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Technology, Identity, and Inertia Through the Lens of "The Digital Photography Company"

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Organizations often experience difficulty when pursuing new technology. Large bodies of research have examined the behavioral, social, and cognitive forces that underlie this phenomenon; however, the role of an organization's identity remains relatively unexplored. Identity comprises insider and outsider perceptions of what is core about an organization. An identity has associated with it a set of norms that represent shared beliefs about legitimate behavior for an organization with that identity. In this paper, technologies that deviate from the expectations associated with an organization's identity are labeled identity-challenging technologies. Based on a comprehensive field-based case study of the entire life history of a company, identity-challenging technologies are found to be difficult to capitalize on for two reasons. First, identity serves as a filter, such that organizational members notice and interpret external stimuli in a manner consistent with the identity. As a result, identity-challenging technological opportunities may be missed. Second, because identity becomes intertwined in the routines, procedures, and beliefs of both organizational and external constituents, explicit efforts to shift identity in order to accommodate identity-challenging technology are difficult. Given the disruptive nature of identity shifts, understanding whether technology is identity challenging is a critical consideration for managers pursuing new technology.

Key words: technological change; organizational evolution; organizational identity; industry emergence
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> Intel equaled memories in all of our minds. How could we give up on our identity? How could we exist as a company that was not in the memory business? It was close to being inconceivable.
>
> (Grove 1996, p. 90)

Technological change can provide tremendous opportunities for firm growth and renewal; however, the challenges of capitalizing on these opportunities are significant. Existing capabilities, resource commitments, behavioral routines, and cognitive frames frequently constrain a firm's response to external change such that the same elements that helped foster success under one technological regime become inertial forces, limiting adaptive flexibility and driving suboptimal outcomes in a different environment (Benner and Tushman 2002, Christensen and Bower 1996, Henderson and Clark 1990, Kaplan 2008, Tripsas and Gavetti 2000, Tushman and Anderson 1986). Part of the challenge is that technological change often has implications beyond the technology itself; new customer segments with different preferences may emerge (Abernathy and Clark 1985, Christensen and Bower 1996, Tripsas 2008); complementary assets necessary for commercialization may shift (Mitchell 1989, Tripsas 1997); new business models may be required (Chesbrough and Rosenbloom 2002, Tripsas and Gavetti 2000); the optimal modular boundaries and degree of vertical integration may change (Baldwin 2008, Jacobides et al. 2006); and different alliance networks may be appropriate (Rosenkopf and Nerkar 2001, Rothaermel and Boeker 2008). A firm may ultimately need to develop an entirely new organizational identity whereby both organizational members and external constituents must alter deeply held assumptions and beliefs about what the firm represents. Even seemingly minor shifts from a technological standpoint may challenge the existing organizational identity if, by pursuing the new technology, the organization violates the core features associated with its existing identity. Yet, despite the potential importance of organizational identity as it relates to technological transitions, the terrain is relatively unexplored.

Organizational identity represents both how organizational insiders and outside constituents perceive an organization (Hsu and Hannan 2005, Pólos et al. 2002). Because distinguishing between these two perspectives can be important to understanding technology and identity dynamics, I use the phrases "internal identity" and "external identity" where that distinction is relevant.[1] Internal identity represents a shared understanding by organizational members regarding what is central, distinctive, and enduring about an organization (Albert and Whetten 1985). It helps insiders to answer questions such as "Who are we? What kind of business are we in?" and guides key strategic decisions such as whether to make an acquisition, enter a new market, or divest a division. When faced with uncertainty or a challenging issue, managers view the issue through the lens of the firm's internal identity, which guides interpretation and action (Dutton and Dukerich 1991b, Markides 2000). External identity, on the other hand, captures how outside audiences such as institutional actors, customers, suppliers, or

complementary producers view the organization (Gioia et al. 2000). Having categorized an organization in a particular way, outsiders associate specific characteristics with it and form certain expectations or codes about how the organization should act (Hsu and Hannan 2005, Pólos et al. 2002). An organization's external identity can provide legitimacy if it abides by the rules of a clearly defined category or trigger confusion if it deviates too far (Benner 2007, Zuckerman 1999).

The continuity of identity provides stability both within the organization and in its projections to outsiders, improving long-term survival (Hannan and Freeman 1984). When environmental conditions necessitate a shift in identity, however, the ensuing change process is risky and difficult to manage (Hannan et al. 2006a, Reger et al. 1994). Radical events, such as the separation of a business unit from its parent in a spin-off (Corley and Gioia 2004), can initiate major changes in identity, but in other situations proactive efforts on the part of top management are needed to facilitate identity shifts (Fiol 2002, Gioia and Thomas 1996).

Although our cumulative knowledge of the dynamics associated with identity is considerable, its specific relationship to technological change efforts remains neglected. I label technologies that deviate from the expectations associated with an organization's identity as identity-challenging technologies and address two core research questions: (1) How does an organization's identity affect its filtering of technological opportunities and its ability to respond to identity-challenging technologies? (2) When an organization's pursuit of an identity-challenging technology results in a shift in identity, how does the change process unfold?

I use an inductive, field-based case study of the entire life of a single firm, Linco[2], to explore these issues. Linco provides a compelling example of the role of identity as it relates to technological change. Upon founding, the firm took advantage of the emergence of digital photography to define itself as a leading supplier of what it called "digital film"—the flash memory cards that store images taken by digital cameras. By engaging in proactive communication and action, the firm established an identity as The Digital Photography Company. Although this identity was effective early on in guiding the strategic actions of the firm, it became a liability when architectural innovation in flash memory created an opportunity that did not fit with the identity. Initially, organizational members did not notice the commercial potential of the identity-challenging innovation, and once noticed it was not initially pursued. Eventually, given environmental pressure, a new CEO was appointed and Linco pursued both this architectural innovation and other technological initiatives that ultimately resulted in intentional efforts to shift the firm's identity. But both internal constituents and external stakeholders were slow to recognize and internalize the shift. After a period of identity ambiguity (cf. Corley and Gioia 2004), a new external identity began to solidify, and the firm finally converged on a new identity in response to an external imperative to clearly define itself to outsiders interested in acquiring the firm.

This study contributes to multiple streams of literature. First, in the field of technology management, it enhances our understanding of why the pursuit of new technological opportunities can be so problematic. The filters imposed by an existing identity, as manifested in the routines and beliefs of organizational members, may blind those members to identity-challenging technological opportunities. And, once identified, identity-challenging technology may necessitate a shift in the firm's identity—a potentially traumatic and disruptive process. Identity is not just one more factor to consider when unraveling sources of inertia. Identity serves as a guidepost, directing the development of some routines and capabilities over others and reinforcing some beliefs over others (Kogut and Zander 1996). So in those instances where new technology requires a change in identity, attempting to alter only routines, capabilities, or beliefs without acknowledging the broader implications for identity can be problematic. Similarly, any effort to change identity must reach beyond corporate rhetoric and extend deep within an organization's processes in order to be effective. Second, this study contributes to the organizational identity literature by explicating, through unique, detailed, longitudinal empirical data, the process by which internal and external organizational identity and the environment dynamically interact and change. For instance, by examining separate measures of the evolution of internal and external identity over time this study highlights the primacy of external identity in transitions—when emerging from a period of identity ambiguity, external constituents in the form of financial analysts first began to converge on a new external identity followed by organizational members for whom ultimate consensus around a new internal identity was triggered by an external imperative from potential acquirers to define the firm. Third, this study highlights the importance of strategic renewal in small, young organizations in contrast to the emphasis of most existing work on large, established organizations. Although start-ups are often portrayed as continuously morphing entities that opportunistically adapt (Bhide 2000, Brown and Eisenhardt 1997, Rindova and Kotha 2001), Linco exhibited a period of relative stability with major reorientation accompanying a change in leadership (Tushman and Romanelli 1985).

