly so (Cyert and March 1963/1992; March and Simon 1958) – and thus the key to making better decisions is getting more and better information. This can be extended even to the dynamic capabilities perspective which argues that "the key role of strategic management is appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competencies to match the requirements of a changing environment" (Teece, Pisano, and Shuen 1997).

Under this conception of strategy, the firm, or the business unit, is the fundamental unit of analysis, and the single decision maker at the top is at its core a representation of the firm as cognizer. Other scholars in very different traditions have called this assumption into question, arguing that research in strategy cannot simply treat firms as macro-level wholes but rather must look inside the organization at the processes and interactions that produce strategic choices. These scholars raise two additional problems with regard to strategy, those of multiple actors and of incongruent interests.

Problem 2: multiple strategy makers. Various scholars have argued that the unit of analysis in strategy should instead be the process or set of practices that produce strategic choice. Whether it is a Mintzbergian notion of emergent strategy (Mintzberg, Raisinghani, and Theoret 1976; Mintzberg and Waters 1985; Mintzberg 1973), the Bower-Burgelman model of autonomous decision making (Bower 1970; Burgelman 1996; Burgelman 1983), or a more practice oriented view of micro-processes (Johnson, Melin, and Whittington 2003; Whittington 1996; Whittington 2003), in this view, strategy-making is not a top down process from a single leader. Early, highly granular studies of strategy-making demonstrate vividly how various coalitions in organizations formed and unformed to influence particular decisions (Baldrige 1971; Pettigrew 1973). Contested and political behaviors are common within top management teams (Eisenhardt and Bourgeois 1988), and various different people or groups shape strategic choice, often in contradiction to the intentions of top management (Burgelman 1991). This stance does not necessarily exclude the role of the top leader in the organization, but it often comes in the form of setting context or establishing strategic intent (Lovas and Ghoshal 2000). The underlying assumption of this stream of research is that, given environmental turbulence (and the resulting information ambiguity), multiple people or groups in the organization have different information and therefore can, and do, make different choices about strategic direction.

Aggregating information is difficult because it is hard to communicate what one really knows as this can often have “sticky,” tacit dimensions (Polanyi 1966; von Hippel 1994)

Problem 3: incongruent interests. Another set of scholars in the organizational economics tradition have highlighted the additional complication that individuals’ interests are not necessarily mapped evenly onto the information that they possess. Differences in individual interests can lead to opportunistic behavior within the firm. As Williamson suggests, “Opportunism refers to the incomplete or distorted disclosure of information, especially to calculated efforts to mislead, distort, disguise, obfuscate, or otherwise confuse...” (Williamson 1985). Hence, incongruent interests within the firm can further complicate the acquisition and communication of the information necessary to make a decision (Aghion and Tirole 1997). Differences in interests lead to different information sharing both in amount and in kind. Career concerns, for example, influence the amount of effort put into work (Holmstrom 1982/1999), and different incentives lead to different kinds of knowledge transfer (Osterloh and Frey 2000).

Given problem 1 (ambiguity or lack of information), it would be tempting to model strategy simply as an information problem. However, the essential nature of problems 2 and 3 (multiple actors and incongruent interests) indicates that this approach would be misleading. In a world of absolutely perfect information (where problem 1 is fully resolved), problems 2 and 3 also go away: there is no aggregation problem if I can know exactly what you know; there is no disconnect with incentives if I exactly know what your interests are. However, the moment even a small amount of ambiguity is introduced (problem 1), then problems 2 and 3 become salient. Similarly, resolution of either problem 2 or problem 3 alone will not provide us a complete answer to the strategy question. Imposing a dictator as the sole decision maker (solution to problem 2 of more than one decision maker) might still produce inappropriate strategic choices because of potentially countervailing individual incentives in the organization to provide the best information. Also, perfectly aligning incentives (solution to problem 3 of incongruent incentives) does not get over the information aggregation problem because it is simply difficult to communicate what one knows. Thus, the understanding the making of strategic choices would be well served by examining the three problems in combination.

What a cognitive perspective helps explain

Various streams of research on cognition have implications for understanding the three problems of strategic choice highlighted above. Cognitive approaches suggest that it is precisely the inherent ambiguity of information that invites multiple interpretations, and that these interpretations matter for decisions and action.

Exploring problem 1: where there is ambiguous information, management interpretation matters. From its roots in notions of bounded rationality (Cyert and March 1963/1992; March and Simon 1958), the managerial cognition field has begun over the past few decades to refine our understanding of the information problem by suggesting that it is managers' interpretations or cognitive frames of the information rather than the underlying information itself that matter for strategic choice (Huff 1990; Ocasio 1997). Consistent with psychological research on bias (Kahneman and Lovallo 1993; Kahneman, Slovic, and Tversky 1994), this work has suggested that interpretations often differ significantly from 'reality' with resulting implications for strategic choice (Bourgeois 1985; Sutcliffe and Huber 1998; Sutcliffe 1994)

As a particular example, a large number of studies have suggested that management definitions of the firm's strategic group (one of Porter's core notions) shape the information gathered, the interpretations made and the strategies chosen (Baum and Lant 2003; Baum and Lant 1995; Ginsberg 1994; Lant and Baum 1995; Porac, Thomas, and Baden-Fuller 1989; Porac, Thomas, Wilson, Paton, and Kanfer 1995; Reger and Huff 1993). Managers are particularly likely to view competitive categories quite differently from each other in turbulent environments (Reger and Palmer 1996). Broader research on firm response to highly ambiguous situations such as technological discontinuity or secular market changes shows that heterogeneous outcomes could also be attributed to differences in management interpretation (Barr 1998; Barr, Stimpert, and Huff 1992; Gavetti and Levinthal 2000; Henderson and Clark 1990; Kaplan, Murray, and Henderson 2003; Siggelkow 2002; Tripsas and Gavetti 2000).

While often not explicitly addressing cognitive frames, much of the work on senior teams and change is consistent with the idea that interpretations matter for strategic outcomes (Bantel and Jackson 1989; Boeker 1997; Lant, Milliken, and Batra 1992; Prahalad and Bettis 1986; Rosenbloom 2000; Sorensen 1999; Wiersema and Bantel 1992). For example, where

environmental change is discontinuous, replacement of the entire senior team is often associated with better firm performance (Tushman and Rosenkopf 1996; Virany and Tushman 1986).

For the most part, these streams of literature tend to treat the CEO or dominant coalition as the sole decision makers in the organization, as the one(s) making the connection between information (about the environment or internal capabilities) and strategic choice. They also draw on a very psychological understanding of cognition as entirely in the mind of individuals where any collective notion of frames is an analytical construct that comes from looking at the average or intersection of individuals' views. The models developed by these scholars are variance (rather than process) theories of social action that mainly focus on establishing cognitive frames as a separate variable explaining strategic choice and action.

Exploring problem 2: where there are multiple players, interpretations are contextual and negotiated. A separate stream of research in social cognition has examined how interpretations are enacted more broadly in organizations where multiple players are engaged in producing choices. The premise of social cognition research is that people act on the basis of interpretations of the world, and in doing so enact particular social realities and endow them with meaning. Thus, shared frames are distinct concept from but related to individual frames. This research makes an explicit critique of the more cognitivist perspectives embedded in the managerial cognition literature (c.f., Lave 1988: 88-89), and instead has portrayed organizations as interpretive or sensemaking systems (Daft and Weick 1984; Weick 1995) in which the “collective mind” is generated through a system of “heedful interrelations” among the members (Weick and Roberts 1993). In this construction, frames are enacted in, not separate from, their contexts. Different environments yield different knowledge and also different forms of knowing (Hutchins 1995; Lave and Wenger 1991). A focus on the micro-level processes shows that choices both shape and are shaped by cognitive frames. This stance has been used to explain intended and unintended technical change outcomes by referring to conflicts in the different technical frames of key actors as they are enacted in particular organizational contexts (Orlikowski and Gash 1994).

This approach takes a more sociological notion of cognition by emphasizing the interaction of individuals and their contexts (Goffman 1974). Shared frames are not simply an analytical construct, but rather are negotiated meanings produced through the actions and interactions of actors. Social cognition research looks not only at these shared frames but also at

the means by which they converge or diverge. Scholars in this stream of research tend to produce process rather than variance theories, preferring to focus on the production of choices over time.

Exploring problem 3: even with incongruent incentives, goal consensus may not be the ideal outcome. Few, if any, researchers on cognition have addressed interests explicitly in their models. However, two of the underpinnings of the incentives literature could be enriched by a cognitive turn. First, Williamson's notion of interests is that all individuals are essentially the same, and that beyond some basic requirements for material subsistence, the major incentive is esteem or status. But, as Douglas (1990) points out, Williamson and others do not address how this status is collectively negotiated in the organization. This conceptualization of interests does not take into account that the interests themselves might be subject to interpretation. In particular, in more dynamic, ambiguous information situations, it may not be clear what the interests are or what the incentives should be. Second, the proposed solution to interests that are incongruent with information is to achieve goal consensus (Holmstrom 1979; Kerr 1975). The better aligned incentives are, the better the outcomes. By definition, this makes conflict dysfunctional. While some research into strategic decision making suggests that this might be the case (Eisenhardt and Bourgeois 1988), other analysis suggests that conflict and politics can actually, especially under highly turbulent situations, produce 'better' decisions (Jehn 1995; Morrill 1995).

Some emerging solutions

This article is motivated by the belief that a study that takes into account all three of these essential problems of strategy would provide fruitful insights into strategic choice in particular under situations of high uncertainty such as periods of technological discontinuity. While cognitive perspectives expand our understanding of these problems individually, there have been limited attempts in the management literature to examine their intersection³. Thomas' book,

³ Emerging research on behavioral economics and behavioral game theory has begun to explore these connections. Yet, because these approaches privilege economic explanations, they cannot accommodate processes for socially negotiating meaning. Frames still remain purely cognitive effects. These models incorporate notions of bounded rationality (which often takes the form of codes) and social utility functions (in which incentives are shaped by social interaction) to explain strategic action both within and between firms. The goal of this work has been to root economics, and game theory specifically, more deeply in cognitive science, where cognition appears in the form of social utility functions (Camerer 2003). These models suggest that even holding beliefs constant, people prefer to make decisions where they have more information (Camerer, Loewenstein, and Weber 1989), that coding systems

What Machines Can't Do, is a noted exception⁴. However, while his ethnographic exploration of the dynamics of organizational change considers “worldviews” and power simultaneously, he treats power as an exogenous factor rather than something endogenous to the framing process and does not consider mechanisms for frames to change over time.

Research in the social movements field, in particular that which focuses on framing and frame alignment in societies and communities (Benford and Snow 2000; McAdam, McCarthy, and Zald 1996; Snow, Rochford Jr., Worden, and Benford 1986; Snow and Benford 1988; Zald and Berger 1978) provides a model that that may have application within organizations as well. This work suggests that groups coalesce around different views when changes in the environment create political opportunities for action (Gamson and Mayer 1996; Snow, Rochford Jr., Worden, and Benford 1986). Actors within social movements are “actively engaged in the production and maintenance of meaning,” and the framing process is “an active processual phenomenon that implies agency and contention at the level of reality construction (Benford and Snow 2000: 613). Proposers (“protagonists”) and challengers (“antagonists”) engage in framing contests in an attempt to shape outcomes. They play out framing strategies to build their own case or neutralize the impact of the other side. These strategies are selected based on the specific issue and the difference of their own frames from those of their opponents. The effectiveness of the strategy determines the degree to which the frames resonate with others (Snow and Benford 1988). The greater the resonance, the greater is the influence on outcomes.

Taking these concepts down a level of analysis, I suggest that they can help explain the decision-making dynamics within firms during periods of discontinuity where interpretations of

developed to cope with the limits of bounded rationality can bias strategic choices towards more frequent events (Cremer, Garicano, and Prat 2003), that rather than “rationally” calculating probabilities, individuals update using categories (and can get stuck in categories even when these beliefs run counter to their own interests) (Mullainathan and Thaler 2002), and that social utility shapes choice and is contingent on actions of others (such as whether I know someone to reciprocate or not) (Gilovich 1993). Rotemberg and Saloner (2000) most explicitly address the three problems in strategic choice in combination by modeling the process dynamics portrayed by Burgelman’s qualitative field studies and including a role for management vision. Their model incorporates the idea that CEO interpretations create a context within which middle managers, acting on their own incentives, can make decisions about strategic direction even if these decisions eventually depart from the CEO’s sense of the firm strategy. While provocative, their argument ultimately hinges on incentives as the only mechanism for producing strategic choices (where interpretation is only contextual), neglecting the possibility that various members of the organization might have different interpretations, and that the resolution of the conflict between them would produce strategic choices.

⁴ Interestingly, this extraordinary book has scarcely been picked up by the management literature in general, and almost not at all by the strategic management literature.

the market and technology, of the solution and of the means for arriving at a decision can be highly disputed. In this case, the resolution of these disputes occurs in the context of specific projects and produce strategic choices about technologies.

Methodology and research design

Analytical approach

My analytical approach was open ended and inductive but was driven by a broad interest in how firms make decisions about investments in technology during periods of high uncertainty (about the nature of the frames about the environment and appropriate response and the role, if any, they played in shaping outcomes). I used ethnographic techniques to study the making of technology investment choices and followed an interpretive approach to understand the generation of meaning by the people within the organization (Gioia and Chittipeddi 1991). Studying specific practices within a single firm makes sense for these purposes because of the desire to uncover the micro mechanisms associated with the strategy-making process (Dougherty 2002; Pettigrew 1987).

My unit of observation was the project while the unit of analysis was the decision itself⁵. In each project, there were myriad decisions made each day regarding which analyses to conduct, which data to use, whom to talk with, etc. I focused on those pivotal decisions in which budget allocations were changed (decisions to invest or to cut funding for particular projects). These decisions were public in the sense that they would be made (or ratified) formally by the management team in review meetings (though they might have actually been made informally at other times). For the purposes of this analysis, I have chosen not to examine other important decisions such as layoffs that affected project composition or the change in staffing of a project (if these had no associated budget implications) because these decisions were not public in the same way, often being made by the senior executive in private without consulting the management team. As I will demonstrate in the discussion below, it is the publicness of the decisions that provoked the framing contests I analyzed (Goffman 1959).

⁵ While the analytical approach was to study the decisions as they were produced, these were impossible to identify *ex ante*. At the starting point of the research, the only evident subject of study is the project and, perhaps, the initial decision to be made. Therefore, the research proceeded by identifying projects to follow in detail. The decisions emerged over the course of the evolution of the project. The full list of relevant decisions could only be identified after the period of observation was complete.

Using the decision as a focal point of understanding management and strategy goes back at least to Barnard (1938). In the context of strategy, Allison (1971) famously used the decision as the unit of analysis to understand government policy in the Cuban Missile Crisis, and there has been some traction in studying decisions in the strategy literature as well (cf., Bourgeois and Eisenhardt 1988; Papadakis, Lioukas, and Chambers 1998). Using the decision as the unit of analysis is not unproblematic: there are many questions about the possibility of separating intent from decision and action, about the precise locus of a decision, about the possibility of capturing the informal decision rather than the formal ratification, about the risk of decontextualizing the decision, and about the difference between the front stage of visible decisions relative to the back stage of non-decision-making (Mintzberg, Waters, Pettigrew, and Butler 1990). The ethnographic approach I used in my study of EQUIPCO's decision-making should address many of these concerns by capturing the precise moments when decisions were taken (whether formal or informal), asking people about their intentions, tracking how decisions were produced, and siting the decision within the broader organizational context.

Because the research was focused on the role of cognitive frames in producing these decisions, I of necessity analyzed the individuals and groups of individuals who enacted the frames and attempted to get their frames to predominate at the point of decision. Thus, the model I develop incorporates the decisions and individuals as well as the interactions between and among them.

Research setting

To examine the dynamics of strategic choice during periods of discontinuous technical change, I chose the communications technology⁶ industry. This industry is in the midst of the fiber optic revolution that has made it possible to transmit voice, data and video communications at dramatically higher rates at lower cost (see Figure 2). While the optical revolution had its roots in the development of optical fibers in the late 1970's, implementation only began in earnest in the late 1980's and accelerated dramatically in the mid-to-late 1990's with the

⁶ This industry encompasses those firms making products, either components or systems, for the communications industry. Component suppliers provide, for example, semiconductors, lasers, cabling including optical fiber, detectors, add/drop modules, multiplexers, attenuators and/or filters. Their customers are primarily the equipment suppliers. Equipment suppliers provide systems that are built from the components and modules. They develop the architectures and platforms of the networks. Their customers are typically service providers (for long haul and metro applications) and enterprises (for local area network applications).

introduction of complementary optical technologies (erbium doped fiber amplifiers and wavelength division multiplexing) and the Internet/World Wide Web⁷. The emergence and rapid proliferation of optical technologies is tightly tied to the boom in the telecommunications equipment and components industry in the late 1990s and the subsequent bust in 2000-2002. Despite this economic downturn (see Figure 3), the technologies continued to change rapidly, generating a great deal of uncertainty and ambiguity. While the literature is inconsistent about how to characterize a discontinuity, the emergence of optical technologies would qualify under any definition as it was a dramatic improvement of cost/performance along key dimensions of merit, produced a major proliferation of new firms, changed the fate of incumbents and altered the economics of the industry.