Sources of Inertia: Technological Change and Identity

The difficulty that firms encounter adapting to new technology has been well documented across a range

of industries (Christensen 1997, Cooper and Schendel 1976, Tushman and Anderson 1986, Utterback 1994). The organizational reasons fall into two broad categories: routines/capabilities and cognition. Existing behavioral routines and procedures, codified in organizational capabilities, persist in the face of change and result in suboptimal responses to innovation (Levinthal and March 1993, Nelson and Winter 1982). Established firms have particular difficulty adapting to competence-destroying technological change that requires the acquisition of fundamentally new knowledge and routines (Tushman and Anderson 1986). For instance, Swiss watch manufacturers were devastated by the transition from mechanical to quartz movements in watches (Glasmeier 1991, Landes 1983). The web of external relationships and social commitments held by Akron-based firms in the tire industry provided an advantage when bias-ply tire technology was dominant but impeded change when radial tire technology emerged (Sull et al. 1997). National Cash Register's initial poor response to the advent of electronic business machines and digital computers was partially related to the rigidity of its manufacturing organization—previously a competitive strength (Rosenbloom 2000). Even seemingly minor architectural innovations can be traumatic given the inertia surrounding organizational information filters and communication patterns (Henderson and Clark 1990). Some routines, such as total quality management, that are meant to improve a firm's efficiency in a core business crowd out more exploratory initiatives, limiting the firm's ability to take advantage of novel opportunities (Benner and Tushman 2003). Thus, in aggregate, core competencies can turn into "core rigidities" or "competency traps" that constrain the development of new capabilities (Barnett and Hansen 1996, Leonard-Barton 1992, Levitt and March 1988).

Even if a firm engages in exploration, cognitive elements can be problematic. Interpretation of a new technology as a threat can result in high investment of resources in a rigid manner that preserves existing routines. For instance, newspapers that viewed the Internet as a threat offered fewer novel features on their websites, perceiving the Internet as primarily another vehicle for distributing the newspaper (Gilbert 2005). Management attention may also play an important role (Danneels 2003, Ocasio 1997). In the communications technology industry, less CEO attention on fiber optics was related to delayed firm entry into the emerging technology (Eggers and Kaplan 2009), and in disk drives, management focus on existing customers precluded recognition of emerging segments where new techology was initially applied (Christensen and Bower 1996). Even if management is focused on the salient issues, beliefs about the fungibility of internal resources can drive suboptimal behavior, as in the case of Smith Corona, where erroneous management beliefs about the value of the brand led to inadequate investment in the digital technologies that replaced typewriters (Danneels 2008). Finally, firms may apply outdated beliefs in the development of business models even if they are successful at developing new technical capability as in the case of Polaroid with digital imaging (Tripsas and Gavetti 2000).

In the midst of this extensive literature, there remains a surprising gap: The influence of organizational identity on firm responses to technological change has not been explicitly examined. This relationship would seem to hold promise for improving our understanding of inertial responses to technological opportunities given the importance of identity dynamics in shaping firm actions in other settings. As a point of departure, I build on and integrate two distinct but related streams of research on identity, one with origins in organizational behavior and the other in sociology.

Whereas original conceptions of internal identity in the organizational behavior literature defined the construct as collective agreement by insiders regarding the central, distinctive, and relatively permanent features of the organization (Albert and Whetten 1985), recent work has emphasized its dynamic nature (Gioia et al. 2000, Nag et al. 2007, Ravasi and Schultz 2006). In particular, research has focused on how organizations respond to identity threats—inconsistencies between internal identity and internal perceptions of external identity. When organizational members discern such a threat, they engage in a variety of strategies to restore consistency. In some cases organizations reframe the threat so that the inconsistency is alleviated without having to change internal identity. For instance, in examining how top business schools responded to the Business Week rankings that threatened internal beliefs, Elsbach and Kramer (1996) found that individuals used cognitive tactics, such as focusing on categories not considered in the external rankings, to retain their positive perceptions of the organization. In other situations, when confronted with an identity threat, managers undertake persuasive communications and actions with the goal of improving external views (Dutton et al. 1994, Gioia et al. 2000). In response to a perceived degradation of outsider perceptions resulting from an inadequate response to homelessness, members of New York's Port Authority eventually reframed the homeless issue and took more aggressive action to solve the problem, hoping to improve outsider views and restore consistency with insider views (Dutton and Dukerich 1991a).

Sometimes a shift in the external environment or desired internal change cannot be accommodated within the constraints of an existing identity, so a change is needed. Reger et al. (1994) propose that the reason total quality management was so difficult for firms to implement was that it required not only a change in organizational behaviors but a fundamental transformation in how an organization viewed itself. Management recognition of the need to change identity and not just alter strategy or operational tactics is crucial if firms are to avoid

an "identity trap" (Bouchikhi and Kimberly 2003). But, not surprisingly, internal identity is difficult to change. Fiol (2002) found that rhetoric was a critical tool for resolving an organization's paradoxical need to lessen individual identification with an organization to facilitate change while at the same time strengthening individual identification with a new internal identity. The importance of passing through an intermediate period of identity ambiguity, which creates a sense-giving imperative for management, has also been recognized (Corley and Gioia 2004, Gioia and Chittipeddi 1991), along with the importance of articulating a desired future identity (Gioia and Thomas 1996).

While the focus of the organizational behavior literature has been on inertia associated with internal identity, the sociology-based literature has emphasized the inertia associated with external identity. Building on the fundamental premise that external audiences value accountability and reliability in organizations (Hannan and Freeman 1984), this literature has documented the risks associated with deviation from an established external identity (Hannan et al. 2006a). Identity in this sense is the classification of an organization as a member of a particular category—a category that has associated with it a set of rules or codes that codify commonly held beliefs and expectations about how the organization will behave—in other words what constitutes legitimate action (Hannan et al. 2006b, Hsu and Hannan 2005, Pólos et al. 2002). The pressure on organizations to conform to these expectations is strong, as seen in Zuckerman's work on the behavior of financial markets (Zuckerman 1999, 2000, 2004).

Combining these two perspectives on organizational identity leads to the conclusion that organizational identity serves a coordinating role, providing a focal point for both insiders and outsiders about what constitutes legitimate action on the part of an organization. As such, identity guides the development of capabilities, the acquisition of knowledge, the evolution of routines, and the framing of issues (Kogut and Zander 1996). Given that technological change can be identity challenging, extending this research into the realm of technology management should bring new insights.[3]

Data and Methods

Because the relationship between identity and technological change is not well understood, I used an inductive, longitudinal, field-based case study that is well suited for developing grounded theory (Eisenhardt 1989, Glaser and Strauss 1967). In particular, this approach enabled me to examine feedback processes driving the change dynamics over time. I studied one organization, Linco, from its founding in 1996 through its acquisition in 2006. Although studying a single organization limits the generalizability of the findings, it allowed me to delve deeply into the organization and thus develop a richer understanding of the evolution of identity, combining measures from both interview data and content analysis of archival data. The firm was chosen as a setting specifically because of the importance of technology and identity in its evolution, so in that sense it is an "extreme case," where the theoretical issues of interest were more "transparently observable" than might typically be the case (Eisenhardt 1989).

Research Setting

Linco originated with a small group of engineers at SemiCo, a supplier of controllers for hard disk drives. Intrigued by the possibilities of an emerging technology, flash memory,[4] these engineers initiated an exploratory research project, which flourished and became a formal business unit in 1993. The group had grown to approximately 30 engineers when, in September 1996, SemiCo decided to spin it off. The employees in the group, along with outside private investors, financed the purchase of the unit, and Linco was formed.

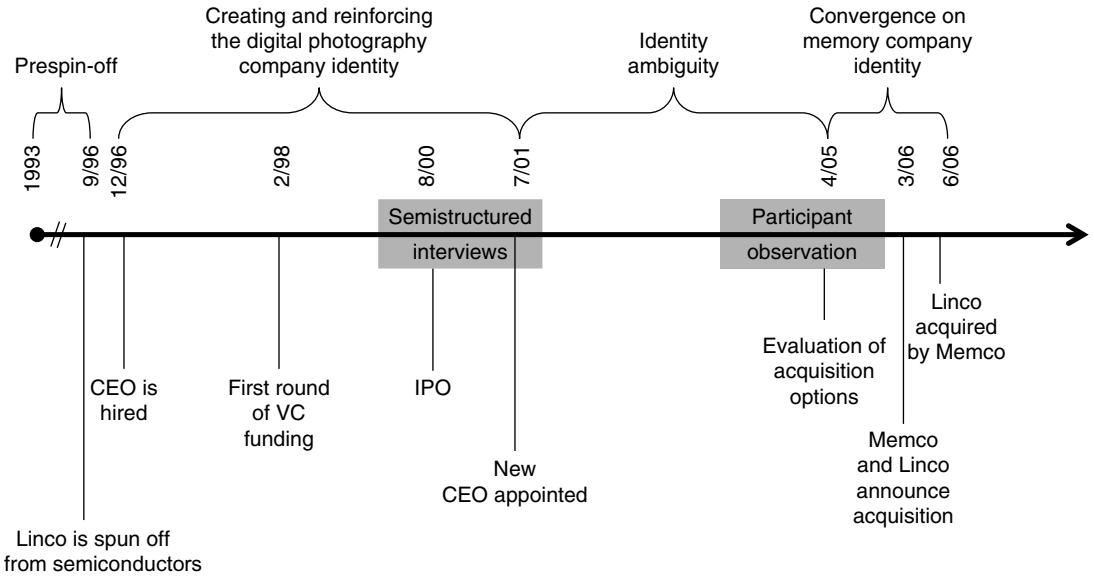
A brief period of turmoil quickly culminated in the hiring of a CEO who, through discussions with senior leaders, had gained consensus around establishing the firm's identity as The Digital Photography Company. For several years, this identity was reinforced as both the digital imaging industry and Linco gained momentum. Linco received multiple rounds of venture capital (VC) and went public in August 2000 having achieved revenues of $88 million and approximately 30% market share for flash memory cards that year. Despite revenue growth, by 2001 financial concerns resulted in the appointment of a new CEO, who attempted to distance Linco from the digital photography company identity to pursue new technological opportunities. A phase of identity ambiguity ensued during which both insiders and external constituents were unsure what Linco stood for. Eventually, sparked by an external offer in mid-2005 to acquire the firm, members of the organization converged on a new identity as a memory company, culminating in the acquisition of Linco by a memory company in June 2006.

Data covering the entire lifespan of Linco were gathered from four sources: (1) semi-structured interviews conducted from the spring of 2000 through the spring of 2001, (2) participant observation from April 2003 through June 2006 (see Figure 1 for the timing of fieldwork relative to Linco's life stages), (3) internal archival materials such as presentations from offsite meetings and strategic plans, and (4) publicly available archival materials. The combination of insider and outsider status provided a unique perspective (Evered and Louis 1981), and multiple sources allowed for triangulation of themes and conclusions (Miles and Huberman 1984).

Interviews and Observation

Between spring 2000 and spring 2001, a research assistant and I conducted a series of semistructured interviews

Figure 1 Linco Field Work Timeline



at Linco as part of another research project. Before conducting the interviews, we developed a profile of the company based on public sources (e.g., press releases, trade journals, business press, and company Web pages) to guide our discussion. The original goal of these interviews was to understand Linco's product development process, and we followed an interview protocol developed for Linco, along with six other firms being studied.

Fourteen individuals were interviewed, and to get a complete picture of the organization we spoke not only with the entire top management team, but also with staff in each functional area. (See Table 1 for a list of interviewee titles.) Each interview lasted over an hour, with a few extending to half-days, and some individuals were interviewed multiple times. Interviews were later followed up with emails to clarify key points. Interviews were taped and transcribed by a professional transcription service.

Table 1 Overview of Linco Informants

Interviewees spring 2000–spring 2001	Informants: Formal interaction April 2003–June 2006	Informants: Informal interaction (in addition to those listed under formal interaction)
CEO and president	CEO and president	R&D staff
Chief operating officer	Chief operating officer	Sales staff
Controller	Chief financial officer	Marketing staff
General counsel	Controller	Administrative assistants
Chief technology officer	General counsel	Receptionist
VP business development	Chief technology officer	
VP marketing	VP business development	
VP sales	VP marketing	
VP operations	VP sales	
VP international sales	VP operations	
Director, applications engineering	R&D staff	
R&D staff	Marketing staff	
Marketing staff	Sales staff	
Director, Internet website	Director, human resources	
	Managing director, Japan	
	Managing director, Europe	

In 2003, I joined the board of directors of Linco, creating an opportunity to study the issue of identity in depth. I was a member of the board from April 2003 until July 2006, when the company was acquired. During this time, I engaged in participant observation and kept detailed field notes (Lofland et al. 2005, Spradley 1980). In total, I made 16 two- to three-day trips for committee and board meetings at Linco's offices. During these trips, I interacted with a broad range of Linco employees as well as with outside investors and advisers. Members of Linco management were frequently invited to present to the board on aspects of the business, providing a formal mechanism for interaction. In addition, I engaged in numerous informal discussions with management and staff. (See Table 1.)

Archival Records

As an insider I had an unusually complete level of access to internal company records, including, for instance, original business plans circulated to potential VC and angel investors, internal strategic plans, financial plans, board books, and presentations to employees. Private company records were supplemented by an exhaustive compilation of all public documents related to the company, including analyst reports from the time the company went public in 2000 through its acquisition in 2006; all articles available in the Factiva, Lexis/Nexis, and ABI Inform databases that mention the company from 1996 through 2006; all press releases and public Securities and Exchange Commission filings of the company; and

marketing literature distributed at trade shows, such as the annual Photo Marketing Association meeting.

Data Analysis

Data analysis occurred in two distinct phases. Initial analysis of the field interviews (from 2000–2001) was conducted by three researchers, following a grounded theory approach. My two coauthors (from the original project) and I independently analyzed the transcripts for common words and topics to highlight key issues and group them into themes. We compared results and repeated the process until we developed a final set of themes. For Linco, the importance of the firm's digital photography identity in guiding product development decisions emerged as a key theme. Although this finding did not become an important element of the published results from the product development project (Staudenmayer et al. 2005), it provided the starting point for the current project.

In analyzing the extended data gathered for the current study, I began by constructing a master timeline that included major events and issues in both Linco's history (e.g., strategic decisions, product announcements, resource allocations, and managerial communications) and the digital photography and flash memory industries (e.g., industry sales and technological innovation). I also coded interviews and field notes, specifically looking for issues related to identity. My goal was to capture the essence of Linco's identity over time and, where appropriate, relate those measures to other parts of the timeline. Clearly, as a participant observer my own bias could influence interpretations. Therefore, I looked to archival sources to confirm or disconfirm conclusions. Internal documents such as strategic plans and presentations were used as supporting evidence for assessments of internal identity, public documents such as press releases as supporting evidence for identity projected by management, and outsider assessments of Linco such as analyst reports and media coverage as supporting evidence for external identity. (See Table 2 for an overview of archival sources.)