-- Insert Figures 2 and 3 about here --

While the bursting of the telecommunications bubble in 2001 brought service provider investment in infrastructure to a relative standstill, there is ample evidence that the pace of technological change has not slowed⁸. The ongoing flux and the fact that the industry is moving at multiple clock speeds (Fine 1998; Fine and Kimerling 1997) at the same time, increases the

⁷ While optical fiber had been produced in the late 1970's by Corning, it was only introduced in the first commercial systems in 1982-85 when MCI put in fiber in the Washington-New York corridor, AT&T installed fiber in the Boston-Washington route and British Telecom lay the first submarine fiber to the Isle of Wight. The use of fiber expanded rapidly in the late 1980's but it was not without its limits. In particular, because of attenuation, the signal needed to be boosted with amplifiers at regular intervals (a number of kilometers). Amplification was very expensive because it required the conversion of the light signal into an electrical signal and then back to a light signal (known as optical-electrical-optical or O-E-O conversion). This was done with relatively costly electronics in large boxes. In addition, separate amplifiers were required for each wavelength of light. In the late 1980's, scientists began to make breakthroughs in fiber-based amplification that would avoid the O-E-O conversion and dramatically reduce the cost of amplification (mainly in the form of erbium doped fiber amplifiers, or, EDFA's). Simultaneously, research focused on finding ways to send multiple colors of light down the same fiber at the same time in order to increase the capacity of each fiber (a technique known as multiplexing). Multiplexing was prohibitively expensive because it required separate amplification for each wavelength at each amplification point. Without these technologies, sales of optical fiber itself slowed dramatically during this time period. By 1992, EDFA products were launched onto the market. This technology made multiplexing more attractive because it reduced amplification costs. Their first application was in reducing amplification costs in submarine applications where small, watertight amplifiers could be placed every 50 miles or so. Later, firms began to see the potential for applying EDFA technology in combination with multiplexing to increase the capacity of existing fibers. The first commercial dense wavelength division multiplexed network went into operation in 1995. The introduction of this technology coincided with and co-evolved with the emergence of the Internet in a way that created tremendous growth in the industry as demand for optical technologies grew rapidly in the late 1990's.

⁸ New research continues in areas as diverse as increased photonic integration to reduce packaging problems, to quantum cryptography, to further breakthroughs in low attenuation and plastic fibers, to quantum-dash lasers and semiconductor optical amplifiers. See "Optical innovators keep up the pace," by Tami Freeman, Fibers.org, February 13, 2003 and "Optical innovators maintain the momentum," by Jacqueline Hewett and Tami Freeman, Fibers.org, January 29, 2003

uncertainty of decision-making about such strategic issues as technology investments, product design, market segment targets and business models⁹. This “high velocity environment” (Bourgeois and Eisenhardt 1988) is particularly suited to my research because there is a threat of obsolescence, the pace and direction are not predictable, decisions to exploit new technologies are usually expensive, and engineering, construction and operating lags reduce flexibility at a time when more flexibility would be desired (Bower 1970).

My study was conducted at an important, multidivisional equipment manufacturer in this industry which I shall call EQUIPCO. This firm was selected as broadly representative of large incumbent firms in the industry and has a tradition in optical and non-optical communications technologies. Relative to other incumbents, this company was a leader in optical patenting and a major player in introduction of optical technologies in communications; more aggressive growth in bubble than other incumbents (Kaplan 2003). The economic downturn, which was at its most dire during the period of my fieldwork, resulted in significant layoffs and budget cutting throughout the industry, and my field site, EQUIPCO, was no exception. While the extremity of this situation was certainly unusual for the industry, it acted to heighten the visibility of the features of interest in the decision-making process. Certainly, the stakes were perceived to be higher than in the preceding “bubble” period where resource decisions were made easily with little oversight and money spent profligately across the industry. These extreme conditions served to bring out the strategy-making dynamics in greater relief than would have otherwise been the case.

Case selection

My study was conducted in the Advanced Technology Group (ATG) of EQUIPCO, a corporate level group charged with identifying and developing advanced technologies beyond the horizon of the business units. Business units had their own development groups but these were largely focused on engineering for existing products. ATG was charged not just with

⁹ For example, there are several competing technologies for next generation products such as filters (thin film vs. fiber Bragg grating vs. arrayed wave guides), optical switches (MEMS, bubble, liquid crystal and others), and platforms (e.g., silicon, indium phosphide, lithium niobate, or gallium arsenide). There is also a good deal of uncertainty around the kinds of technologies that will best meet the needs of the increasingly important metro (regional) and access (“last mile”) market segments that have lagged behind long haul in moving from analog to digital to optical. And, few in the industry share an understanding of the nature of the “killer apps” for driving demand growth in the future.

developing technologies but making sure that they have direct relevance to the market and to the internal customers, the business units. As a result, while the organization was mainly composed of technical personnel, they also had two groups of business and marketing people to help shape the business cases for the projects pursued by the organization (see Figure 4 for the general organization chart).

-- Insert Figure 4 about here --

I started with a series of unstructured orienting interviews with all of the group's senior management team and selected additional managers and engineers. These interviews focused on developing a baseline understanding of ATG's decision-making processes and on identifying specific projects that might be fruitful to follow in depth. I was also provided with the entire list of existing projects "on the books" (meaning that they had been officially approved and a budget had already been allocated to them) and through the interviews accumulated an additional list of projects that were emerging. I sought to identify cases that were in critical technology areas and in their early stages or at a critical juncture as I began my field work. To assure variation, care was taken to study very different projects within the firm so that the findings would apply across a broad range of situations, from incremental to more radical innovation, from decisions to reduce investment to decisions to make an important resource commitment, from more technology-oriented projects to those more focused on assessing market opportunities.

Due to space limitations, I describe in this paper two of the five projects I studied in depth (out of the more than 40 total projects in the group at the time of my study). These two projects – LAST MILE and MULTISERVICE – were chosen for their contrasts: they were based on completely different kinds of technologies, were led by different people, were opposed for different reasons and followed very different trajectories from initial proposal through the various investment decisions along the way. The idea is that common themes should be reflective of underlying structures rather than any more superficial commonalities in the projects. In addition to formally following these cases, I also collected general information on several other projects through the course of the interviews and observations. These data gave me a qualitative sense that the cases I selected were roughly representative of other projects in the portfolio and helped me calibrate the findings from my focal projects.

All investment decisions in the ATG organization were subject to a formal decision-making process which involved a technical *Steering Committee* made up primarily of senior technical personnel that reviewed and shaped projects until they were ready to advance for a decision and an investment *Review Board* made up of the group's senior management team that had the formal responsibility of approving and monitoring projects¹⁰. Figure 5 shows the ATG organization chart with the positions of individuals related to the LAST MILE and MULTISERVICE projects and their membership in either of the decision-making bodies.

-- Insert Figure 5 about here --

This two-tier process had been put in place about 18 months before the period of observations in order to apply more discipline to the decision-making process, especially in assuring an adequate business case had been developed. The Steering Committee and Review Board required each project being reviewed to prepare a business case using a template that included: a decision statement (time frame plus financial and human resources), a description of the technology, analysis of the addressable market and EQUIPCO's potential share (to produce a revenue value of the project to the corporation), letters of support from business units and end customers, an analysis of risks and the proposed mitigation strategy, a rationale for why ATG was the right group to run the project, program milestones, and a project plan. While these procedures sound quite formal and rational, it will become clear in the analysis of the projects that the decision-making did not always follow this path cleanly. The most important effect of the formal procedures was that resource allocation decisions became public and therefore open to dispute. While there was much wrangling in the backrooms, and decisions were not always (or even often) made in the actual formal meetings, the necessity of going through the process made possible the framing contests I observed.

¹⁰ The head of the Advanced Technology Group at EQUIPCO, Brad Copeland, describes the decision-making process technology investment as relatively formal. First, there is a Steering Committee that vets the technologies. Each project team or proposer has to fill out a loosely defined template to "go through the math" (covering market, product displacement, and other issues similar to those in a startup business plan). The technology is weighed relative to EQUIPCO and ATG priorities. The question is: "is he dreaming in Technicolor or does he have something here?" If the technology passes the test, then it will be reviewed in a quarterly (more ad hoc) meeting with the Review Board (Brad and his direct reports). This is a second level of approval and review. Investment decisions always go through these layers, at least formally.

Data collection

The core of my data collection occurred over the 8 months from April to December 2002. In this period, I conducted over 80 formal, unstructured interviews, observed more than 30 formal and informal team meetings (from 2 to 10 hours long), and collected related documentation for each project (e.g., spreadsheets, PowerPoint presentations, e-mail exchanges, agendas, and minutes of meetings). This took place in the course of seven (3-5 day) site visits to the headquarters location, five (1 day) site visits to one of the branch locations, and regular telephone meetings and interviews when I was not physically on site¹¹.

The goal of this approach was to surface multiple overlapping sources of data. Thus, for any formal meeting, I interviewed key participants before the meeting to understand their expectations and goals, I attended the meeting and took notes, I collected presentation materials as well as agendas and action item memos coming out of the meeting, and then I interviewed key participants afterwards to get their reactions and interpretations of what had happened. Not only did I focus on facts and events for the chronology (Bourgeois and Eisenhardt 1988) but I also sought deliberately to understand each informant's interpretations of the situation: in addition to the "What did you do? When? Who said what to whom?" questions of Bourgeois and Eisenhardt's "courtroom" style interviews, I also asked "Why?" While the observations and interviews were unstructured, I did focus on understanding the chronology of the project, the key turning points, the players involved, the dynamics among the team members and specifically what role frames or interpretations might or might not play in the outcomes.

Nearly all interviews were recorded and transcribed¹². In addition, I made detailed notes during each interview and wrote these up within a day. Each of the notes included a comprehensive report of the interview as well as a separate section with my reflections which included thoughts about emerging themes, surprises, new information, and contrasts with prior interviews. Due to company policy, I was not able to record the meetings I attended, but I took

¹¹ Since the company was highly geographically dispersed, the vast majority of the teams' interactions took place on conference calls with the aid of Netmeeting technology to share PowerPoint documents. Nearly all of the meetings were supplemented by a telephone connection. Therefore, I was effectively fully immersed at the site for the full 8 months because being "in the field" took on a slightly non-traditional meaning as these contacts were often conducted electronically. Other than the two weeks at the end of August when most of my informants were on vacation, I had daily contacts with informants through interviews or teleconference meetings.

¹² Two interviewees were not comfortable being recorded. For these interviews, I have interview notes only.

Careful notes and also wrote these up shortly after the meetings. Where I participated in meetings through a teleconference, I was able to type the dialogue nearly verbatim.

Analysis

My analysis followed the principles of inductive, grounded theory from cases (Eisenhardt 1989; Glaser and Strauss 1967; Sutton and Staw 1995; Yin 1984). The processing of the data began as I began my field work: I wrote commentaries on each interview and meeting and composed weekly memos summarizing emerging themes. After the field work concluded, I used my field notes, transcripts and archival materials to construct time lines for each of the projects covering both the actual events that took place and the different interpretations of those events by the key players in each project at different points in time. These chronologies included detailed information and quotes from the interviews, field notes and archival materials. This level of detail allowed me to locate the key turning points in projects and identify the mechanisms by which they were achieved. Based on the insights generated from the chronologies as well as the emerging themes from the weekly memos, I developed an initial list of themes and codes for analyzing the data. Using the ATLAS.ti text analysis software, I coded each element of the chronologies, adding new codes as they emerged through multiple close readings of the data.

Based on this information, I constructed a model by inferring from the field data hypotheses about causal relationships that led to patterns of behavior witnessed during the projects (Glaser and Strauss 1967). I iterated between raw data, emerging themes and the related literature to settle on overarching concepts and how they interrelated in a model. To assure internal validity, I searched for patterns and underlying mechanisms by comparing across decisions to look for differences and understand why they occurred. Once I had developed a preliminary model of the dynamics associated with the strategy-making in each of the cases, I conducted a series of additional interviews with key informants to validate the themes, iterating further where differences emerged. In the next section, I present the findings from the analysis of the six decisions in LAST MILE and MULTISERVICE.

Findings – how framing contests produced strategic choices at EQUIPCO

The analysis in the paper covers two projects – LAST MILE and MULTISERVICE. Each of these projects reflects a different strategic choice about EQUIPCO response to the crisis in the evolution of optical technologies. LAST MILE was a proposal to introduce optical

technologies all the way to the end user access point in order to increase demand for bandwidth throughout the system and relieve the glut in the optical core. MULTISERVICE was a proposal to develop a bridging technology that allows customers to maintain legacy equipment while taking advantage of new optically-enabled technologies in the network. Table 1 summarizes the main thrust of the two projects (unit of observation) and the specific pivotal decisions studied in each (unit of analysis). In this section, I describe the evolution of each of the projects and demonstrate the role frames played in shaping strategic choices.

-- Insert Table 1 about here --

LAST MILE

The LAST MILE project was initially proposed by Hugh Collins, a senior scientist in ATG, to expand optical or high bandwidth access technologies. As optical technologies spread throughout the communications system, the “last mile” was the least penetrated because the economics had not historically supported expansion. With the crash in the long haul optical market, people like Hugh Collins perceived that a solution to the glut of bandwidth in the long haul was to increase the ability of users to access it by installing high bandwidth, likely fiber-based, connections to those without them. The contested views in this project revolved around differences in beliefs about the future level of demand (“access optimists” vs. “access pessimists”) and about the appropriateness of optical technologies (in particular the “Widget”¹³ that Hugh had previously prototyped) as a solution to the access bottleneck. The project proceeded through three hotly contested decisions, an initial decision to initiate a “100 day” study to scope out a major technology development project, an interim decision to continue the study despite very strong opposition to halt the project, and a final decision to make a small investment in technology development to support a single EQUIPCO product line.

In the evolution of the LAST MILE project, the frames of the proposers and challengers differed significantly. Each group engaged in efforts to shape the frames of others, and other time, these efforts led to investment decisions. Regarding the Widget/anti-Widget debate in the LAST MILE project, Hugh saw himself as an expert in access technologies and Widgets in particular, and felt that those who did not understand (those “who spell ‘access’ with a ‘k’” as he

¹³ The nature of the technology is disguised.

termed it) should not have a legitimate claim on influencing the decisions about the project. From his perspective, if the marketing team did not want to spend “a red cent” digging up a road to put in fiber, it must have been because they did not understand. His remedy for lack of understanding was data and analysis. In this project, it came in the form of PowerPoint documents running in the hundreds of pages filled with data to show the need for optical technologies to solve the access problem and profiling detailed specs of proposed solutions. The data-driven approach went hand-in-hand with a belief in discussion and consensus as a way to mobilize people to support a particular frame. Initially, proposers and challengers on felt that they could win the day if they could only get the other side to understand their views.

When the business team presented an analysis of market economics that they claimed supported the view that the solution had to be “backhoe free” (in other words, no new installation of fiber), the technical working team claimed that the economics were not granular enough and launched a counter effort to specifically map out the limitations of the existing copper for key customer segments. Much of the debate got crystallized around whether people supported or opposed an optical solution (based on the Widget technology). These struggles were complicated by the high level of uncertainty about the future evolution of the market – both the technical and business team struggled to identify potential “killer apps” that would drive a discontinuous increase in demand for bandwidth. Though neither side could agree on one nor a few of these drivers, the technical team continued to hold a belief that one would emerge. The business team insisted that if one could not be identified, then it was unlikely to materialize. By mid-July, the business team had concluded with “90%” certainty that the project should not continue after the interim review date, while the technical team were more convinced than ever that a solution was needed and was possible.

This data and analysis-based framing strategy failed on both sides. Hugh Collins noted about the challengers to the project that “If they find facts to support their view, they grab it at face value. Anything that contradicts their view, they put through a micro-fine sieve.” Reciprocally, the marketing team had a similar view a about the technical team’s response to data: according to Susannah Watts, “If they don’t like the data, they say it is flawed and go on their merry way...” This in turn led to an effort to “debunk the debunkers” based on further data and analysis. For example, when Albert Lee of the market analysis team in the LAST MILE project disputed the need for fiber in access technologies, Hugh Collins launched a major effort

to analyze the specific capabilities of copper in various different settings to show that it would not adequately satisfy demand in important customer categories.

During this period, each side intensely lobbied the senior executive and the head the Steering Committee (Brad and Theresa) as well as all of the members of the Review Board. The review meeting, once it was finally scheduled, was highly contentious, each side feeling that the other had misrepresented the data. According to Vince Weston, who by this point was being eased out of the project by his fellow business team members, the marketing people “gave such a biased view of the market—they clamped down on the market so bad that someone presenting [to invest in it] would look foolish. It was sheer ‘we’ve made up our mind’ on the marketing side.” Hugh and Jack, the most senior people on the technical team, said to the marketing people, “we think you did good work but we don’t believe it.” The debate on the market sizing went something like this: the marketing team numbers showed relatively low levels of demand for bandwidth. Jack said, “Once people get it, they will always want more.” Susannah said, “Well, I have dialup and it’s just fine.” The marketing people simply said that “for the foreseeable future, there will only be a need for 100kb usage per line and therefore there is no market.” Hugh walked out of the meeting in mid-debate out of frustration. As a result, no decision was made; Brad gave the project go ahead for one more month to resolve the differences in views, but Hugh was replaced by Hermann Meier, a more junior manager (and protégé of Hugh).