Finally, content analysis, in the form of normalized word counts,[5] was used to provide quantitative confirmation of the qualitative assessments. Content analysis has been increasingly used in managerial research, in particular as a means for measuring cognitive constructs that are difficult to codify (Duriau et al. 2007). Confirmation of internal identity was based on the letter to shareholders in Linco's annual reports, which has the advantage of providing a consistent, comparable measure over time. Although these letters certainly represent what management would like outsiders to know about an organization and in that sense contain an element of projected identity, they have also been shown in prior research to represent what management considers most salient to the firm and as such provide a reasonable gauge of managerial attention and beliefs about key issues (Abrahamson and Hambrick 1997, Kaplan 2008, Kaplan et al. 2003, Osborne et al. 2001). In fact, Fiol's (1995) comparison of internal planning documents and the letter to shareholders found that, although the interpretation of an issue as threat or opportunity was not consistent across the documents, the basic issues and themes examined were. Confirmation of Linco's external identity was based on the text (excluding tables and financials) of financial analyst reports over time. These reports include analyses of the firm, identify key issues, and make projections about future performance, thus providing a sense of what analysts consider salient in evaluating the firm (Benner 2008, 2009).

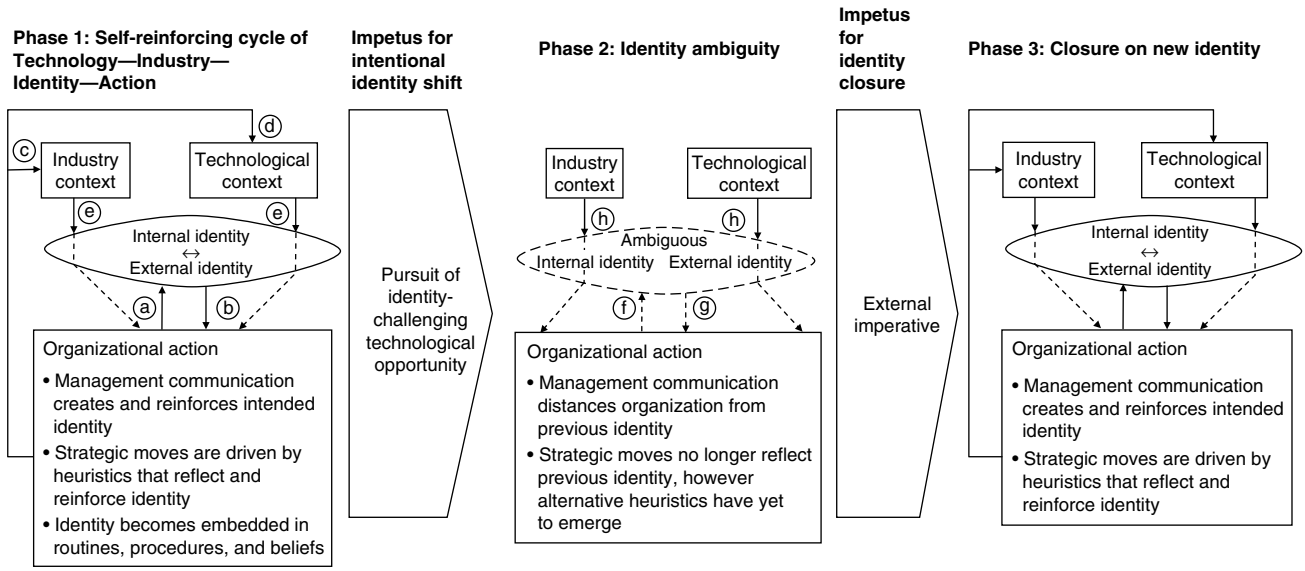
For both letters to shareholders and analyst reports, I counted photography and memory words. These two themes were identified as important based on the qualitative analysis. Using a concordance of words in the annual reports and analyst reports, I identified a set of words related to photography (photo, image, picture, film, camera, and associated variations) and to memory (disk, media, card, flash, memory, storage, controller, floppy, and associated variations).

Data were analyzed iteratively until a point of theoretical saturation was reached (Glaser and Strauss 1967). As part of this iterative process, I wrote a teaching case study about Linco's identity and technological opportunities in the fall of 2004. This case was circulated among Linco's management team and within the board (which included some of the original investors in the company) to check for accuracy and correct any inappropriate representations. It was also circulated and discussed among

Table 2 Overview of Archival Data Sources

Evidence of internal identity (how insiders view the firm)	Evidence of projected identity	Evidence of external identity (how outsiders view the firm)
Internal documents	Business plans (1997–1999)	Analyst reports (2000–2006)
Strategic plans (2000–2006)	Offering memorandum (1999)	Company profiles (2000–2006)
Offsite presentations and meeting notes (1999–2006)	SEC filings (2000–2006)	Media coverage (1996–2006)
Board books (2003–2006)	Conference calls with analysts (2000–2006)	
Annual report letter to shareholders	Press releases (1997–2006)	
	Interviews published in the media (1997–2006)	
	Advertising, brochures (1997–2006)	

Figure 2 A Model of Identity Change in Response to Technological Opportunities



academic colleagues, thereby helping to refine original interpretations and providing some external validation for my conclusions.

A Model of Identity Change in Response to Technological Opportunities

The model of identity change in response to technological opportunities that emerged from Linco's experience comprises three phases: (1) a self-reinforcing dynamic supporting the original identity, (2) a period of identity ambiguity triggered by pursuit of identity-challenging technological opportunities, and (3) convergence on a new identity with a new self-reinforcing dynamic. (See Figure 2.) In phase one, the identity is created and then reinforced through a feedback process among the original identity, organizational action, technology, and industry. Organizational action in the form of both management communications about the identity and strategic actions consistent with the identity help to establish coherent, shared beliefs among insiders and outsiders regarding what the organization represents (arrow a). Those beliefs in turn influence action, providing heuristics that guide decision-making routines (arrow b). Organizational actions also influence the industry's growth and shape aspects of its development (arrow c). In particular, organizational action directs technological progress in the industry such that it builds on the firm's strengths (arrow d). Input from the industry and technological environment are then noticed and filtered through the lens of the firm's identity, resulting in ongoing management action that reinforces the identity (arrow e). The first source of inertia in this model is therefore the cognitive screen that identity places on environmental stimuli, resulting in noticing and interpreting events—in particular, technological change—in a manner consistent with the existing identity.

The second source of inertia comes from the positive feedback loop that reinforces consistent elements of the system. Breaking this cycle and shifting identity is difficult, as illustrated by Stage 2 of the model. Triggered by a decision to take advantage of an identity-challenging technological change, management communication and strategic actions distance the organization from the previous identity (arrow f). However, without a clear alternative identity articulated, the organization enters a period of identity ambiguity, where both internal and external constituents are unclear as to what the organization is. The ambiguous identity provides unclear signals to the members of the organization, and new heuristics are therefore slow to develop, resulting in a broader, exploratory set of strategic moves (arrow g). Similarly, signals from the industry and technological environment are no longer focused by the identity, resulting in a broader range of actions (arrow h). The ability to shape the industry and the technological context is diminished given this unclear commitment. Eventually, in Stage 3, internal and external audiences converge on a new identity, led by a movement in external identity with final closure on internal identity triggered by an external imperative to focus. The consistency in identity leads to another self-reinforcing dynamic like that of phase 1.