During this next stage, some progress was made in aligning views through an intensive e-mail exchange among several of the key parties. However, as the date for the next review approached, the Hugh and Hermann “staged a coup” (in Hermann’s words) by ceasing to communicate at all with the business team and spending their time searching for a willing partner among the business units. They felt that the only way to move ahead was to get a business unit lined up to support the effort (and after trying several potential avenues within the corporation, they found receptivity with some of the managers in one product line area). When the next review date approached, the business team, infuriated that they had not been consulted in the development of the final proposal, got the meeting postponed and forced the group to work together to come up with a consensus. The net result: the proposal was scoped down to a small team conducting further exploration of potential line extensions for one EQUIPCO product line. Interestingly, all of the different players felt that they won: the proposing team got to invest

further (in an area that was one of the many they had identified from the outset) and the challengers made sure that the project did not grow out of control and “become another major optical project” (which meant, from their perspective, another project with a large amount of investment in a market area that was unlikely to pay out).

These framing strategies changed the frames used by the different groups from the first decision to initiate the project to the final decision to invest in a small development effort. To summarize the nature of the frames and their change over time, I coded the various frame elements of all of the key players. The appendix provides more details of the techniques of this frame analysis. Grouping the frame elements into themes based on common combinations found among the informants, I find in the LAST MILE project, for example, seven major themes: optimistic or pessimistic about the access market, supportive optical technologies, advocating technology first solutions, focused on the value of business cases, attributed value to analytical rigor, or prioritized the business unit needs first. Grouping the project participants according to their roles either as proposers, challengers or decision makers (members of the Review Board), I find that the patterns of activation of frame elements were quite different, both across groups and over time.

Figure 6 shows that in the LAST MILE project, the proposers started out with frames that were predominated by access optimism and belief in optical technologies, while the challengers had not galvanized around much in the early stages. Over time, through the dynamics of the framing process, the proposers changed their views to focus more on themes of technological leadership and responsiveness to business unit needs. Meanwhile, the challengers developed stronger viewpoints on the lack of opportunity in access markets and in the need for business cases. The Review Board actually had to relax their views about the value of rigorous analysis in order to fund the project; their criteria rested instead on the passion of the team leadership and the value of supporting a business unit. Nevertheless, they only funded the project for a small proportion of the initial request. Figure 7 shows the net impact of these framing strategies over the course of the project from the first decision to the third.

-- Insert Figures 6 and 7 here --

MULTISERVICE

The MULTISERVICE project was an algorithm that would allow carriers to provide multiple services to their customers without requiring the customer to scrap legacy installed equipment on their premises. It was developed initially by some relatively junior mathematicians in Jack Stafford's group in response to his request for people to look into future technologies. Jack attempted to bring the project to the Steering Committee but was told he needed a business case before it would be considered. The contest in this project stemmed from different beliefs about the viability of a business case (and indeed what should be included in a business case) and the ability for EQUIPCO to profit from the innovation given existing business unit capabilities. Specifically, the proposed approach focused on optical applications of a technology that could in theory be applied more broadly. This approach was based on a particular view of the future evolution of the Metro (regional) network technologies and architectures. The project proceeded through three different decisions. The first was an approval to develop the technology for a specific and slightly tangential niche application. A marketing person (Tom Rentham) assigned to help out was unsuccessful in finding a case for the project overall, but did identify this small niche application while working with a product line manager in a business unit. The second decision was a refusal by the Steering Committee (and Theresa Veneto, its leader) to invest in the project when an adequate business case could not be produced. Frustrated by what he perceived as narrow-mindedness about the market opportunity and months of foot-dragging by the Steering Committee, Jack Stafford took the case directly to a customer, got their support and began fully staffing up a major development effort. This third decision was only ratified two months later by the Review Board.

Different framing strategies were also used over the course of the decisions in the MULTISERVICE project. The first decision was so unproblematic (a business unit requested help on the developing the technology for a related niche applications) and the business case therefore so compelling (small investment to help a business unit) that little effort was needed to align frames. However, the second decision (not to invest in the major development project) was much more contested. Jack Stafford was convinced of the potentially "revolutionary" value of the technology. He met with Brad, who had a background in this kind of technology, and sold him on the idea that this was "the future" for service providers. Yet, Tom Rentham, who was assigned to develop a business case, found strong resistance from the business units who thought

the technology was “threatening and cannibalizing” of their value added services or who believed that “customers are not initially accept that... You need a transition strategy, an evolutionary strategy for your customer. You cannot flash convert all of them to [the technology].” Given this resistance, Tom felt that the project could not be supported because he believed the Steering Committee decision making process that required a solid business case was valuable. This was the frame that won the day when the project was turned down (“put on the back burners”).

Jack got extremely frustrated, believing that Tom was not trying hard enough to build a business case. Jack felt that the business team was not being creative enough to overcome the “linear thinking” of the business units. In his view, he was not being trusted to go ahead based on his own expertise about the technology, and all of the effort to develop a business case distracted from his effort to get things moving. But, without any pull from the business unit, he was having trouble constructing the business case on his own. When Tom got laid off and George Arden took over the marketing role on the project, Jack went the very next day to see if he could get a more favorable read on the business case. But George’s analysis of the addressable market proved no more supportive of the project. George got so aggravated at being pushed to build a case he did not believe that he refused to work further on the project.

Jack eventually got help from Edward Fischer to see a customer (a major service provider) directly. In contrast to the EQUIPCO business units, he found that this particular customer was quite intrigued by the technology and agreed to use it in a trial of a new network. At that point, Jack did not even attempt to go back to the Steering Committee for fear that the project would be rejected again. He simply began to staff up a major development project, seeking personal approval from his boss, Erik Helgesen. He said, “I made the decision to go ahead with it. You make those decisions because you know that it is a good idea ...If you do not do that, if you wait around for formal approval, then you never get anything done, because you miss the window of opportunity.”

It became apparent to Theresa Veneto that this decision had been made outside of the formal channels and she lobbied Brad and Erik intensively to get the project considered by the Steering Committee and Review Board. Jack found many different excuses to delay the review, and by the time it happened, the project had already been underway for two months. Theresa justified the decision to ratify Jack’s actions in the following way: “You’ll be permitted [to

invest] if you get a customer and a business unit saying that their gut is saying this makes sense. So you are not standing alone, and it is tested enough with a few people. We will hedge it. I am willing to hedge. But don't come to me alone, and say 'Believe in me, trust me.'”

For the MULTISERVICE project (Figure 8), the frames grouped differently from those salient in the LAST MILE project. One significant frame was around the preference for incremental projects that did not require carriers or their customers to install much new infrastructure. This was similar to the “access pessimists” in the LAST MILE project. For the first decision on MULTISERVICE, an investment in developing the algorithm for a related niche applications, everyone was relatively aligned in this area. The other major themes were the importance of a business case, the value of the Steering Committee approval process and the focus on ATG and EQUIPCO providing technical leadership to its customers. Moving from the first decision to the second (from a small incremental project to a proposal for a major investment in development) triggered different mixes of frames, with less emphasis on incremental action and more emphasis on technical leadership. At this stage, the proposers still believed that the project would be approved on its merits in the Steering Committee process. When that proved not to be the case (Decision 2), they strengthened their focus on technical leadership for the customer. Because Jack Stafford was able to get a customer on board, he was effectively able to neutralize the opposition to the project who had been insisting that it follow the regular decision making rules. The challengers decreased their insistence on a fully vetted business case in favor of a belief that technical leadership should win when the customer wants the technology (Figure 9).

-- Insert Figures 8 and 9 here --

The success of the challengers in the second decision lay in their ability to question the diagnostic and solution frames of Jack Stafford and his team and to prevail on the decision makers to hold to the governance frame that the formal, Steering Committee process should be followed for major new development project decisions. The success of Jack in the third decision came from his ability to uncouple the solution frame from the diagnostic one and instead link it to a governance frame that emphasized meeting customers' advanced technology needs.

Discussion—a model of framing contests

Recalling the model presented in Figure 1, I suggest that parallel but interlinked processes of framing and politics triggered by particular decision context that shaped choices about technology investment. In this discussion, I amplify the role of frames and framing strategies through stories from my observations at EQUIPCO and offer a more complex model of dynamics linking cognition and politics to strategy-making.

Frames

The people in the ATG group at EQUIPCO recognized the great degree of information ambiguity in the form of environmental, technological and organizational uncertainties. Because the environment and technology (and organizational rules and procedures) were uncertain, beliefs about what was going on were contested and meaning had to be negotiated. During the LAST MILE project, Hugh remarked: “Like most things, there is no absolute truth in anything. And, if you want to find the aspect to say it is a dog project, you can prove it conclusively it’s a dog. If you want to find the aspect to say, ‘yeah, here are the golden nuggets that could make something really useful out of it’, you’ll find it.” Rational analysis in the canonical sense could not necessarily resolve the differences, since project team members and decision makers experienced both an inundation of potentially relevant information and a paucity of “hard facts.” Whether a project was a “dog” or had “golden nuggets” was highly dependent on the frame of the perceiver. Beliefs about who had a right to define the nature of this reality became a matter of debate (Becker 1967) during the period of discontinuity faced by EQUIPCO.

People evoked different kinds of frames to give meaning to uncertainties. These frames were constructed from an individual’s larger repertoire of frame elements (or building blocks) that are built up over time based on his or her history. This notion is similar to Swidler’s (1986) concept of cultural repertoires or “tool kits” from which people construct “strategies of action.” A project participants’ frames do not simply spring up randomly but rather are the encoding of previous individual and organizational experience including individual career histories, project experience, the nature of the technology, individual and group demographics, firm accumulations of capabilities and industry norms (Zerubavel 1997). An individual’s multiple different histories generated knowledge accumulations (Bourdieu 1977) that were encoded into a frame in a particular instance. This notion is captured along one dimension in the research on “thought

worlds” which are derived from participation in different functional groups (such as R&D or marketing) and lead to conflicts of interpretations during new product development projects (Carlile 2002; Dougherty 1992). The findings in the study reported here suggest a more multidimensional notion of self of which the departmental or functional orientation is only one part of the repertoire enacted in a particular situation (Fine 1996). The differences in views I observed were not given by a participant’s function alone and changed as a result of the negotiation process. In this setting, the social construction of worldviews was itself a contested, political process.

These frame elements could be grouped into three different categories that mattered in EQUIPCO technology investment decisions: frames about the diagnosis of the challenge facing EQUIPCO (including the nature of the environment, the problem definition, the firm’s capabilities), about the potential technological solution (including the economic model, the product architecture, the type of technology) and about the governance system for arriving at a decision (including who should have power in the decision-making process and what kinds of evidence should be valid).¹⁴ Contests occurred on each dimension or often across dimensions. All of these types of frames were important because they affected the response to information, the interpretation of the data, the definition of the project scope and the impressions of the viability of a project (see Table 2 for examples of these frames).

-- Insert Table 2 about here --

Diagnostic frames were related to the problem as perceived by the participants: whether user demand for bandwidth would increase in a linear or discontinuous manner, whether server manufacturers were customers or competition, whether EQUIPCO could manage the economics of the access business. The managerial cognition literature’s characterization of frames has focused almost exclusively on diagnostic frames. These could focus on several different dimensions, most of which have been identified individually in managerial cognition research but which rarely have been considered collectively. These include: the environmental landscape (Gavetti and Levinthal 2000; Levinthal 1997), nature of the technical change (Garud and Rappa

¹⁴ While I derived these categories inductively from the field data, they are fully consistent with social movements frame analysis – e.g., Benford and Snow’s (2000) categorization of diagnostic, prognostic, action mobilization frames.

1994; Tripsas and Gavetti 2000), the competitive structure (Daft and Weick 1984; Porac, Thomas, and Baden-Fuller 1989; Sutcliffe and Huber 1998), the degree of threat or opportunity, munificence or scarcity in the environment (Dutton and Jackson 1987; Jackson and Dutton 1988), and the firm's capabilities (Prahalad and Bettis 1986). The cases of strategic decisions about technology at EQUIPCO demonstrate that not only were these factors subject to interpretation but those interpretations varied widely within the organization.

In addition to the frames about the environment, frames about the relevant solutions were also contested: whether a project was an incremental line extension or a platform for a radical technology, what form a solution should take (e.g., whether a solution was best implemented in hardware or software), whether a project would take advantage of existing corporate capabilities or obsolete them. These frames are consistent with definitions of innovation found in the literature – incremental or radical (Abernathy and Utterback 1978) and competence enhancing or competence destroying (Tushman and Anderson 1986) – but the disagreements among participants' interpretations demonstrate that the nature of the innovation itself was not predetermined but rather subject to interpretation.

Frames about the governance system for decision-making (who had authority to make the decision, what criteria should be used and what kind of evidence was valid) were also contested in the EQUIPCO projects. Those people (mainly technical) who had come from the old central research organization tended to want funding to use to follow their “gut feel” about technologies. They wanted to be trusted as experts to make their own decisions without needing to be beholden to anyone. According to one member of the LAST MILE marketing team, “They come from an old school of ‘give me a pot of money and let me go.’” Another group of more senior management who were tasked with changing the processes and the culture to be more focused on venture capital-style investing believed that all projects should go through a rigorous review in the formal decision-making bodies (the Steering Committee and the Review Board) and should not receive investment unless key criteria from a template were met. Another group (primarily the marketing team and several of the senior executives) believed that little funding should be provided to those projects without explicit support from the business unit and a business case to match. In the projects, this often played out as negotiation between beliefs about who has power to make a decision, who should be part of the process, what rules for decision-making should exist and what the agenda for the decision-making meetings should be (Fine 1984). The

Appendix includes a list of all of the frame elements that were relevant for the actors in the LAST MILE and MULTISERVICE projects.

On the LAST MILE project, Hugh Collins described his beliefs about the market opportunity as: “Oh my gosh, EQUIPCO has made a blunder by not being in broadband access technologies. We need to get into that space somehow ASAP or sooner.” His diagnostic frame of the market was connected to a solution frame emphasizing the value of optical technologies and a governance frame that technical expertise should predominate in the decision making. On the other hand, challengers to the project argued that this proposal emerged because people were still in the “bubble mindset,” meaning the mindset during the telecommunications boom of the late 1990’s when companies made massive investments in new technologies “because they fall in love with technologies because they are cool without considering market realities.” The success of the challengers lay in their ability to both weaken the diagnostic frame and unlink the solution frame from it. While they could not ultimately deny that there were some gaps in broadband access coverage in the market, they were able to reframe it as a set of niche opportunities rather than a wholesale problem. In addition, they established the notion that even if there were some opportunities, the solution did not have to be optical, that “no backhoe” solutions would be preferred. On the other hand, the proposers salvaged the project by moving the governance frame of the decision makers from one dominated by business case logic to one that privileged passion and the potential for technical leadership.

On the MULTISERVICE project, Jack Stafford proposed a technology that he thought would overcome a widespread problem of legacy equipment in the industry. He attributed the resistance to his proposal to the “linear thinking” of the business units and the ATG marketing team: “people cannot get their heads around anything that is disruptive.” Instead, he argued that “technology is gut feel... We have a broad knowledge about what is happening in the industry and the way this technology could help. The question is how to get people to move beyond their mind blocks.” But, the challengers to the project argued that the technology had only niche applications due to its optical focus. From their view, the project therefore had no business case and should not be funded.

Not every frame element was relevant to an individual in every decision context. The interaction of the decision with an individual’s repertoire of frame elements produced different salient frames. Exploiting the overlap of people on the LAST MILE and MULTISERVICE

projects, I find that these individuals drew differently from the repertoire depending on the context (as demonstrated in Table 3). For example, for the MULTISERVICE project, Jack Stafford held a view that ATG should develop new technologies rather than outsource them, but for LAST MILE he was strongly opposed to internal development. This difference of views held despite the fact that adequate outsourcing options existed for both projects. Similarly, Brad Copeland was focused on the role of ATG as a technology leader in the MULTISERVICE project but emphasized the importance of a strong economic business case for the LAST MILE project.

-- Insert Table 3 here --

Framing strategies

The differences in individual frames in these uncertain contexts produced contests about the interpretation that should predominate when making the decision. These contests manifested themselves in the use of various framing strategies by proposers and challengers in order to influence the decision makers.

Where decisions were public, these contests were played out between proposers and challengers for the decision-makers. The proposers advocated some form of change in current investment patterns (either investment in a new project, further investment in an existing project or reduction of investment in an existing project). These proposals emerged from a set of frames held by the individual or group making the proposal. As the proposers brought projects into the public domain in order to get funding, some form of challenge materialized. These challenges were based on a separate and conflicting set of frames. The decision makers were the “audience” in Benford and Snow’s (2000) terms – to be mobilized or influenced by the framing strategies. At ATG, the decision makers were the Steering Committee and Review Board as well as their associated heads, Theresa Veneto and Brad Copeland.

These divisions of individuals or groups in the proposing or challenging mode were to a certain extent, though not entirely, across the two major functions in ATG: business (or marketing) and technology. In general the technology team members wanted additions to the budget and the business team wanted subtractions (or at least steady state). This functional dichotomy was only one of the possible drivers of divergent views. There were other permutations. For example, the challenges to the MULTISERVICE project investment were not

just from the business team but also from others in the technical group who were not directly working on the project.