Identity and Technological Change at Linco

I next describe in detail the history of Linco that gave rise to the model.[6] Table 3 provides representative data from Linco across the three phases. Because I do not have detailed data on the events that occurred before the

Table 3 Representative Data Supporting Interpretations of Identity Across Stages

	1. Identity: The digital photography company (12/96–7/01)	2. Identity ambiguity (7/01–4/05)	3. Identity: The flash memory company (4/05–6/06)
Internal identity (interviews, internal documents, and annual report letter to shareholders)	"It feels really different working at Linco compared to FlashCo [his former employer]. Here everyone is always talking about digital photography…it's there in everything we do" (VP of sales, May 2001 interview). "Today, Linco is recognized as a best-of-class supplier of high-performance digital photography products" (2000 letter to shareholders).	"Should we be in the MP3 business? How does that fit with who we are" (board member, October 2003 meeting)? "Linco is the leader in controller technology. …in addition to photography, a variety of intelligent devices such as MP3 players, PDAs, cell phones, and camcorders are using portable digital media" (2001 letter to shareholders).	Description of Linco: "The leader in solid state storage" (8/4/05 strategic planning document). Memory card BU mission statement: "To provide simple, innovative and trusted solutions to people with a need to store, carry or transfer data" (8/4/05 strategic planning document). (no letter to shareholders written after 2004)
Projected identity "about us" section of press releases	"Linco is a leading designer, developer, and marketer of award-winning digital film and connectivity solutions for the professional, commercial, and amateur digital photography markets" (through July 2001).	"Linco is a leading designer, developer, and marketer of award-winning removable *flash-based digital storage media, card readers and ATA controller solutions for the digital photography, consumer electronics, industrial and communications markets*" (starting 8/2/2001).	"Linco is a leading marketer and manufacturer of *NAND flash memory products* including memory cards, USB flash drives, card readers, and ATA controller technology for the digital photography, consumer electronics, industrial, and communications markets" (June 2006).
External identity (analyst reports)	"We are confident that management, while attuned to these opportunities [licensing opportunities for its controller technology in e-books and digital music], is keeping focused on seizing the market for end-to-end digital photography solutions" (JP Morgan 2000).	Linco is described in March 2003 as both "a leading provider of digital film" and "a leader in flash memory-based digital media cards" (See Tables 4 and 5).	In response to the announcement of the acquisition of Linco by MemCo, a semiconductor firm, "This is a positive for MemCo's NAND business since Linco adds expertise in NAND controller and system design, brand recognition with flash cards and retail channel strength" (Needham 2006).

Linco unit was spun off, I begin with a post-founding description of how the initial digital photography identity was established and how the coemergence of the industry, technology, and firm reinforced that identity.

Phase 1: The Self-Reinforcing Dynamic of Technology, Industry, Identity, and Action

Choosing the Digital Photography Company Identity. As a new firm, Linco had the luxury of asking the question, "What do we want to be?" The digital photography identity was not an obvious choice. When Linco spun off from SemiCo, it consisted of a group of approximately 30 engineers, a set of patents in the emerging flash memory technical space, and a few industrial customers that used Linco for custom technology development. Given the strong technical backgrounds of the original founders, one might have expected a technology-driven storage company identity similar to that of the parent company, SemiCo. But before a broadly shared belief about identity could solidify among the original team, a series of discussions began with a CEO candidate, Jake, who identified the opportunity to focus on digital photography. Linco's technology had an advantage over the competition in the speed with which it could record data on a flash memory card, and Jake, an avid amateur photographer, noted that the speed advantage was particularly valuable for storing images taken with a digital camera. With this opportunity in mind, Jake was hired as a consultant in late 1996 and appointed president and CEO in October 1997. Linco's senior team could have conceived of the firm as a flash memory card company with a strategy that focused on the digital photography market, but they instead chose to make digital photography the defining element of the new firm. The association with digital photography thus went much deeper than merely a chosen market segment.

Creating the Digital Photography Company Internal Identity. Although the senior team had committed to the digital photography identity, the uncertainty surrounding the spin-off had created a sense-giving imperative (Corley and Gioia 2004, Gioia and Chittipeddi 1991), and other Linco personnel, both technical and nontechnical, were seeking clarity. Jake immediately set about building a broader, shared understanding within the firm. Upon his arrival, he gathered the employees and made a formal presentation during which he noted, "We are not

just a controller company. We are not just a technology company. We are The Digital Photography Company." The chief technology officer described Jake's influence: "When Jake joined the company, our entire focus shifted to digital photography . . . . He had enormous passion for photography and saw the digital revolution as providing amazing opportunity in that arena. So we tried to meet our existing obligations to industrial controller customers, but all efforts in development and sales were directed to the digital photography market." In addition to explicit communication about the identity, Jake attempted to make digital photography a part of every employee's personal life, giving each individual a digital camera for the holidays in 1999. "Jake wanted everyone to experience digital photography if they were going to work for The Digital Photography Company," noted the COO. As early adopters personally involved in the digital photography category, employees' individual level of identification with Linco increased.

Indeed, by 2000, Linco's employees held a strong common belief that the firm's central distinguishing feature was its identity as a digital photography company. When describing the firm in 2000 interviews, individuals at all levels, from the VP of operations to the VP of marketing to R&D staff responded to the question, "What makes Linco unique?" with a mention of its digital photography company identity. Linco's VP of sales, who had previously worked for FlashCo, the primary memory card competitor, compared the two organizations, commenting, "It feels really different working at Linco . . . here everyone is always talking about digital photography . . . it's there in everything we do." The 2000 annual report letter to shareholders also highlighted photography stating, "Linco is recognized as a best-of-class supplier of high-performance digital photography products." There was also clear evidence that organizational members "believed their own PR" with employees personally engaged in reputation-building efforts (Elsbach 1996). For instance, one advertising campaign included creative digital photographs of a top manager's daughter. Internal identity was also expressed in Linco's preferred choice of acquirer (Graebner and Eisenhardt 2004). In early 2001 the CEO suggested, "Kodak is the firm that should acquire us. If I were the CEO of Kodak, I'd buy Linco tomorrow. In fact, I've thought of taking a picture of their management team, digitally adding myself to the photo, and sending it to them."

Projecting the Digital Photography Company External Identity. Establishing an external identity was challenging because in 1996 the digital photography category did not exist as such in the minds of outsiders. Only approximately 1 million digital cameras were sold that year, and less than 2% of the U.S. population owned a digital camera. Competitors in the emerging industry came from diverse backgrounds including analog photography (e.g., Kodak), consumer electronics (e.g., Sony), and computing (e.g., Apple). With few players focused exclusively on digital photography, the industry lacked coherence (cf. McKendrick and Carroll 2001), and it therefore was not clear what being The Digital Photography Company meant. As a result, Linco engaged in not only shaping external perceptions of the organization's identity, but also external perceptions of the industry.

Linco's approach with retailers was to make the firm synonymous with the new digital photography category in the minds of retail buyers who were trying to make sense of the category (Weick 1995). When categorizing novel products, individuals make analogies to existing products (Gentner 1983, Gregan-Paxton et al. 2002, Gregan-Paxton and John 1997). Linco shaped these analogies through rhetoric and design such that retailers compared Linco memory cards to analog film. Instead of calling the product a flash memory card like the competition did, Linco called it "digital film" and put the words digital film on the package. Linco designed its packaging to be bright gold, closely matching Kodak analog film. Analog film has a speed rating, so Linco created one for its digital film. As the CEO noted, "I wanted to find some metric that was analogous to the ISO rating on analog film, and came up with the idea of using the X rating from CD-ROM drives." Finally, a corporate logo that represented a digital picture was printed on all packaging and used in corporate communications. Retailers responded by selling Linco memory products in the camera section of the store. The VP of marketing described Linco's position: "We basically established digital film as a category for the retailer. Before then, flash memory for cameras was sold mostly in the computer memory section of the store. We provided educational materials and point-of-sale support to the salespeople too. So they viewed us as the experts." Linco solidified its external identity with retailers by providing semi-independent category consultants who helped stores organize their digital photography retail space.

The financial community was the other important constituent for Linco. The firm's name was changed from Linco Microsystems to Linco Media in early 1997 to distance Linco from its parent, SemiCo, in the minds of early investors. This shift is consistent with research that has shown the importance of naming and name changes in signaling identity and establishing institutional legitimacy (Glynn and Abzug 2002, Glynn and Marquis 2004, Lee 2001). Business plans circulated to potential VC investors in 1997 and 1998 articulated the company's mission "to become the leading supplier of digital film for the digital camera market" and included forecasts of the digital camera market and documentation of Linco's digital film speed advantage. Linco raised its first round of VC in February 1998, and one of the initial VC investors reflected, "Our firm invested in Linco because

of the clear focus on digital photography. It was a market about to take off, and Linco had valuable differentiation in the form of speed."