Given these strong differences in views within the organization, the proposers and challengers were not able to impose their own set of frames on the decision-making process, at least not without a fight. Instead, they engaged in a framing process where they attempted to neutralize the opposition and sway the decision makers in their favor (Fine 1984). Both sides employed a number of different kinds of framing strategies. Each endeavor to shape the frames associated with a decision was met with counterframing – “attempts to rebut, undermine, or neutralize a person's or group's myths, versions of reality, or interpretive framework” (Benford and Snow 2000: 626) – from the opposing side. At EQUIPCO, these framing and counterframing strategies took four forms: creating a motivational vision, convincing with data (and challenging the credibility of the data), lobbying and pure power plays. These categories of framing strategies have what appear to be political overtones; and, indeed they do, as I shall discuss in the following section of the paper. For the moment, I will focus on how these kinds of behaviors were aimed at shaping the frame that would predominate as the investment decision was made. Choices about which strategy to use were highly context-dependent. Depending on the distance of one’s own frame from others and the degree of resistance received, different framing strategies made more or less sense.

Coming from an old central research culture where the senior technologists were apparently simply trusted to pursue relevant projects, the proposers from the technology group often started with a vision and an attitude of “trust me, I know what’s best.” Hugh Collins started to sell the LAST MILE project with a vision of EQUIPCO as a company that needed to live up to its “broadband birthright,” arguing that it was an “absolute disaster” not to have a larger presence in access technologies. He claimed that if EQUIPCO was going to stake its territory as a network company, then it needed to be in all parts of the network. This line of reasoning did not galvanize many people to his side, so he expanded it to include a competitive threat: EQUIPCO was losing bids to other competitors because it did not have a full portfolio. Jack Stafford spent the early days of the MULTISERVICE project selling his project in “conversations in the hall, after meetings... I get on the white board, I create a vision.”

To the extent that “trust me” arguments were not compelling (as they very rarely were in the period of austerity imposed by the economic downturn), as an engineering organization, their

first recourse was to the data. Many studies of engineering cultures highlight the deep belief in rational analysis and data (Bucciarelli 1994; Kunda 1986). Consistent with this view, people at EQUIPCO noted that the company “is an engineering organization with engineering values and engineering analysis. You have to persuade people analytically.” Much as convincing with data was the first real framing strategy used, the first line of defense was to challenge the credibility of the data. Challengers often engaged in counterframing along these dimensions (‘the vision doesn’t make sense,’ or ‘your data is the product of faulty analysis’). Therefore, these strategies were often ineffective in getting a particular frame to resonate with others. Thus, proposers (and challengers) often engaged in lobbying of various decision makers to gain influence. In the event that none of these strategies proved effective, team members often resorted to power plays such as withdrawing from the project or leaving meetings in order to avoid an undesirable decision outcome.

Using this understanding of the micro-dynamics in the LAST MILE and MULTISERVICE projects, I developed a more nuanced model of the framing process as observed at EQUIPCO (Figure 10). This model connects frames and framing strategies to decision outcomes. Two sets of interactions matter in the projects. The interaction of the individual’s frame repertoires with the specific decision context produces the salient frame. The interaction of the individual’s (or group’s) frames with others shapes the framing strategies and the consequent degree of frame resonance. The frames about of the diagnosis, solution and governance formed realities that constrained and enabled the emergence of collective action on the part of the proposers and challengers. At EQUIPCO, the dominant frames were not a known feature of the organization (Fine 1984; Strauss 1978) but rather a product of the framing contests based on the meaning that the uncertain environment had for the different actors.

-- Insert Figure 10 here --

Frames and framing strategies intertwined with interests and political strategies

As proposed in the model in Figure 1, the framing processes were tightly intertwined with interests and political processes. My observations suggest that these processes operated in similar fashions: a decision context triggered a set of salient interests from a broader repertoire of interests; the interaction of these interests with others’ provoked political strategies aimed at mobilizing support. But, more than these framing and political processes being parallel, the

cases I studied demonstrate that they interacted with each other in a reciprocal manner at every stage of the process. Frames and interests are mutually constituting. Framing and political strategies were often inseparable. They worked together to produce a dominant frame that shapes the strategic choice.

Much as individuals had a repertoire of frames, they also might have several interests, only some of which got activated by a particular decision context. Interests ran from the tangibly beneficial (preserving one's job, getting a promotion, commanding a larger number of resources), to the more intangibly beneficial (getting a patent, being seen as an expert, being a truth teller). Some interests had a group aspect to them (contributing to the project team, supporting one's own functional group, or making ATG look good in the EQUIPCO organization). Often different interests were at odds with each other. When Hugh left the LAST MILE decision meeting mid-stream, he was acting on his interest in being a truth teller and expert but against those of commanding more resources. When Tom Rentham refused to support a business case for the MULTISERVICE project, he was seen as a team player by the marketing group but not by the project team.

Interests and frames shaped each other. Tom's interest in supporting the values of the marketing group helped trigger the salience of the "business case" frame for the MULTISERVICE project. Reciprocally, his previous experience on a technically credible project that failed due to lack of business unit support produced a "mindset that we've got to actively sell this before it is finished" and an interest only in supporting projects with business cases. Given Hermann Meier's training as an optical engineer, he was more likely to see optically-based solutions as the most appropriate for solutions to broadband access needs on the LAST MILE project. On the other hand, an optical solution for the project would help preserve his job at a time when investments in optical technologies were decreasing.

Thus, a retelling of the LAST MILE story could interpret the "pro access"/"pro optical" stance as one about a self-interested desire to preserve jobs and maintain status. At the time of the initiation of the LAST MILE project, ATG had just made a substantial cut in another major optical project. Though many argued that the origin of the effort emerged from a pure assessment of market needs, behind this was an organizational need. The "cynical" view was that LAST MILE was aimed particularly at giving the now underemployed optical engineers something to do in order to avoid coming under the ax of downsizing that was passing through

the entire corporation. Hugh, the project leader, adjusted the framing of the project over time in search of a logic that would sway the decision makers. This was not entirely based on what he considered to be good for the project *per se* but rather the need to justify the project in order to keep it going.

At first glance, these responses would appear to be about raw interests alone: people supported projects if the alternative might not include them and therefore put their jobs at risk. Yet, much of people's perceptions of job alternatives were driven by their ability to envision alternative futures. The framing of the environment and the technology got interpreted in terms of personal interests. In an era when layoffs were rife throughout the EQUIPCO organization, people did not want to frame a situation in a way that was inconsistent with individual or collective interests. For example, resistance to the previous cuts in the optical program only diminished when the optical engineers saw that new projects, such as MULTISERVICE or LAST MILE, would provide other project opportunities that people could fit themselves into. Different framings supported different factions or different interests.

Political strategies for influencing outcomes took very much the same form as the framing strategies – vision, convincing with data, lobbying or power plays (Eisenhardt and Bourgeois 1988; Stevenson and Greenberg 2000) (see Table 4 for a comparison for both projects). Hugh's "trust me, I'm right" strategy at the initiation of the LAST MILE project was as much an attempt to "bulldoze" the project through as it was to influence the way others saw the opportunity. His early data gathering effort that produced a 238 page PowerPoint document was both an attempt to convince people with data and to overwhelm challengers with information to the point where they would be incapable of responding. Using data to convince often came up against challengers who found that the data were not convincing. The facts were "slippery" in the hands of different people with different interpretations. Frustrated that the framing strategies were meeting with overpowering resistance from challengers, proposers turned to more overtly political actions such as subverting the process, lobbying decision makers or seeking side deals¹⁵. In the LAST MILE project, the "coup" staged by Hugh Collins and

¹⁵ Using Eisenhardt and Bourgeois's definition of politics in strategy-making... "Politics are the observable, but often covert, actions by which executives enhance their power to influence a decision. These actions include behind-the-scenes coalition formation, offline lobbying and cooptation attempts, withholding information and controlling agendas. Politics contrast with the straight forward influence tactics of open and forthright discussion, with full sharing of information, in setting open to all decision makers." (Eisenhardt and Bourgeois 1988)

Hermann Meier not only had the effect of giving them time to build their case that access technologies had a business logic but it also pushed the marketing team at least temporarily out of the decision process. It also brought in the trump card of direct business unit support for the project. On MULTISERVICE, Jack Stafford gave up on getting approval through the normal decision channels and instead focused his attention on getting support from a customer. He ultimately resorted to a side deal with his boss when he could not get formal approval through normal decision-making channels. These actions were primarily about locating a higher source of power to support the project. This power could come from a business unit (as in LAST MILE) or a customer (as in the MULTISERVICE project).

-- Insert Table 4 here --

Where disputes in meaning occurred, they often led to an escalation of commitment in which team members became increasingly intransigent. Escalation of commitment was also tightly linked to interests as it resulted from attempts at self justification or preservation of position (Staw 1976; Staw 1981). Polarization in frames increased the likelihood of side deals where the decisions often got made. For those at the headquarters location, this meant circling the halls of the building where the senior executives sat with the explicit plan of catching the eye of one of them through the glass walled offices and getting a minute to pitch their case. Disagreements about frames did not tend to occur in productive debates but instead were personalized. People in the organization talked about decisions against projects that they had championed as personal embarrassments. It was easy to tell who "owned" a project by how defensive they were when it was discussed in a group. The attacks on viewpoints were often perceived as "vitriolic." In the LAST MILE project, Hugh Collins got so angry at the challenges and questions that he stormed out of the room in a critical decision meeting. One of the senior business executives who was challenging the proposal described it this way: "suffice it to say, he walked out on me."

Thus, the framing of a project shaped and was shaped by the interests of the various actors. Different frames activated different interests. Interests not only shaped the frames that people brought to a situation but were also the outcome of the framing process itself in which interest formation was itself a sensemaking activity. Reaction (either support or challenge) to a proposal was regulated by the effect that the proposal could have on the interests of the individuals involved. While it is true that individuals and groups on the LAST MILE and

MULTISERVICE projects acted to advance their interests, the evidence suggests that these interests were shaped by their frames.

This process was recursive. Not only did frames set the stage for framing contests, but the outcome of the contests in turn shaped the frames held by the participants (Hunt, Benford, and Snow 1994). For example, after the main decision emerged in the LAST MILE project (in which only a limited budget was provided but Widgets were included as a potential solution) each also claimed to have gotten what they wanted. The business team members claimed that they were never “anti-Widget” per se, and just wanted the proportion of the investment to be in line with the proportion of the opportunity (even though they explicitly stated anti-Widget sentiments at earlier stages). The technical team said that they had been proposing this focus all along, even though they had initially requested a much expanded scope with large in-house development. Once the outcome was known, they adjusted their frames to be consistent. Susannah Watts of the marketing team claimed, “We boxed them into this box. It is basically... three full time resources for three months. I do not even give a damn if they build a Widget at this stage, we have prevented them from starting out another all singing all dancing stealth project that is another optical program by any other name, which was the objective that we went in with.” Hugh Collins claimed, “They finally went where I wanted to go six months ago.”

In Figure 11, I present the full model of framing contests that integrates frames and interests as they produce decisions about technical investments. In this model, cognition matters not as a static “frames” but rather as social process of framing. Individuals have repertoires of both frames and interests, elements of which are made salient by the particular decision context. These frames and interests are mutually constituting. Individuals and groups engage in influence strategies (both framing and political strategies) based on the distance from and challenge posed by the frames and interests of others. Different influence strategies can be undertaken for both framing and political purposes, and often these are empirically inseparable. The ability of influence strategies to get frames to resonate and to mobilize action determines which frame predominates as the choice is made. This process is recursive at all stages: influence strategies can reshape the decision question posed or alter the salience of frames and interests. Similarly, the decision outcome alters the future questions, frame and interest repertoires and influence strategies used.

-- Insert Figure 11 here --

Conclusion

In summary, the stories of the investment decisions in the LAST MILE and MULTISERVICE projects provide some insight into the mechanisms through which cognitive frames influences strategic choice. Based on this analysis, I propose a new understanding of framing in the context of technical change. Information ambiguity is the linchpin of strategic decision making during discontinuities, and cognition is a key mechanisms for explaining how managers cope with it. But the results from this study require a move beyond the unidimensional, social psychological sense of cognition as an aggregation of individual views to an interactive and dynamic process of meaning construction (Gamson 1992).

Looking at strategy-making in this way opens up the possibility for examining cognition not simply as “frames” nor even as a situated process of “framing,” where cognition is collective in that it is the product of interactions among people (Kogut and Zander 1992; Lave 1988; Lave and Wenger 1991; Orlikowski and Gash 1994) but as a politically charged and self-conscious process for negotiating meaning (Gamson 1992; Hall 1982). The frames themselves are simply “snapshots” that are an artifice required for analysis but do not capture the dynamic of the actual framing process (Oliver and Johnston 2000). Any representation of a firm level construct measuring cognition would only be the product of the negotiated outcome from the diverse internal views. Framing is purposeful in the sense that individuals and groups develop implicit or explicit framing strategies to shape the outcomes of investment decisions, and it is contested in the sense that the frames of different groups often come into conflict (Benford and Snow 2000). This view contrasts with the pure cognitivist approach in which knowledge is a context-free, “factual” construct and bounded rationality is based only on the technical limits of the mind (Simon 1947). In this setting, frames about the diagnosis of the challenges, the nature of the solution and the governance of the decision were contested. Decisions became the locus in which these framing contests played out.

The role of cognitive framing can only be understood by connecting it to multiple actors and their interests. In the LAST MILE and MULTISERVICE projects, many people were relevant in producing strategic choices, and groups of proposers and challengers coalesced to advance their own perceived interests and frames. They engaged in political and framing strategies to influence the decision outcome. Power was based on the ability to control the

construction of the frames that would predominate as investment choices were made. These choices then “resignify which set of collective beliefs are salient, and alter the meaning of actors’ interests” (Ellingson 1995). This process is not just about senior management engaging in both “sensemaking” and “sensegiving” (Gioia and Chittipeddi 1991) but instead about multiple levels of the organization enacting frames in framing contests in which the “sensegiving” process itself is problematized.

Ultimately, linking framing and politics to understand strategy at a micro level bridges the divide between content and process in the study of strategy. Firm response to technical change is therefore enacted through the conflicts in frames where outcomes are determined through a political process. The articulation of this dynamic suggests that the framing processes within firms could be a more proximal explanation of heterogeneous firm response to discontinuous technical change.

Bibliography

- Abernathy, William J. and James M. Utterback. 1978. "Patterns of Industrial Innovation." *Technology Review* 80:40-47.
- Aghion, P. and J. Tirole. 1997. "Formal and real authority in organizations." *Journal of Political Economy* 105:1-29.
- Allison, Graham T. 1971. *Essence of decision; explaining the Cuban missile crisis*. Boston: Little Brown.
- Baldrige, J. Victor. 1971. *Power and conflict in the university; research in the sociology of complex organizations*. New York,: J. Wiley.
- Bantel, Karen A. and Susan E. Jackson. 1989. "Top Management and Innovations in Banking: Does the Composition of the Top Team Make a Difference?" *Strategic Management Journal* 10:107-124.
- Barley, Stephen R. and Gideon Kunda. 2001. "Bring work back in." *Organization Science* 12:76-95.
- Barnard, Chester Irving. 1938. *The functions of the executive*. Cambridge, Mass.,: Harvard University Press.
- Barney, Jay. 1991. "Firm Resources and Sustained Competitive Advantage." *Journal Of Management* 17:139-158.
- Barr, P. S. 1998. "Adapting to unfamiliar environmental events: A look at the evolution of interpretation and its role in strategic change." *Organization Science* 9:644-669.
- Barr, Pamela S., J. L. Stimpert, and Anne S. Huff. 1992. "Cognitive Change, Strategic Action, and Organizational Renewal." *Strategic Management Journal* 13:15-36.
- Baum, J. A. C. and T. K. Lant. 2003. "Hits and misses: Managers' (mis)categorization of competitors in the Manhattan hotel industry." Pp. 119-156 in *Geography and Strategy*, vol. 20, *Advances in Strategic Management : A Research Annual*.
- Baum, Joel R. and Theresa K. Lant. 1995. "Cognitive sources of socially constrained competitive groups: examples from the Manhattan hotel industry." in *The institutional construction of organizations : international and longitudinal studies*, edited by W. R. Scott and S. Christensen. Thousand Oaks, Calif.: Sage Publications.
- Becker, Howard Saul. 1967. "Whose side are we on?" *Social Problems* 14:239-47.
- Benford, Robert D and David A Snow. 2000. "Framing processes and social movements: An overview and assessment." Pp. 611-639 in *Annual Review of Sociology*. Palo Alto.
- Boeker, Warren. 1997. "Strategic change: The influence of managerial characteristics and organizational growth." *Academy of Management Journal* 40:152-170.
- Bourdieu, Pierre. 1977. *Outline of a theory of practice*. Cambridge ; New York: Cambridge University Press.
- Bourgeois, L. J., III. 1985. "Strategic Goals, Perceived Uncertainty, and Economic Performance in Volatile Environments." *Academy of Management Journal* 28:548-573.
- Bourgeois, L. J., III and Kathleen M. Eisenhardt. 1988. "Strategic Decision Processes in High Velocity Environments: Four Cases in the Microcomputer Industry." *Management Science* 34:816-835.
- Bower, Joseph L. 1970. *Managing the resource allocation process: a study of corporate planning and investment*. Boston: HBS Press.
- Bucciarelli, Louis L. 1994. *Designing engineers*. Cambridge, Mass.: MIT Press.
- Burgelman, Robert A. 1996. "A process model of strategic business exit: Implications for an evolutionary perspective on strategy." Pp. 193 in *Strategic Management Journal*.
- Burgelman, Robert A. 1983. "A Process Model of Internal Corporate Venturing in the Diversified Major Firm." Pp. 223 in *Administrative Science Quarterly*.