In addition to communicating through private documents such as business plans, Linco also engaged in active management of media (Kim and Pennings 2009, Rindova and Fombrun 1999). The "About Us" section of press releases described Linco as "a leading designer, developer, and marketer of award-winning digital film and connectivity solutions for the professional, commercial, and amateur digital photography markets." And a 2001 Wall Street interview began with the CEO's statement that "Linco is a digital photography company . . . . We consider ourselves the only true pure play in this new and exciting sector" (JP Morgan H&Q 2001).

When Linco went public in August 2000 management had to categorize the firm for the financial community using an established SIC code. Because digital photography did not have a separate SIC code, management selected the photography SIC code (3861). This choice was a direct contrast to Linco's primary memory card competitor, FlashCo, which classified itself under the semiconductor SIC code and was covered exclusively by semiconductor analysts. There was initially no overlap in coverage between Linco and FlashCo. Linco's CEO courted photography analysts, and one Kodak analyst covered Linco. The rest of Linco's coverage came from computer/peripheral analysts. This categorization may have reflected a belief in the minds of analysts that digital cameras were a PC peripheral. The Linco analysts clearly associated the firm with digital photography. In late 2000 one analyst wrote, "Linco is a pure play investment in the digital photography market. They've done a terrific job of branding their digital film and are leading the market in providing innovative new products" (*Business Wire* 2000). Another clarified the expectations that this identity created in his mind, stating, "We are confident that management, while attuned to these opportunities [licensing opportunities for its controller technology in e-books and digital music], is keeping focused on seizing the market for end-to-end digital photography solutions" (JP Morgan 2000). In addition, an analysis of photography versus memory words in all 2000 analyst reports shows that the mean number of photography words was significantly greater than the mean number of memory words. (See Table 5.)

Finally, independent information providers categorized Linco as a photography firm. Hoovers, in their online business information profile of January 2001, wrote, "Linco is betting a digital picture is worth more than just a thousand words. The company designs and markets digital film (a digital storage device) and connectivity products for digital cameras." Other directories and databases, including One Source, Wards, D&B Million dollar directory, Disclosure, Compustat, and CRSP, all described Linco as a photography company under SIC code 3861.

Organizational Action Reflects and Reinforces Identity. Linco's identity was reflected in the capabilities, routines, procedures, and beliefs of the organization, creating a strong link between identity and action. For instance, the resource-allocation process, a critical activity (Bower 1970), was guided by identity. On December 1, 1997, shortly after Jake's formal appointment, Linco announced its first memory card optimized for use in a digital camera, and the firm continued to focus future investments there. As a staff engineer noted, "Our product road map is driven by the digital photography market." The result of this was a series of faster, higher-capacity cards: between 1998 and 2000, Linco's cards went from speeds of 4X to 12X, and the maximum capacity increased from 32 MB to 320 MB. In addition, relationships with camera companies resulted in digital film optimized for specific camera models. When new nonphotography applications for memory cards were considered, they were routinely rejected. For instance, a November 1999 planning document included an evaluation of "digital film cards in MP3 players," but the application received no funding.

Capital investment decisions were similarly guided by identity. Linco faced a critical decision early on about whether to invest in a fabrication facility (fab) to manufacture flash memory. Linco's primary competitor, FlashCo, was vertically integrated through a joint venture and, as a result, experienced certain advantages including access to flash memory when it was in short supply and the ability to innovate in the flash memory component of the memory card (as opposed to just the controller). Linco in contrast purchased flash memory and combined it with a Linco controller to produce a memory card. Linco's identity was clearly reflected in the decision to forgo investment. "We were a photography company with a retail presence, not a memory company, so it made no sense to invest in a fab," commented one executive.

The digital photography identity also became embedded in HR policies and practices. Linco grew rapidly from 25 employees in 1997 to 187 employees by 2000. Although relevant experience and technical qualifications were important hiring criteria, one other factor considered at the margin was whether the candidate had an interest in photography. Populating the firm with amateur photographers increased individual identification with the firm's identity. In line with this emphasis, employees were also encouraged to interact with professional photographers, and employees developed personal relationships with many of the opinion leaders in the new space.

Linco's expansion trajectory was also driven by the heuristics associated with the digital photography identity. Guided by a desire to provide an end-to-end digital photography platform, Linco pursued a series of new products in areas that required technical capability well beyond Linco's core expertise in controller technology.

In April 1999, Linco acquired Webphoto.com, an Internet photo-finishing and photo-sharing site. This move was followed by the acquisition of a small group of software developers and the announcement of photo management and editing software in September 2000. In aggregate, these products and services started to provide photographers with a seamless process such that, other than making the camera itself, Linco touched every aspect of the photographer's experience.

Shaping the Industry and Technological Context. Because the digital photography industry was just beginning in 1996, there was an opportunity for Linco to shape the identity of the industry in a manner consistent with its own identity. The actions taken were consistent with what Santos and Eisenhardt (Forthcoming, p. 13) call "claiming the market . . . defining a distinct identity for both the firm and the nascent market such that the two become synonymous. If entrepreneurs are successful, their firm becomes the cognitive referent." As discussed earlier, Linco helped establish digital film as a category for retailers. The firm also launched a digital photography educational website in September 2000, helping to spur demand and shape the industry architecture (cf. Jacobides et al 2006). Customers in nascent markets are typically uncertain about what dimensions of merit to use when evaluating new products (Garud and Rappa 1994, Tushman and Rosenkopf 1992), and Linco took advantage of this ambiguity by establishing speed as the critical metric for evaluating digital film. Linco's success in establishing speed as important resulted in Linco's main competitor investing significant technical resources to increase the speed of its own memory cards. But Linco had been effective not only in establishing speed as important, but also in defining and diffusing the methodology by which it was measured. So when FlashCo advertised faster speeds based on a different metric, Linco won a false-advertising suit and FlashCo was forced to withdraw the claim. The press at the time noted, "The Court found that FlashCo wrongly measured 'release-to-click' time and claimed it was 'click-to-click' time . . . . This methodology [release-to-click] is inconsistent with industry standards" (*Business Wire* 1999).

Inertia Associated with the System. Because the industry and technological context were viewed through the lens of the digital photography identity, Linco employees' ability to see other technical opportunities was limited. Perhaps the strongest evidence of this is that Linco did not recognize the commercial potential of an architectural innovation in flash memory, USB flash drives, until other firms had entered the market. It turns out that, within Linco, employees had been using the digital film memory cards (which had USB connectivity) to transfer data files—essentially as high-capacity replacements for floppy disks. The step from this internal application to a USB flash drive, an architectural innovation that required a new interface between the memory and USB connector, required minimal engineering effort. But no one recognized this application as a potential commercial opportunity. In retrospect the COO commented, "The functionality [of what employees were doing] was exactly that of a USB flash drive . . . . But we didn't think to do it until SysCo announced one. We looked at their product and went, 'Duh.' " Even once the competitive product was noticed, Linco's interpretation of the flash drive opportunity was driven by the firm's digital photography identity, and because USB flash drives did not fit with that identity, Linco did not initially enter. As the VP of Marketing noted, "We tried to justify flash drives by arguing that people could store and transfer pictures on them, but that just didn't fly." So while SysCo announced their first product in late 1999, the first time that USB flash drives appeared in any Linco internal planning documents was not until May 2001 when the line item "Evaluate removable USB 'Floppy' Potential" appeared in the agenda.