- . 1991. "Intraorganizational ecology of strategy making and organizational adaptation: theory and field research." *Organization Science* 2:239-262.
- Camerer, C., G. Loewenstein, and M. Weber. 1989. "The Curse of Knowledge in Economic Settings - an Experimental-Analysis." *Journal of Political Economy* 97:1232-1254.
- Camerer, Colin. 2003. *Behavioral game theory : experiments in strategic interaction*. New York; Princeton, N.J.: Russell Sage Foundation; Princeton University Press.
- Carlile, Paul R. 2002. "A pragmatic view of knowledge and boundaries: Boundary objects in new product development." *Organization Science* 13:442-455.
- Christensen, Clayton M. and Richard S. Rosenbloom. 1995. "Explaining the attacker's advantage: Technological paradigms, organizational dynamics, and the value network." *Research Policy* 24:233-257.
- Cremer, Jacques, Luis Garicano, and Andrea Prat. 2003. "Codes in organizations." *Working paper*.
- Cyert, Richard Michael and James G. March. 1963/1992. *A behavioral theory of the firm*. Cambridge, Mass.: Blackwell Business.
- Daft, Richard L. and Karl E. Weick. 1984. "Toward a Model of Organizations as Interpretation Systems." *Academy of Management Review* 9:284-295.
- Dougherty, Deborah. 1992. "Interpretive Barriers to successful product innovation in large firms." *Organization Science* 3:179-202.
- . 2002. "Grounded theory building: some principles and practices." Pp. 849-867 in *Companion to Organizations*, edited by J. A. C. Baum. Oxford, UK: Blackwell Publishers.
- Douglas, Mary. 1990. "Converging on autonomy: anthropology and institutional economics." Pp. 98-115 in *Organization theory : from Chester Barnard to the present and beyond*, edited by O. E. Williamson. New York: Oxford University Press.
- Dutton, Jane E. and Susan E. Jackson. 1987. "Categorizing Strategic Issues: Links to Organizational Action." *Academy of Management Review* 12:76-90.
- Eisenhardt, Kathleen M. 1989. "Building Theories From Case Study Research." Pp. 532 in *Academy of Management Review*. Mississippi State.
- Eisenhardt, Kathleen M. and L. J. Bourgeois, III. 1988. "Politics of Strategic Decision Making in High-Velocity Environments: Toward a Midrange Theory." *Academy of Management Journal* 31:737-770.
- Ellingson, Stephen. 1995. "Understanding the dialectic of discourse and collective action: Public debate and rioting in antebellum Cincinnati." *The American Journal of Sociology* 101:100.
- Fine, Charles H. 1998. *Clockspeed: winning industry control in the age of temporary advantage*. Reading, Mass.: Perseus Books.
- Fine, Charles H. and Lionel C. Kimerling. 1997. "Biography of a Killer Technology: Optoelectronics Drives Industrial Growth with the Speed of Light." OIDA.
- Fine, Gary Alan. 1984. "Negotiated orders and organizational cultures." *Annual Review of Sociology* 10:239-262.
- . 1996. "Justifying work: Occupational rhetorics as resources in restaurant kitchens." *Administrative Science Quarterly* 41:90-115.
- Finkelstein, Sydney and Donald Hambrick. 1988. *Strategic Leadership: Top Executives and Their Effects on Organizations*. Minneapolis/St. Paul: West Publishing Company.
- Gamson, William A. 1992. *Talking politics*. Cambridge England New York, NY, USA: Cambridge University Press.
- Gamson, William A. and David S. Mayer. 1996. "Framing political opportunity." Pp. 275-290 in *Comparative perspectives on social movements: political opportunities, mobilizing structures, and cultural framings*, edited by D. McAdam, J. D. McCarthy, and M. N. Zald. Cambridge England: Cambridge University Press.

- Garud, Raghu and Michael A. Rappa. 1994. "A socio-cognitive model of technology evolution: The case of cochlear implants." *Organization Science* 5:344-362.
- Gavetti, Giovanni and Daniel Levinthal. 2000. "Looking forward and looking backward: Cognitive and experiential search." *Administrative Science Quarterly* 45:113-137.
- Gilovich, Thomas. 1993. *How we know what isn't so : the fallibility of human reason in everyday life*. New York: Free Press.
- Ginsberg, Ari. 1994. "Minding the competition: From mapping to mastery." *Strategic Management Journal* 15:153-174.
- Gioia, Dennis A. and Kumar Chittipeddi. 1991. "Sensemaking and Sensegiving in Strategic Change Initiation." *Strategic Management Journal* 12:433.
- Glaser, B.G. and A.L. Strauss. 1967. *The discovery of grounded theory: strategies for qualitative research*. Chicago: Aldine Publishing Company.
- Goffman, Erving. 1959. *The presentation of self in everyday life*. New York: Anchor.
- . 1974. *Frame Analysis: An Essay on the Organization of Experience*. Northeastern University Press.
- Hall, S. 1982. "The rediscovery of ideology: return to the repressed in media studies." Pp. 56-90 in *Culture, society, and the media*, edited by M. Gurevitch, T. Bennett, J. Curon, and J. Woolcott. London New York: Methuen.
- Hambrick, Donald C. and Phyllis A. Mason. 1984. "Upper Echelons: The Organization as a Reflection of Its Top Managers." *Academy of Management Review* 9:193-206.
- Henderson, Rebecca M. and Kim B. Clark. 1990. "Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms." *Administrative Science Quarterly* 35:9-30.
- Hendry, John. 2000. "Strategic decision making, discourse, and strategy as social practice." *The Journal of Management Studies* 37:955-977.
- Holmstrom, B. 1979. "Moral Hazard and Observability." *Bell Journal of Economics* 10:74-91.
- Holmstrom, Bengt. 1982/1999. "Managerial incentive problems: A dynamic perspective." Pp. 169-182 in *The Review of Economic Studies*. Oxford.
- Huff, Anne Sigismund. 1990. "Mapping strategic thought." Chichester, New York: John Wiley and Sons.
- Hunt, SA, R.D. Benford, and D.A. Snow. 1994. "Identity fields: framing processes and the social construction of movement identities." Pp. 185-208 in *New Social Movements: from ideology to identity*, edited by E. Larana, H. Johnston, and J. R. Gusfield. Philadelphia: Temple University Press.
- Hutchins, Edwin. 1995. *Cognition in the wild*. Cambridge, Mass.: MIT Press.
- Jackson, Susan E. and Jane E. Dutton. 1988. "Discerning Threats and Opportunities." *Administrative Science Quarterly* 33:370-387.
- Jehn, Karen A. 1995. "A multimethod examination of the benefits and detriments of intragroup conflict." *Administrative Science Quarterly* 40:256-82.
- Johnson, Gerry, Leif Melin, and Richard Whittington. 2003. "Guest editor's introduction: Micro strategy and strategizing: Towards an activity-based view." *The Journal of Management Studies* 40:3-22.
- Johnson, Gerry, Stuart Smith, and Brian Codling. 2000. "Microprocesses of institutional change in the context of privatization." *Academy of Management Review* 25:572.
- Kahneman, Daniel and Dan Lovallo. 1993. "Timid choices and bold forecasts: A cognitive perspective on risk taking." *Management Science* 39:17.
- Kahneman, Daniel, Paul Slovic, and Amos Tversky. 1994. *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge University Press.
- Kaplan, Sarah. 2003. "At the heart of a revolution: communications firm response to the emergence of optical technologies." *Working paper*.

- Kaplan, Sarah, Fiona Murray, and Rebecca M. Henderson. 2003. "Discontinuities and Senior Management: Assessing the Role of Recognition in Pharmaceutical Firm Response to Biotechnology." *Industrial and Corporate Change* 12:203-233.
- Kerr, Steven. 1975. "On the folly of rewarding A, while hoping for B." Pp. 769 in *Academy of Management Journal*. Briarcliff Manor.
- Kogut, B. and U. Zander. 1992. "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology." *Organization Science* 3:383-397.
- Kunda, Gideon. 1986. *Engineering culture: culture and control in a high-tech organization*.
- Lant, Theresa K. and Joel Baum. 1995. "Cognitive Sources of Socially Constructed Competitive Groups: Examples from the Manhattan Hotel Industry." Pp. 15-38 in *The Institutional Construction of Organization: International and Longitudinal Studies*, edited by W. R. Scott and S. Christensen. Newbury Park, CA: Sage Publications.
- Lant, Theresa K., Frances J. Milliken, and Bipin Batra. 1992. "The Role of Managerial Learning and Interpretation in Strategy." *Strategic Management Journal* 13:585-608.
- Lave, Jean. 1988. *Cognition in practice: mind, mathematics, and culture in everyday life*. Cambridge ; New York: Cambridge University Press.
- Lave, Jean and Etienne Wenger. 1991. *Situated learning: legitimate peripheral participation*, Edited by R. Pea and J. S. Brown. Cambridge, UK: Cambridge University Press.
- Levinthal, Daniel A. 1997. "Adaptation on rugged landscapes." *Management Science* 43:934-950.
- Lovas, B. and S. Ghoshal. 2000. "Strategy as guided evolution." 21:875-896.
- March, James G. and Herbert Alexander Simon. 1958. *Organizations*. New York,: Wiley.
- McAdam, Doug, John D. McCarthy, and Mayer N. Zald. 1996. *Comparative perspectives on social movements: political opportunities, mobilizing structures, and cultural framings*. Cambridge England New York: Cambridge University Press.
- Meyer, Alan D. 1982. "Adapting to Environmental Jolts." *Administrative Science Quarterly* 27:515-37.
- Mintzberg, H., D. Raisinghani, and A. Theoret. 1976. "Structure of Unstructured Decision-Processes." *Administrative Science Quarterly* 21:246-275.
- Mintzberg, H. and J. A. Waters. 1985. "Of Strategies, Deliberate and Emergent." *Strategic Management Journal* 6:257-272.
- Mintzberg, Henry. 1973. *The Nature of Managerial Work*: HarperCollins Publisher.
- Mintzberg, Henry, James Waters, Andrew M Pettigrew, and Richard Butler. 1990. "Studying Deciding: An Exchange of Views Between Mintzberg and Waters, Pettigrew, and Butler." *Organization Studies* 11:1-16.
- Morrill, Calvin. 1995. *The executive way : conflict management in corporations*. Chicago: University of Chicago Press.
- Mullainathan, Sendhil and Richard Thaler. 2002. "Behavioral Economics." *International Encyclopedia of the Social and Behavioral Sciences*.
- Ocasio, William. 1997. "Towards an attention-based view of the firm." *Strategic Management Journal* 18:187-206.
- Oliver, Pamela E. and Hank Johnston. 2000. "What a good idea! Ideologies and frames in social movement research." *Mobilization: an international journal* 4:37-54.
- Orlikowski, Wanda J. and Deborah C. Gash. 1994. "Technological Frames: Making Sense of Information Technology in Organizations." *ACM Transactions on Information Systems* 2:174-207.
- Osterloh, Margit and Bruno S Frey. 2000. "Motivation, knowledge transfer, and organizational forms." *Organization Science* 11:538-550.
- Papadakis, V. M., S. Lioukas, and D. Chambers. 1998. "Strategic decision-making processes: The role of management and context." *Strategic Management Journal* 19:115-147.

- Pettigrew, Andrew M. 1987. "Context and Action in the Transformation of the Firm." *The Journal of Management Studies* 24:649.
- Pettigrew, Andrew M. 1973. *The politics of organizational decision-making*. London: Tavistock.
- Polanyi, Michael. 1966. *The tacit dimension*. Garden City, N.Y.,: Doubleday.
- Porac, Joseph F., Howard Thomas, and Charles Baden-Fuller. 1989. "Competitive Groups as Cognitive Communities: The Case of Scottish Knitwear Manufacturers." *Journal of Management Studies* 26:397-416.
- Porac, Joseph F., Howard Thomas, Fiona Wilson, Douglas Paton, and Alaina Kanfer. 1995. "Rivalry and the industry model of Scottish knitwear producers." *Administrative Science Quarterly* 40:203-227.
- Porter, Michael E. 1980. *Competitive strategy: techniques for analyzing industries and competitors*. New York: Free Press.
- . 1996. "What is strategy?" *Harvard Business Review* 74:61-78.
- Prahalad, C. K. and Richard A. Bettis. 1986. "The Dominant Logic: A New Linkage Between Diversity and Performance." *Strategic Management Journal* 7:485-501.
- Reger, Rhonda K. and Anne Sigismund Huff. 1993. "Strategic groups: A cognitive perspective." *Strategic Management Journal* 14:103-123.
- Reger, Rhonda K. and Timothy B. Palmer. 1996. "Managerial categorization of competitors: Using old maps to navigate new environments." *Organization Science* 7:22-39.
- Rosenbloom, Richard S. 2000. "Leadership, capabilities, and technological change: The transformation of NCR in the electronic era." *Strategic Management Journal* 21:1083-1103.
- Rotemberg, Julio J and Garth Saloner. 2000. "Visionaries, managers, and strategic direction." *The Rand Journal of Economics* 31:693-716.
- Ryan, Charlotte. 1991. *Prime time activism : media strategies for grassroots organizing*. Boston, MA: South End Press.
- Schumpeter, Joseph Alois. 1934. *The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle*. Cambridge, Mass.: Harvard University Books.
- . 1942. *Capitalism, socialism, and democracy*. New York: Harper.
- Siggelkow, Nicolaj. 2002. "Misperceiving interactions among complements and substitutes: Organizational consequences." Pp. 900-916 in *Management Science*. Linthicum.
- Simon, Herbert A. 1947. *Administrative behavior; a study of decision-making processes in administrative organization*. New York,: Macmillan Co.
- Snow, David A., E. Burke Rochford Jr., Steven K. Worden, and Robert D. Benford. 1986. "Frame Alignment Processes, Micromobilization, and Movement Participation." *American Sociological Review* 51:464-481.
- Snow, David and R.D. Benford. 1988. "Ideology, Frame Resonance, and Participant Mobilization." Pp. 197-217 in *International social movement research: From structure to action: comparing social movement research across cultures*, vol. 1, edited by B. Klandermans, H. Kriesi, and S. G. Tarrow. Greenwich, Conn.: JAI Press.
- Sorensen, J. B. 1999. "Executive migration and interorganizational competition." *Social Science Research* 28:289-315.
- Staw, Barry M. 1976. "Knee-Deep in the Big Muddy - a Study of Escalating Commitment to a Chosen Course of Action." *Organizational Behavior and Human Performance* 16:27.
- . 1981. "The Escalation of Commitment to a Course of Action." *Academy of Management Review* 6:577.
- Stevenson, William B and Danna Greenberg. 2000. "Agency and social networks: Strategies of action in a social structure of position, opposition, and opportunity." *Administrative Science Quarterly*:651-678.

- Strauss, Anselm L. 1978. *Negotiations: varieties, contexts, processes, and social order*. San Francisco: Jossey-Bass.
- Suchman, Lucille Alice. 1987. *Plans and situated actions: the problem of human-machine communication*. Cambridge: Cambridge University Press.
- Sutcliffe, Kathleen M and George P Huber. 1998. "Firm and industry as determinants of executive perceptions of the environment." *Strategic Management Journal* 19:793-807.
- Sutcliffe, Kathleen M. 1994. "What executives notice: Accurate perceptions in top management teams." *Academy of Management Journal* 37:1360.
- Sutton, Robert I and Barry M Staw. 1995. "What theory is not." *Administrative Science Quarterly* 40:371.
- Swidler, Ann. 1986. "Culture in Action: Symbols and Strategies." *American Sociological Review* 51:273.
- Teece, David J., Gary Pisano, and Amy Shuen. 1997. "Dynamic capabilities and strategic management." *Strategic Management Journal* 18:509-533.
- Tripsas, Mary and Giovanni Gavetti. 2000. "Capabilities, cognition, and inertia: Evidence from digital imaging." *Strategic Management Journal* 21:1147-1161.
- Tushman, Michael L. and Philip Anderson. 1986. "Technological Discontinuities and Organizational Environments." *Administrative Science Quarterly* 31:439-465.
- Tushman, Michael L. and Lori Rosenkopf. 1996. "Executive succession, strategic reorientation and performance growth: A longitudinal study in the U.S. cement industry." *Management Science* 42:939-953.
- Utterback, James M. 1994. *Mastering the Dynamics of Innovation*. Cambridge, Mass.: Harvard Business School Press.
- Virany, Beverly and Michael L. Tushman. 1986. "Top Management Teams and Corporate Success in an Emerging Industry." *Journal of Business Venturing* 1:261-274.
- von Hippel, Eric. 1994. "'Sticky Information" and the Locus of Problem Solving: Implications for Innovation." *Management Science* 40:429-439.
- Weick, Karl E. 1995. *Sensemaking in organizations*. Thousand Oaks: Sage Publications.
- Weick, Karl E. and Karlene H. Roberts. 1993. "Collective mind in organizations: Heedful interrelating on flight decks." *Administrative Science Quarterly* 38:357-381.
- Wernerfelt, Birger. 1984. "A Resource-Based View of the Firm." *Strategic Management Journal*:171-180.
- Whittington, Richard. 1996. "Strategy as practice." *Long Range Planning* 29:731-735.
- . 2003. "The Work of Strategising and Organising: for a Practice Perspective." *Strategic Organisation* 1:56-65.
- Wiersema, Margarethe F. and Karen A. Bantel. 1992. "Top Management Team Demography and Corporate Strategic Change." *Academy of Management Journal* 35:91-121.
- Williamson, Oliver E. 1985. *The economic institutions of capitalism : firms, markets, relational contracting*. New York: Free Press.
- Yin, Robert K. 1984. *Case study research: design and methods*. Beverly Hills, Calif.: Sage Publications.
- Zald, M. N. and M. A. Berger. 1978. "Social-Movements in Organizations - Coup D'Etat, Insurgency, and Mass Movements." *American Journal of Sociology* 83:823-861.
- Zerubavel, Eviatar. 1997. *Social mindscapes: an invitation to cognitive sociology*. Cambridge, Mass.: Harvard University Press.