Impetus for Intentional Identity Shift

After unit sales increases of 200% in 1999 and 150% in 2000, sales of digital cameras in the United States stalled between 2000 and 2001 with an increase of only 2%, and by late 2001 Linco was in financial distress. The firm had consistently lost money because of, among other factors, large expenditures building the brand. The funding environment had shifted since the heyday of the Internet, and raising additional money was difficult. In July 2001 the company's COO, Edward, was promoted to president and CEO and was given the charter to find a path to profitability. In pursuit of this path, he felt strongly that the firm needed to take advantage of identity-challenging technological opportunities that did not fit with the firm's digital photography identity. "It became clear to me that our technology was not going to be an advantage in other areas of digital photography [other than memory cards]. Our advantage was in semiconductors and memory. I needed a path to break even, so I made a lot of quick changes." In the third quarter of 2001 Edward spun off the Webphoto.com website and stopped all development of digital editing and picture management software. A USB flash drive—the product that the company had initially overlooked—was developed and shipped in mid-2002. In 2002, Linco also removed the words "digital film" from its memory cards in anticipation of widespread use of the cards in other applications, in particular cell phones and gaming devices. "The shift away from being The Digital Photography Company was not gradual from my perspective," stated Edward.

Phase 2: Identity Ambiguity

Although the new CEO viewed the shift as discontinuous, his actions created ambiguity about the organization's identity for both internal and external constituents.

Ambiguity can serve as a useful stage in identity-change efforts by creating a sense-giving imperative that opens organizational members to alternatives (Corley and Gioia 2004, Gioia and Chittipeddi 1991); however, the articulation of a clear desired future goal is also an important step in the process (Gioia and Thomas 1996). In this case, a protracted period of identity ambiguity ensued because efforts to communicate the shift were more focused on what Linco was not, and an alternative desired identity was not initially outlined. In some sense, an anti-identity (Sarason 1998) was emerging with no revised identity claims.

In an all-employee meeting held by Edward right after his appointment on July 27, 2001, the first slide of the presentation listed the three key features of Linco as "technology, brand, partners." Digital photography was not mentioned. Employees did not know how to make sense of the new direction. Edward acknowledged, "People weren't saying, 'I won't follow you.' They were saying, 'Who are we?' ... I started out saying we are a technology company—we exploit our technology where it matters, but then that created backlash in marketing and sales, so I changed it and said we are a 'balanced' company." The identity reflected in the annual report letter to shareholders over time reflected a movement away from photography, but no alternative identity. While the normalized average number of photography words decreased from 0.042 in 2000 down to 0 in 2005, the normalized number of memory words stayed relatively stable with minor increases and decreases (see Table 4).

In external communications, the new CEO continued to mention digital photography but also emphasized alternative growth venues. In an October 2001 interview in response to the question, "So where do you see the biggest market opportunity?" he responded, "Retail with a focus on digital photography. We really see memory cards as enabling technology for PDAs, cell phones, and MP3 players" (Wilson 2001). This response was in sharp contrast to his predecessor, who invoked the Digital Photography Company mantra whenever possible. As seen in Table 3, the "About Linco" section of firm press releases shifted almost immediately after the new CEO took over, but the description became ambiguous, mentioning multiple technologies and markets.

Table 4 Internal Identity as Reflected in the Annual Report Letter to Shareholders

	Mean normalized count of words in annual report letter to shareholders	
Year	Photography words	Memory words
2000	0.042	0.011
2001	0.008	0.017
2002	0.014	0.013
2003	0.007	0.018
2004	0.000	0.013

Organizational Action Inertia. Identity ambiguity was reflected in internal discussions about new products. In late 2003 when Linco announced an MP3 player, one board member commented, "Should we be in the MP3 business? How does that fit with who we are?" Early the following year the technical team presented a range of possible new product directions to the board in a strategy session prompting another board member to ask, "We're no longer The Digital Photography Company, but are we a retail company, an OEM company, or an IP company?" The proposed products ranged from RFID sensors for retailers to consumer MP3 video players. A number of OEM opportunities were also discussed—applications where Linco would sell, not through retail channels, but to another firm that packaged Linco technology for an end customer. The pursuit of this OEM business, however, sometimes conflicted with the retail business, prompting an engineer at the meeting to comment, "We keep coming up with great opportunities to sell our technology through OEM relationships to others, and the retail side keeps vetoing the business, claiming that it will hurt our own retail sales." In the midst of this session, a sense of frustration and confusion emerged as attempts were made to prioritize among the multiple opportunities. The CEO described the problem, "People had used the identity as a crutch .... When they had an identity as the Digital Photography Company, it made strategic choices easy—they didn't have to think. Once the crutch went away, people had to analyze decisions." But analyzing choices without the guidance of a shared understanding of what the company represented caused disagreement about which opportunities to prioritize.

Thus, even though the CEO's initial actions provided a change signal, in the wake of the ambiguity about a new identity, the organizational routines associated with the digital photography identity persisted both within and outside the organization. The majority of development resources continued to be allocated to digital photography projects. In July 2003, 10 of 13 product-development projects were related to memory cards for photography, two to USB flash drives, and one to an MP3 player. This allocation did not change significantly until mid-2004 when the combined number of USB flash drive and MP3 player development projects equaled the number of memory card projects. Members of the sales force continued to emphasize the differentiation for photography markets when promoting Linco with retailers, and, not surprisingly, retailers continued to view Linco as a digital photography company and were not receptive to other products. As the VP of sales noted, "We were a big supplier of digital film to Retco, but when they decided to add USB flash drives to their offerings they didn't even think to invite us to bid for the business." Symbolic elements were also slow to change. For

Table 5 External Identity Reflected by Financial Analysts

Year	Percentage of Linco analysts that also cover FlashCo (major competitor) (%)	Number of semiconductor analysts covering Linco	Mean normalized count of words in analyst reports		Comparison of photography and memory means: two-tail t test
			Photography	Memory	
2000	0	0	0.022	0.012	Photo > memory ($p = 0.015$)
2001	0	0	0.010	0.017	n.s. ($p = 0.14$)
2002	0	1	0.011	0.012	n.s. ($p = 0.80$)
2003	40	5	0.013	0.019	Memory > photo ($p = 0.005$)
2004	70	8	0.007	0.017	Memory > photo ($p = 0.013$)
2005	90	9	0.005	0.016	Memory > photo ($p = 0.018$)

instance, up until July 2004 the bottom of the official firm stationery had the footer, "The Digital Photography Company." When this phrase was eliminated, it was not replaced; the space was left blank. Similarly, the company logo, which was tied to photography, was not updated until July 2004, when the name of the company was also shortened to Linco from LincoMedia.

Evidence of External Identity Inertia. Although Edward began making changes in late 2001, directories continued to list Linco as a photography company for the remainder of the organization's life. The primary SIC code for Linco was still listed as 3861 (photography) in 2005 by Hoovers, Wards, D&B Million dollar directory, One Source, Disclosure, Compustat, CRSP, and Mergent. Because Linco's revenue mix had not changed significantly enough—memory cards were still the largest segment—this audience had no mechanism by which to initiate a change in classification.

The financial analyst community was also slow to react to Edward's changes, taking until 2003 to begin to categorize the firm differently. Before 2003 Linco's coverage had been computer peripheral analysts, with one photography analyst. As seen in Table 5, in 2003 semiconductor analysts finally began to cover Linco and categorize it with the other main player selling memory cards, FlashCo. Overlap in coverage with FlashCo thus increased from no common coverage in 2002 to 90% of Linco's analysts also covering FlashCo in 2005. The addition of semiconductor analysts started to shift the external identity as seen in a content analysis of Linco's analyst reports using normalized counts of photography words and memory words to represent the manner in which analysts viewed the firm (see Table 5). Overall, photography words decreased and memory words increased from 2000 to 2005, and, although memory words exceeded photography words in 2001, it was not until 2003 that one could not reject the null hypothesis that the means were the same.