Appendix – Description of frame analysis

Focusing specifically on the frames of the individuals in each project and for each decision, I used the multiple sources of data (observations from meetings, interviews, e-mails and documents) to generate a description of the salient frame in each context. These descriptions included detailed elements of the frames as well as the sources to which the viewpoints could be attributed (industry level, EQUIPCO, ATG, functional and capability-based norms). Based on these detailed descriptions, I generated a list of frame elements by type of element and source. I then coded each individual according to which elements were in their repertoire based on their demographics. The table below summarizes this data for the elements that were relevant for at least one individual for the Last Mile and Multiservice projects. This list is not comprehensive in the sense that it does not include any frame element that was never activated by any individual on any decision for these two projects. An analysis of more projects and decisions would likely expand the list of elements.

Frame elements by type

SOURCE	TYPE	ELEMENT
Industry	Diagnosis	<ul style="list-style-type: none"> Carriers have no funds for capital expenditures; will not invest in new infrastructure ("no backhoe") Carriers will invest in new technologies if they are carefully targeted, don't cannibalize revenues, create ST sales Demand for bandwidth will increase exponentially (potential for killer apps) No killer apps on the horizon; demand for bandwidth will increase slowly
	Solution	<ul style="list-style-type: none"> Access is the current rate limiter in the industry. Solve the bottleneck by solving access. Any new technologies will have to take advantage of existing infrastructure (e.g., copper) Any new technologies will have to be low risk, and able to be implemented incrementally.
	Governance	<ul style="list-style-type: none"> Industry crisis due to faulty economic calculus; therefore more rigorous economic analysis required for investment.
EQUIPCO (corporate)	Diagnosis	<ul style="list-style-type: none"> EQUIPCO should not be in the access business. EQUIPCO needs an end-to-end solution for the customer. EQUIPCO's competence is in high end, low volume network equipment; cannot manage low margin businesses. EQUIPCO should only put limited focus on long haul optical technologies, emphasize other technological thrusts.
	Solution	<ul style="list-style-type: none"> EQUIPCO should be a technical leader in the industry, respond to competitive threats. Build projects internally rather than source externally. EQUIPCO needs to be more customer facing.
	Governance	<ul style="list-style-type: none"> Need to focus on short term cash flow producing projects.
ATG (division)	Diagnosis	<ul style="list-style-type: none"> Given the change in the market, ATG needs to reorient its priorities (no more "lab" mindset) ATG needs to prove its value added to the corporation (no overlap with the business unit)
	Solution	<ul style="list-style-type: none"> ATG needs to support the business unit needs ATG needs to think ahead of the business units, research should be forward thinking, independent of day-to-day
	Governance	<ul style="list-style-type: none"> Passion for an idea, despite the odds, may carry the day in decision-making (a way to deal with uncertainty)
Functional—business	Diagnosis	<ul style="list-style-type: none"> Pessimistic about market demand prospects.
	Solution	<ul style="list-style-type: none"> Technical proposals are likely to not be practical, not to take into consideration market needs, likely pet projects Our role is to help tech teams come up with meaningful business cases Our role is to quash technical projects that do not have realistic business cases We need to make sure that every project is supported by at least one business unit
	Governance	<ul style="list-style-type: none"> All projects need to have a market-based business case. Must be evaluated on economic and technical merits. All projects should be vetted through the TSC process in order to assure a good business case

SOURCE	TYPE	ELEMENT
Functional—technical	Diagnosis	<ul style="list-style-type: none"> Optimistic about market demand prospects (the market crash is short-lived).
	Solution	<ul style="list-style-type: none"> We should be building cool stuff The push to make business cases on all projects is eroding the creativity of the technical group Marketing/business unit people are linear thinkers; technical people understand future needs better than others
	Governance	<ul style="list-style-type: none"> The technical people are the experts and should be trusted to pursue the right projects. Technology driven solutions should win in the decision-making process
Role	Diagnosis	<ul style="list-style-type: none"> NA
	Solution	<ul style="list-style-type: none"> NA
	Governance	<ul style="list-style-type: none"> Functional leader: belief that own function is critical to the decision-making process TSC member: make sure the project will get approved by the IRB
Capabilities	Diagnosis	Background in: <ul style="list-style-type: none"> Optical: market downturn in optical demand is temporary/short-lived. Access: access is the bottleneck in the communications system. Non-optical: optical is saturated for a long time to come.
	Solution	Background in: <ul style="list-style-type: none"> Access: EQUIPCO needs to be in access. Access: access technologies require a low-cost, high-volume economic model that EQUIPCO can't manage. Devices: most solutions will involved building a device. Non-device (architecture/software): solutions may not require building a device. Optical: need to continue developing optical technologies to prepare for return of market. Optical: optical technologies have broad application beyond long haul. Non-optical: not everything needs an optical solution Non-ATG EQUIPCO experience: more likely to appreciate need for business case, not technology for own sake Outside experience: more likely to appreciate need for business case, not technology for its own sake; less likely to be attached to overarching EQUIPCO frames
	Governance	Background in: Engineering: belief in value of "rational, objective" analysis
Personal background	Diagnosis	<ul style="list-style-type: none"> Personal experience affecting diagnosis (e.g., specific projects, experiences with success and failure).
	Solution	<ul style="list-style-type: none"> Personal experience affecting solution (e.g., specific projects, experiences with success and failure).
	Governance	<ul style="list-style-type: none"> Personal experience affecting views on governance (e.g., specific projects, experiences with success and failure).

I then coded each individual according to which elements were in their repertoire based on their demographics. Thus, all project members had access to the industry, EQUIPCO and ATG elements. Only technical people had access to functional-technical frame elements, and marketing/business people to functional-business elements. Based on individual background and experience, I noted which had access to each capability-based frame element. For example, those with academic and project backgrounds in optical technologies had the optical frame elements in their repertoires. I coded the frame elements that were the salient for each individual for each decision in each project. I grouped the various frame elements into common combinations found among the informants. I first identified which elements appeared grouped together on a consistent basis across informants and across decisions. Based on the general topics represented by the elements, I derived a representative theme for the frames. In the table below, I provide an example of the groupings of frame elements for the LAST MILE project.

Example: groupings of frame elements for the LAST MILE project

CLUSTER NAME	TYPE	SOURCE	SPECIFIC FRAME ELEMENT
Access optimists	Diagnostic	EQUIPCO	Access: access technologies require a low-cost, high-volume economic model that EQUIPCO can't manage.
Access optimists	Diagnostic	Function-tech	Access: EQUIPCO needs to be in access.
Access optimists	Diagnostic	Capability	EQUIPCO needs an end-to-end solution for the customer.
Access optimists	Diagnostic	Capability	The technical people are the experts and should be trusted to pursue the right projects.
Access optimists	Solution	Function-tech	Access: access is the bottleneck in the communications system.
Access optimists	Solution	Capability	EQUIPCO competence in high end, low volume network equipment; can't manage low margin businesses.
Access optimists	Solution	Capability	Optimistic about market demand
Access optimists	Solution	Capability	Marketing/business unit people are linear thinkers; technical people understand future needs better than others (are more able to be visionary)
Access optimists	Solution	Capability	Access is the current rate limiter in the industry. Solve the bottleneck by solving access.
Access optimists	Governance	Function-tech	EQUIPCO should be a technical leader in the industry, and respond to competitive threats to this leadership.
Pro-optical	Solution	Industry	Optical: optical technologies have broad application beyond long haul.
Pro-optical	Solution	EQUIPCO	Optical: market downturn in optical demand is temporary/short-lived
Pro-optical	Solution	Function-tech	Optical: need to continue developing optical technologies to prepare for return of market.
Tech first	Solution	EQUIPCO	We should be building cool stuff
Tech first	Solution	Function-tech	The push to make business cases on all projects is eroding the creativity of the technical group
Tech first	Solution	Capability	Build projects internally rather than source externally.
Tech first	Governance	ATG	Technology driven solutions should win in the decision-making process
Tech first	Governance	Function-tech	Devices: most solutions will involved building a device.
Access pessimists	Diagnostic	Industry	Carriers have no funds for capital expenditures and will not invest in new infrastructure ("no backhoe").
Access pessimists	Diagnostic	Industry	No killer apps on the horizon; demand for bandwidth will increase slowly
Access pessimists	Diagnostic	EQUIPCO	EQUIPCO should put only limited focus on long haul optical technologies and emphasize other technical thrusts
Access pessimists	Diagnostic	Function-business	Pessimistic about market demand trends
Access pessimists	Diagnostic	Capability	Non-optical: optical is saturated for a long time to come.
Access pessimists	Solution	Industry	Any new technologies will have to be low risk, and able to be implemented incrementally.
Access pessimists	Solution	Industry	Any new technologies will have to take advantage of existing infrastructure (e.g., copper)
Access pessimists	Solution	Capability	Non-optical: not everything needs an optical solution
Business case	Diagnostic	Industry	Carriers will only invest in new technologies if they are carefully targeted, don't cannibalize existing revenues and create short term revenues.
Business case	Solution	ATG	ATG needs to think ahead of the business units, research should be forward thinking and independent of the day-to-day business.
Business case	Solution	Capability	Non-device (architecture/software): solutions may not require building a device.
Business case	Solution	Capability	Outside experience: more likely to appreciate need for business case, not technology for its own sake; less likely to be attached to overarching EQUIPCO frames
Business case	Solution	EQUIPCO	EQUIPCO needs to be more customer facing.
Business case	Solution	Function-business	Our role is to quash technical projects that do not have realistic business cases
Business case	Solution	Function-business	Technical proposals are likely to not be practical, not to take into consideration market needs, likely to be pet projects
Business case	Governance	Function-business	All projects should be vetted through the TSC process in order to assure a good business case
Business case	Governance	Role	TSC member: make sure the project will get approved by the IRB
Analytical rigor	Diagnostic	EQUIPCO	Engineer: belief in value of "rational, objective" analysis
Analytical rigor	Governance	Capability	Industry crisis due to faulty economic calculus; therefore more rigorous economic analysis required for investment.
Analytical rigor	Governance	Industry	Passion for an idea, despite the odds, may carry the day in decision-making (a way to deal with uncertainty)

CLUSTER NAME	TYPE	SOURCE	SPECIFIC FRAME ELEMENT
Business unit focus	Diagnostic	ATG	ATG needs to prove its value added to the corporation (no overlap with the business unit)
Business unit focus	Diagnostic	ATG	ATG needs to support the business unit needs
Business unit focus	Diagnostic	EQUIPCO	EQUIPCO should no longer in the access business.
Business unit focus	Solution	ATG	Given the change in the market, ATG needs to reorient its priorities (no more "lab" mindset)
Business unit focus	Solution	Capability	Non-ATG EQUIPCO experience: more likely to appreciate need for business case, not technology for its own sake
Business unit focus	Solution	Function-business	Our role is to help tech teams come up with meaningful business cases
Business unit focus	Solution	Function-business	We need to make sure that every project is supported by at least one business unit
Business unit focus	Governance	EQUIPCO	Need to focus on projects with a short term, cash flow orientation
Business unit focus	Governance	Function-business	All projects need to have a clear market-based business case. Must be evaluated on economic as well as technical merits.

I also grouped the informants into categories of proposers, challengers and Review Board. I then calculated what percent of the potential frame repertoires in any particular area were salient for that group of people for a particular decision. This allowed to me to depict the major differences between the groups and show how they evolved over time

Table 1: Description of the projects studied, units of observation and units of analysis

Unit of observation: the project	Unit of analysis: pivotal decisions (resource allocation decisions)
<p>“LAST MILE”: Large project to identify market and technical opportunity in access technologies</p>	<ul style="list-style-type: none"> • Decision 1: Choice to initiate major exploration project in new market • Decision 2: Decision to continue investing in project for another month (continue analysis until the end of August) • Decision 3: Decision to narrow focus to a particular application area, for a specific business unit and product line
<p>“MULTISERVICE”: Effort to introduce a protocol technology that would allow carriers to offer multiple services to their customers without them having to scrap legacy equipment</p>	<ul style="list-style-type: none"> • Decision 1: Investment in developing a specific function as an incremental improvement for a specific product line • Decision 2: Decision not to fund larger project due to lack of business case • Decision 3: Informal decision to dedicate resources to the development of the technology (later ratified by steering committee)

Table 2: Typology of frames and examples of disputes in LAST MILE and MULTISERVICE projects

Type of frame	Description	LAST MILE	MULTISERVICE
Diagnosis of the challenge	<ul style="list-style-type: none"> • <i>The nature of technical change (evolutionary or revolutionary)</i> • <i>Threat or opportunity from the market</i> • <i>Structure of competition</i> • <i>Munificence or scarcity of resources</i> • <i>Firm capabilities</i> 	<ul style="list-style-type: none"> • Whether or not EQUIPCO could manage the economics of the access business • Whether demand would increase in a linear or discontinuous manner • Whether or not carriers would be willing to lay new fiber 	<ul style="list-style-type: none"> • Whether or not service providers would be willing to invest in new infrastructure
Solution	<ul style="list-style-type: none"> • <i>Incremental or radical technology</i> • <i>Competence enhancing or competence destroying</i> • <i>Product architecture</i> 	<ul style="list-style-type: none"> • Whether or not an optically-based solution was required • Whether the technology should be developed in-house or outsourced 	<ul style="list-style-type: none"> • Whether the project was an incremental, niche opportunity or a radical technology • Whether or not an optically-oriented solution was appropriate • Whether or not the technology would be revenue and competence enhancing or cannibalizing
Governance of the decision	<ul style="list-style-type: none"> • <i>Who has authority to make the decision</i> • <i>What criteria should be used for the decision</i> • <i>What kind of evidence is valid</i> 	<ul style="list-style-type: none"> • Whether technical experts or market analysis should judge the value of a specific technology 	<ul style="list-style-type: none"> • Whether it was sufficient for the project leader to do a side deal with management or if the Steering Committee and Review Board had the final say • Whether or not a business unit needed to be on board to justify a project • Whether technical experts or market analysis should judge the value of a specific technology

Table 3: Examples of different elements of frame repertoire made salient by particular project and decision contexts

	BRAD COPELAND	THERESA VENETO	HUGH COLLINS	JACK STAFFORD	TOM RENTHAM
Job, functional group	Head of ATG	Director, technical group	Senior scientist, technical group	Director, technical group	Manager, marketing group
Review Board?	√	√	√		
Steering Comm.?		√	√	√	
LAST MILE PROJECT					
Role on project	Only in job function	Head of architecture sub-team	D1-2: head of project. D3: advisor to head of project	Member of technical sub-team	Member of marketing and architecture sub-teams
Decision 1	Wants a program to look at getting "access to access," not a major development project.	Only interested in access project to the extent it helps sell other EQUIPCO products; not interested in a product revenue story. Should not look to invent a new broadband access technology. Have to fill out the templates for the Steering Comm. in order to get approval. Require e-mails from people in the business units	EQUIPCO's "broadband birthright": need to be in access to have an end-to-end solution. It is an "absolute disaster" not to have a larger presence in access technologies. Solution will be fiber-based ("Widget" technology). Because "business units have not signed up to a long-term vision that is beyond their radar screen," ATG has to push new technologies.	EQUIPCO needs an end-to-end solution, but not sure if anything needs to be done by ATG. Wants to see the analysis from Hugh. He thinks that 100 days is not nearly enough. It takes a long time to work with the product groups. And, they have even less than 100 days for a decision to not go ahead if market viability can't be shown.	Carriers will not invest in new infrastructure. EQUIPCO needs an access solution, but "What we do not believe is that we need any development we need to try to do that. It is really a strategic marketing and a strategic channel relationship we need to develop." "No proprietary solution." "Need to apply the process...to see if there is a business case for EQUIPCO."
Decision 2	Sees the gap in the EQUIPCO portfolio, but "we have to navigate in multiple directions. And, we need to understand where the market opportunities are relative to those directions...and what our core competencies are." ATG used to be isolationist, now needs to connect better to the business units and the market. "greater magnitude associated with the broader scope decisions than the narrow scope decisions and you have to get it right"	Continued belief that ATG should not do any technology/product development. Interim decision points are not updates but rather go/no go decisions (part of Steering Comm. discipline). Process needs to be taken seriously.	Threat from competition: need to have an end-to-end solution. "And I agree with them that those good old days for putting this stuff in the ground on the assumption customers will use it and buy it, they have gone. But, that does not mean to say we cannot making some use of fibers where it makes economic sense."	"They did not have clear definition of what it was they were actually doing."	Similar to previous frame. More emphasis on the need for a business case. "Bottom line, don't think about putting a backhoe in. It is way way cheaper to live with the copper."
Decision 3	"I want the passion. I want the emotion. I want you to pour your heart and soul into this." "Recall that at the end of the day in my job is to hedge activities for the company and I can't do that with a singular approach."	Willing to accept a small development project if it is "contained" and if the business unit has specifically asked for it.	ATG's role to provide technical leadership to support business units. Optics may be a part of the solution. "We have to do a more contained" project. "Given we are so publicly out of access and our customers now know we're out of it, we would have to rebuild our credibility with them to get back in. We do not have enough bandwidth to do that with all the other things we got to do."	Response time is the driver of bandwidth demand so "30 kbps per employee is useless." "It is not going to be everything copper." But, "there is a huge amount of competition in this area. And so you do not make a lot of money on it. So it is better to partner with somebody externally." "The disappointment I have is that they are focusing on the technology and not focusing on who is doing the technology out there and who we are going to recommend."	[Laid off before decision tabled.]

	BRAD COPELAND	THERESA VENETO	HUGH COLLINS	JACK STAFFORD	TOM RENTHAM
Job, functional group	Head of ATG	Director, technical group	Senior scientist, technical group	Director, technical group	Manager, marketing group
Review Board?	√	√	√		
Steering Comm.?		√	√	√	
MULTISERVICE PROJECT					
Role on project	Only in job function	Only in job function	Only in job function	Head of project	Lead marketing team member
Decision 1	"No brainer." Interesting technology with specific application in a business unit.	Where there is obvious business unit support, the project should go ahead.	Interesting technology. Should go ahead if the business unit wants it.	"Where you get traction in business unit is where you have a very linear process." "So when the alligators are biting and some business unit needs something done, we will pull resource and put it on that and what will happen is, the larger vision will never get enough resources to get to where it wanted to go."	"Me being in the role, drove home that mindset that we got to actively sell this before it's finished. We don't just do the infinite detail and then hope that someone picks it up." His goal is "to get a direct connection to some business unit for a product so that the technology development can be steered to have a better fit to the product."
Decision 2	"That's a really nice bridge technology. That's the future." Key is finding "the right place to do it" (right business unit).	"Because you can arbitrarily pick and do many different things and lot of them sounded pretty cool, but if you look at them in terms of what is the likelihood they will make it to market successfully..." "Need to add other dimension, not just the technology but also need the business case to show likelihood that the technology actually get into the market. I told you that you should have waited a few weeks until you had all of the data." They need to make sure they "go beyond the realm of personal interpretation of the data by getting others to agree to it."	"It is very significant for few product lines and it certainly helps [key product] penetrate where it wouldn't have gone before, but I do not think it is earth shattering. Why? Because it is not doing that huge shift of the business epicenter of the company."	Urgency argument: this is an activity that is moving rapidly in the industry. We can sit back and let others take the lead, or we can exert some leadership. Technical experts should predominate in the decision-making. "Technology is gut feel." Counter to Steering Committee approach: "They want to have all the ducks lined up before they even start things. All that does is slow down the process." Multiservice is a "disruptive technology." Marketing and business units have "linear thinking that seems to drive things and anything that is disruptive, people cannot get their heads around it."	Continuing focus on business unit needs. "Strong belief that the technology is useful," but because it is "threatening and cannibalizing to the business units," should not go ahead with the project.
Decision 3	"Why is this project being discussed? I thought it was already underway for several months."	"You'll be permitted if you get a customer and a business unit saying that their gut saying this makes sense and we are going to support you, so you are not standing alone and therefore you've communicated enough and it is tested enough with a few people, we will hedge it, I am willing to hedge."	Decision-making is "process heavy" and implemented in a heavy handed manner making the technical people feel that they are being micromanaged. Results in "spending hours, weeks, months to generate charts to get through them which is sapping the effort [to work on the projects] because we are spending 20-30% of our time to work the story to get through them." "This company does not have trust in its visionaries."	Customer need argument. Customer asked for a prototype, which gives us the justification to go before the investment board." "If you wait around for formal approval, then you never get anything done, because you miss the window, of opportunity."	[Laid off before decision tabled.]

Table 4: Examples of influence strategies and their framing and political aspects

LAST MILE

Influence strategy	Strategy	Framing aspect	Political aspect
Vision	Hugh argues that he knows access better than others	Lends credibility to his position that EQUIPCO needs an access offering and that ATG can develop one	“Trust me, I’m right” seen as a bullying tactic of a senior scientist
Convince with (or challenge) the data	At start of project, Hugh develops 200+ PowerPoint deck of data	Provides detailed data supporting his view	Makes it difficult for challengers to argue against him unless they invest substantial time in “debunking”
Lobbying	Before Decision 3, Susannah lobbies Theresa to make sure marketing team has input on proposal	Influences Theresa’s views on the project.	Susannah uses personal relationship to assure influence in the final decision.
Power plays	Hugh walks out of the Decision 2 meeting	Reinforces the strength of his belief in the project	Protects the project from being cancelled in the meeting. Reinforces his position as a truth-teller Leads to loss of personal power as he is removed from the project
	Before Decision 3, Hugh and Hermann “stage a coup”	Gives them time to develop a new way of framing the project (business unit needs)	Avoids the input of the marketing subteam

MULTISERVICE

Influence strategy	Strategy	Framing aspect	Political aspect
Vision	Jack meets with Brad to explain the technology and show its potential.	Builds enthusiasm for MULTISERVICE as “the next big thing.”	Brings in support from the head of the group.
Convince with (or challenge) the data	Tom does not develop a business case document for the project	Supports his view that there is not business unit demand and that a project should not be approved unless a business case exists.	Reinforces the power of the Steering Committee. Supports Tom’s position as a neutral arbiter.
Lobbying	Jack attempts to get George to develop a business case after Tom is laid off.	Attempt to influence how George sees the MULTISERVICE opportunity.	Divide and conquer strategy to continue to seek support from different parties until it can be found.
Power plays	Jack refuses to come to the Steering Committee after he makes the informal decision to staff the project	Reinforces his stance that the Steering Committee process gets in the way of creativity and market responsiveness	Allows the project to proceed to a point where it was entrenched and stopping it would have been costly.

Figure 1: schematic of model of framing contests for technology strategy-making

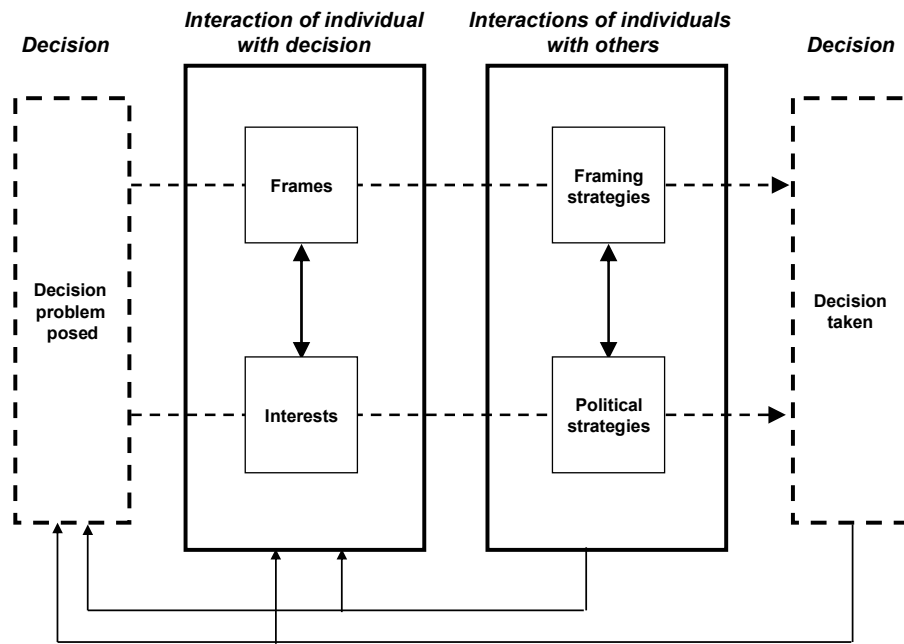
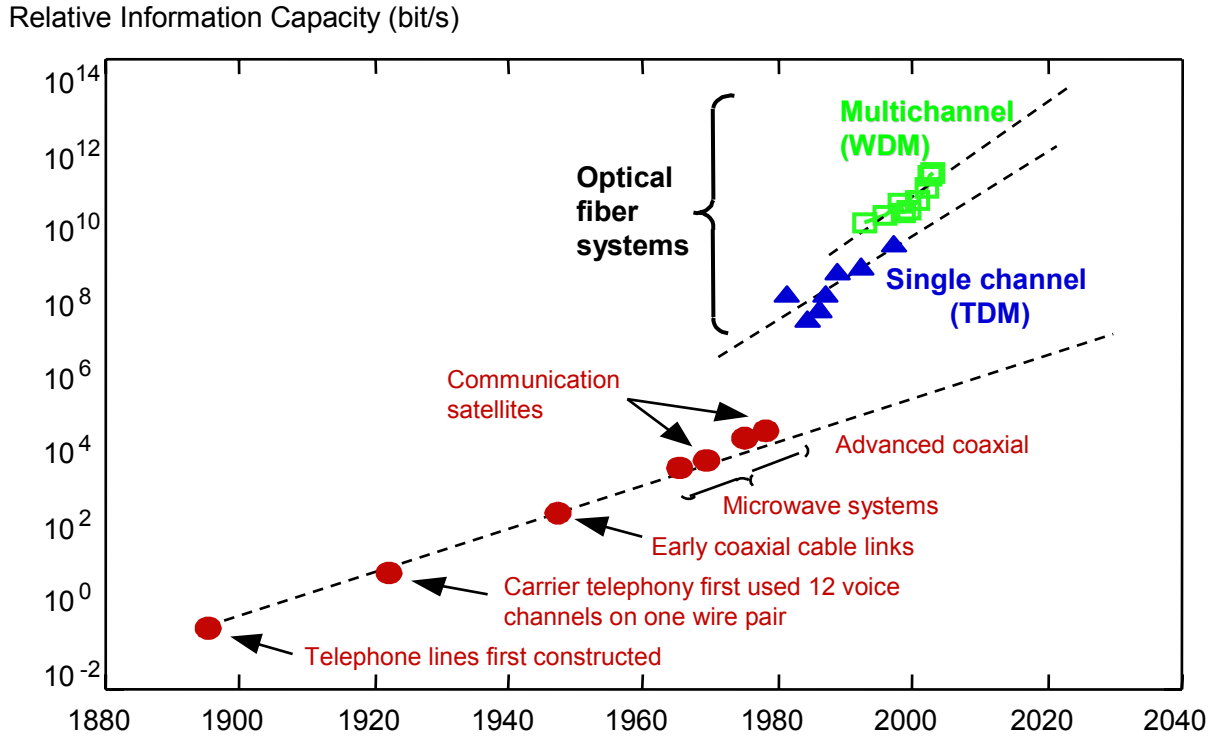
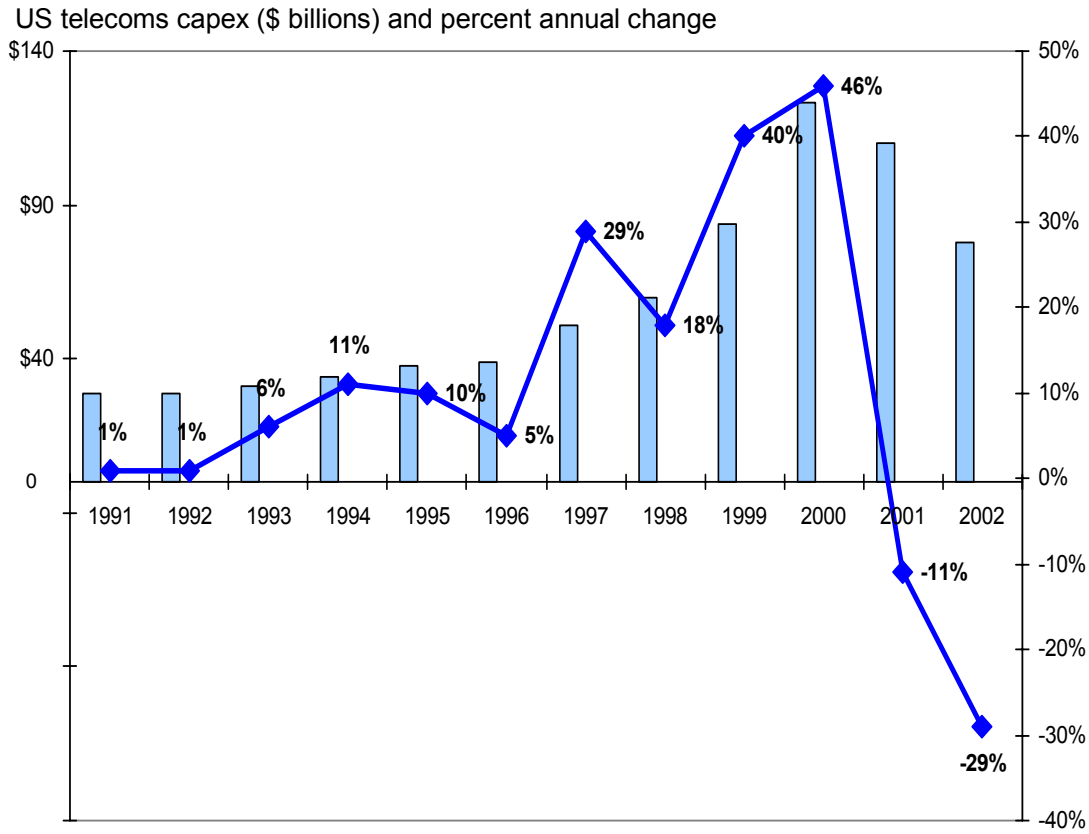


Figure 2: emergence of optical technologies in the communications industry



Source: Fine and Kimerling, "Biography of a killer technology"

Figure 3: performance of the communications equipment and components industry



Source: JP Morgan

Figure 4: organization of EQUIPCO's Advanced Technology Group (ATG)

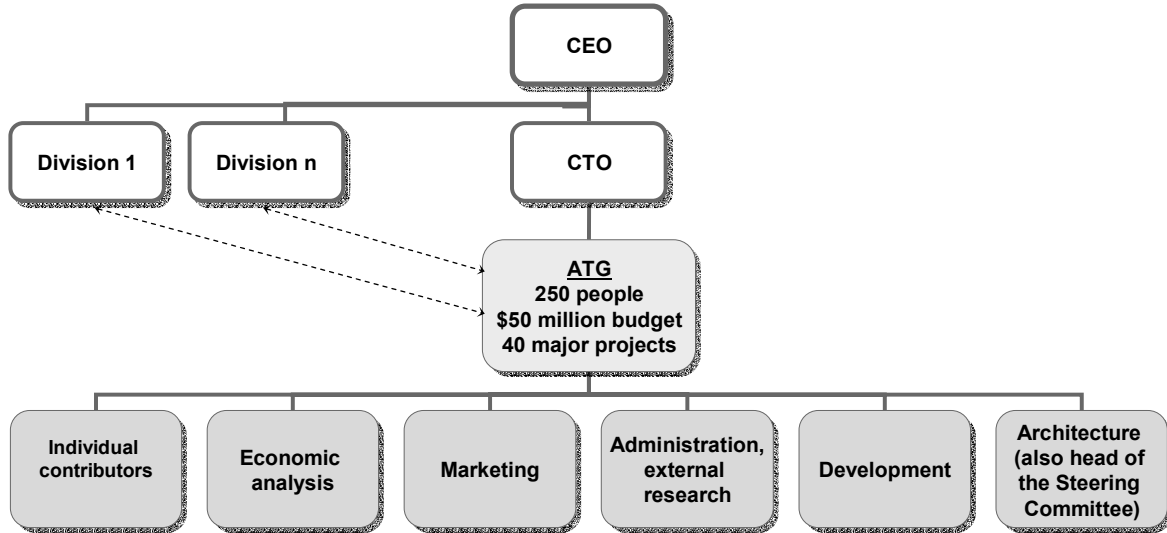


Figure 5: key players in Review Board, Steering Committee and two projects studied in EQUIPCO's Advanced Technology Group

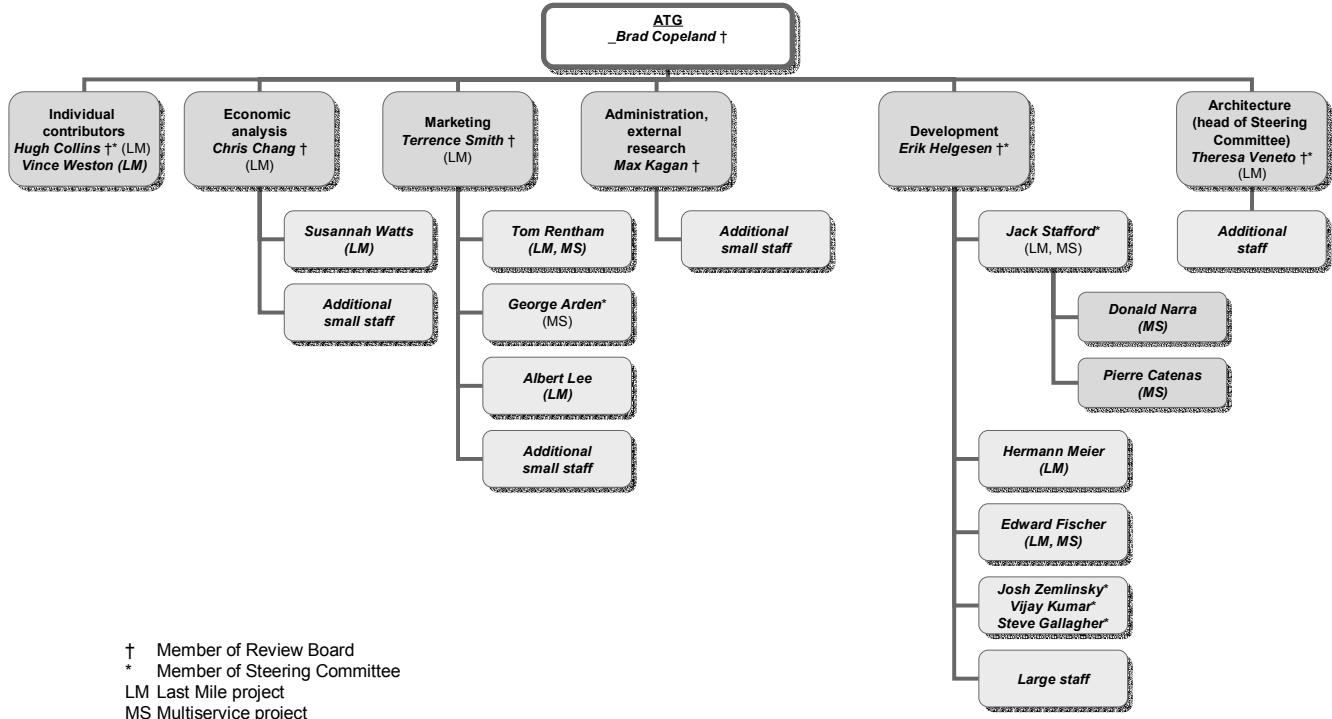


Figure 6: LAST MILE, frame elements by group for each decision

Percent of potential frame elements made salient in each decision

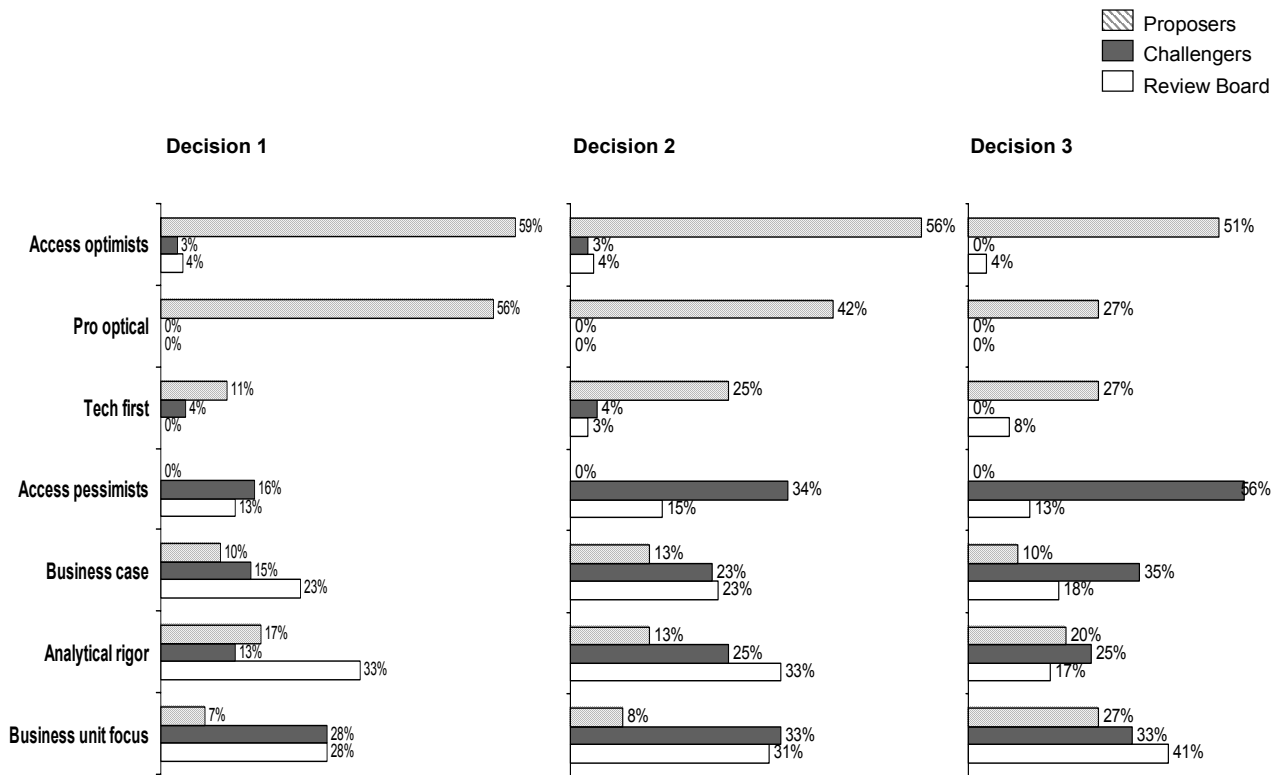


Figure 7: LAST MILE. Change in salience of frame elements from Decision 1 to 3.

Change in percent of potential frame elements made salient in each decision

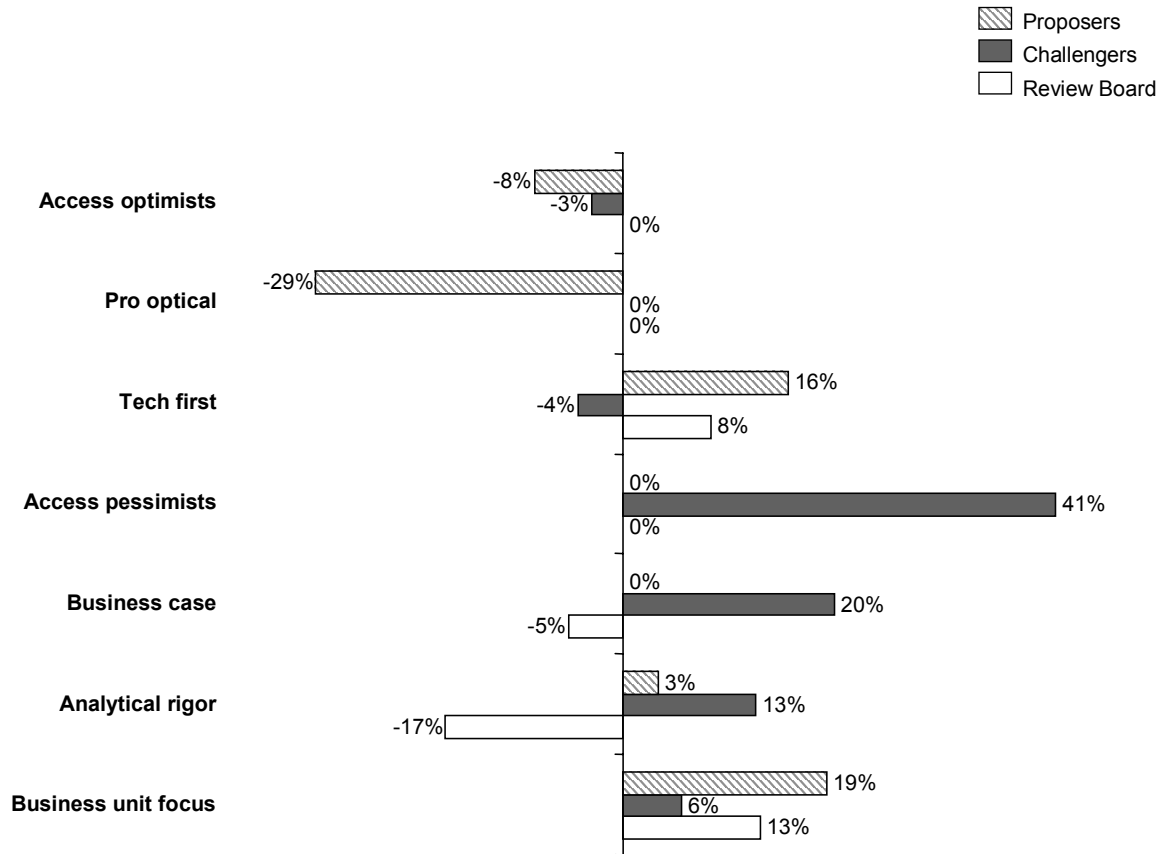


Figure 8: MULTISERVICE, frame elements by group for each decision

Percent of potential frame elements made salient in each decision

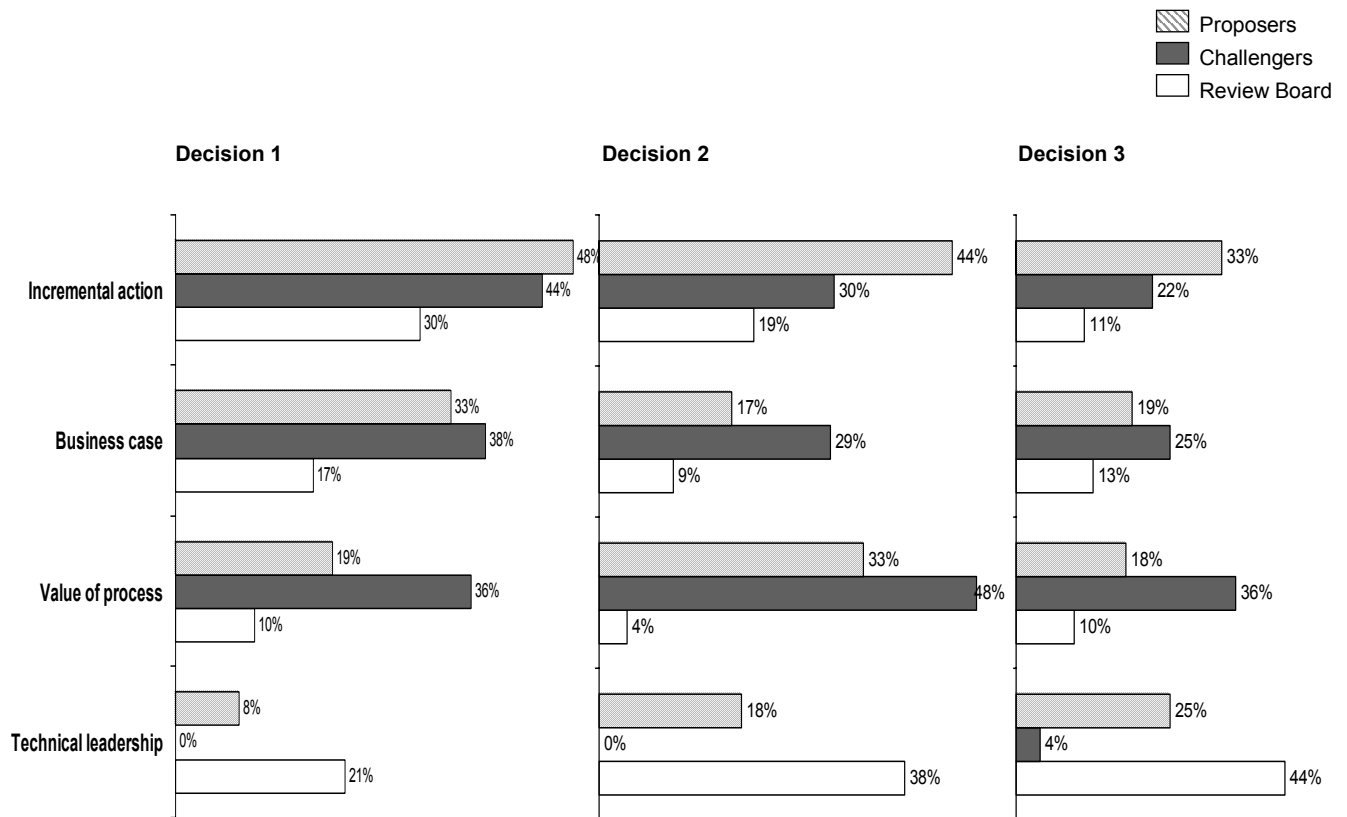


Figure 9: MULTISERVICE. Change in salience of frame elements from Decision 2 to 3.

Change in percent of potential frame elements made salient in each decision

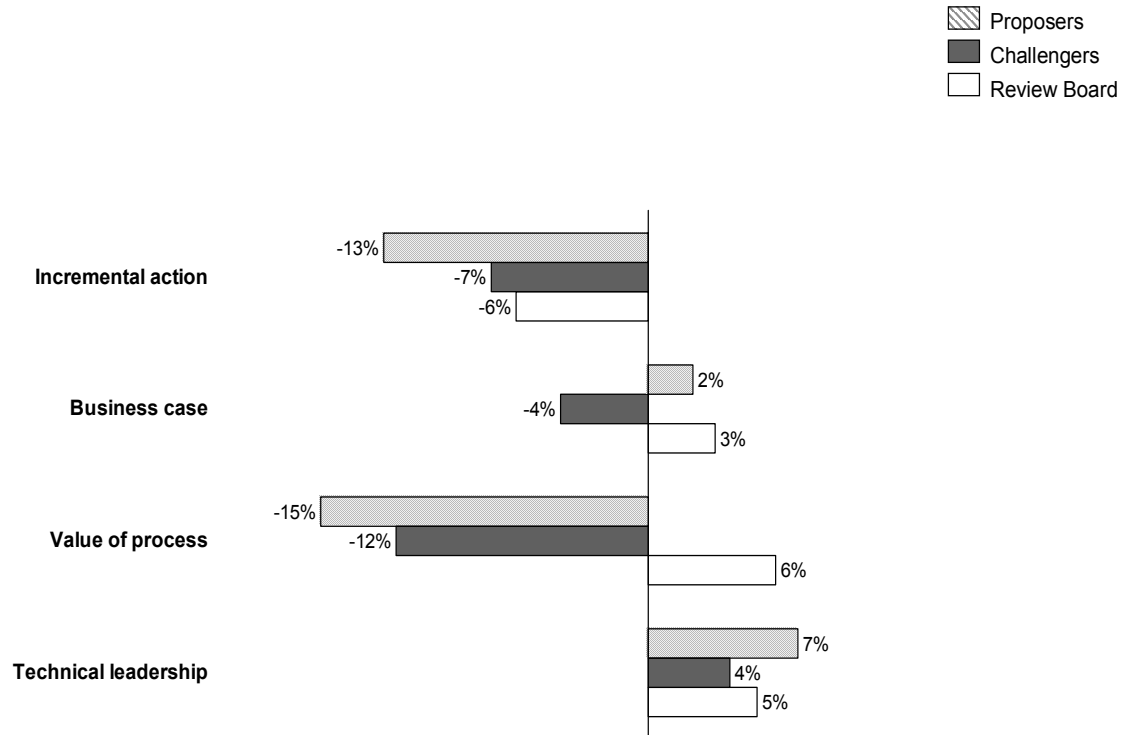


Figure 10: role of frames in strategy making

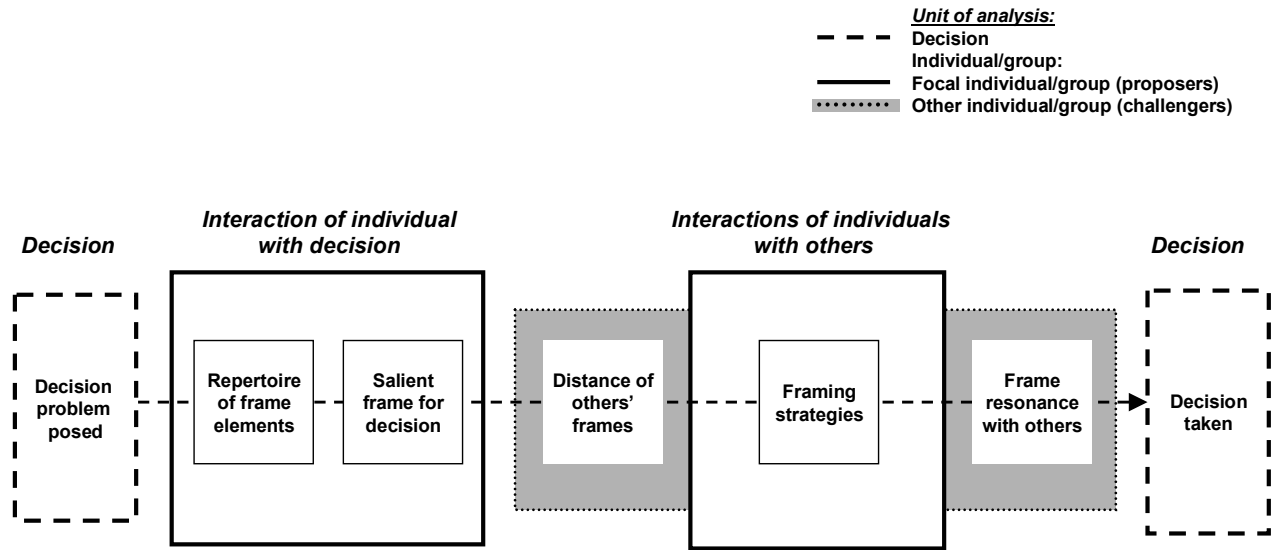


Figure 11: integrative model of framing contests in strategy-making