Additional insight comes from comparing the reports of an analyst who initiated coverage of Linco when the firm went public in 2000 with that of semiconductor analysts who initiated coverage in 2003. Even in 2003, the analyst who had first covered Linco when it was considered a digital photography company continued to view the firm as a digital photography company and applied the same models he had been using all along. Table 6 compares the 2003 reports of this original analyst with those of new analysts. The original analyst still described Linco as "a leading provider of high performance digital film . . . for the digital photography market," as opposed to a new analyst initiating coverage, who described Linco as "a leader in flash memory-based digital media cards." The original analyst also used significantly more photography words than the new analysts, with no significant difference in memory words. Most interestingly, the original analyst continued to provide projections of the size of the digital camera market and used those data to support his financial models and his buy recommendation. He made no mention of flash drives despite the fact that they were the fastest-growing category for Linco and by the end of 2003 comprised almost 20% of Linco's sales. In constrast, the new analyst provided no camera data and supported his buy recommendation by mentioning Linco's position in USB flash drives and its controller intellectual property. The contrast in these reports makes clear that the driver of the change in external identity was coming from the new semiconductor analyst coverage.

Converging on the Flash Memory Media Company (2005–2006)

Once a firm establishes a particular identity with the financial community, institutional pressures to conform to that identity become strong (Benner 2007, Porac et al. 1999, Zuckerman 1999). As the new CEO noted, "The . . . semiconductor analysts were happy to have us go back to being a memory company. They loved it when I started talking in their terms . . . . They were happy to not have to ask about digital photography." The increasing dominance of semiconductor analysts covering Linco accelerated a shift in external identity, which began to influence the organization's internal identity. The cumulative effect of the external expectations and the growth of flash drive and other nonphotography products, which were expected to reach 40% of revenues by 2006, eventually led insiders to identify with what

Table 6 External Identity Inertia: Original Linco Analysts Retain Photography Framing

Data from 2003 analyst reports	Analyst who initiated coverage in 2000	Analysts who initiated coverage after 2001	Comparison of original (from 2000) analyst and new analysts' means: two-tail t test
Photography words (mean normalized count)	0.0248	0.0068	Original analysts > new analysts ($p = 0.000$)
Memory words (mean normalized count)	0.0228	0.0182	n.s. ($p = 0.130$)
Text excerpts	5/15/03 report • "Linco is a leading provider of high performance digital film and connectivity products for the digital photography market." • Support for recommendation: —Flat pricing trends —Strong Q1 digital camera shipments —Shift to three-megapixel resolutions bodes well for capacity demand • Data in report: —Projection of digital camera market size	5/30/03 report • "Linco is a leader in flash memory-based digital media cards." • Key reasons to invest —Number 2 player overall in one of the fastest growing semiconductor segments —Number 2 flash card brand to SNDK in retail with our estimate of 12% of total flash card market share —Market leader in USB flash drives —IP leader in controller technology —Leverages Samsung's NAND flash memory manufacturing	

had been the core of the original spin-off—a flash memory company.

This trend toward convergence on a memory company identity was brought to a head in April 2005 when an unsolicited inquiry about acquiring the company was received. An elaborate procedure ensued in which investment bankers and other advisers helped the top management team and board to engage a number of other potential acquirers in conversations. This process caused the team to question in an open and deep way what was truly distinctive about Linco. Vigorous debate ensued over an extended period as competing identity claims surfaced. Was Linco an IP company or a retail company? A photography company or a memory company? The potential acquisition did not materialize, but it did result in closure on an internal memory company identity. As one of the original founders commented, "I guess in the end we went back to what we were originally—a technology company applying flash media in a wide range of application areas."

The memory company identity solidified with the formation of two separate business units in late 2005: a "memory card" business unit and a "flash drive and OEM" business unit. A strategic plan from August 2005 described the organization as "the leader in solid state memory." Although the digital photography industry had recovered by this point, with a compound annual growth rate of approximately 50% between 2001 and 2005, and Linco still held an approximately 25% share of the market for memory cards used in digital cameras, the organization no longer viewed itself as a digital photography company. The fact that the memory company identity had taken hold was made clear by the firm that acquired Linco in the end. Of the many potential acquirers contacted by the investment bankers and management, in the end a memory company prevailed and in July 2006 the Linco was acquired for approximately $850 million.

Discussion and Conclusions

The model of technology, identity, and inertia that emerged from Linco's history provides new insight into why established firms find some technological change so challenging. Although existing research has identified numerous sources of inertia in established firms exploring new technological domains, identity is a critical piece of the puzzle. As the core essence of the organization, identity directs and constrains action. The routines, procedures, information filters, capabilities, knowledge base, and beliefs of an organization all reflect its identity. So when a technology is identity-challenging to an organization—when pursuing it would violate the core beliefs about what the firm represents—organizations face significant obstacles to adopting it. First, identity serves as a lens that filters a firm's technical choices. It influences what gets noticed, how it is interpreted, and what action is taken (Daft and Weick 1984, Ocasio 1997). Identity-challenging technological opportunities may simply pass by unnoticed as in the case of Linco's initial experience with USB flash drives. When identity-challenging technology is noticed, identity-based beliefs may color interpretations of it or established routines may preclude participation. Second, the self-reinforcing dynamics among identity, organizational action, and the industry and technological context create a strong impediment to change.

Linco experienced a protracted period of identity ambiguity, during which existing routines persisted, before finally converging on a new identity. Because identity becomes intertwined with the knowledge base, routines, and procedures of both the organization and external constituents, explicit efforts to shift identity in order to accommodate identity-challenging technology are difficult to accomplish, implying the need for systemic, major reorientations (Tushman and Romanelli 1985).

The difficulty of shifting identity foregrounds the importance of understanding whether new technology is identity-challenging to an organization. Radical, competence-destroying technology that is not identity-challenging may be demanding, but when a technology is also identity-challenging management is faced with even greater hurdles. In this situation management must not only acquire the competencies needed to develop and commercialize the new technology, they must also explicitly direct a potentially hazardous identity-change process. More subtle to recognize are identity-challenging technological changes that are not radical or competence-destroying. Incremental technological advances that are applied to entirely new markets for instance may violate expectations if a firm's identity is based on a product market. The USB flash drive was an incremental, competence-enhancing technological shift for Linco, but it destabilized its digital photography identity. One might also expect that when technological convergence merges the functionality of previously distinct products, the identity of producers that made the original separate products would come into question. For instance, the potential convergence of PDAs, cell phones, pagers, cameras, and MP3 players into a single device challenges the identity of the disparate individual producers. These organizations may need to shift identity, but, given the initial ambiguous framing of what the new product is (Kaplan and Tripsas 2008), the desired future identity may be unclear.

Clearly not all identity-challenging technologies are worth pursuing. In particular, organizations evaluating growth opportunities based on new technology are in a position different from that of those facing a complete transition from one technological regime to another. For organizations contemplating growth, the dilemma is whether to bypass a potentially attractive identity-challenging technological opportunity in order to maintain a consistent identity, or whether to pursue the technology and embark on the risky endeavor of shifting organizational identity. Although there is obviously no single resolution to this dilemma, this study highlights the importance of recognizing and evaluating the trade-offs associated with it. For organizations facing a complete transition from one technology to another, the issues are more complex. In these situations, technology is often identity-challenging because it creates an entirely new product category or industry that performs the functions previously performed by a firm's products. Examples would include the automobile, which made the buggy obsolete, or word processing software/desktop printers, which made typewriters obsolete. Because sales of products based on the original technology will eventually shrink, management is faced with a daunting undertaking. If management decides to pursue the identity-challenging technology it can either adopt a broad identity that encompasses the new product category/industry or simply shift from one product-based identity to another. For instance, a buggy manufacturer might attempt to become a "personal transportation company" or an "automobile manufacturer." Alternatively, an organization may decide to define itself in terms of the original technology and pursue new opportunities that leverage that technology. For instance, Fujifilm is in the midst of a transition from being an imaging company to being a specialty chemicals company—an identity that enables it to leverage its long history of developing and manufacturing analog film (Gavetti et al. 2007). Again, although this study does not suggest which path is best to pursue, it highlights the importance of analyzing the identity implications of technology.

This study thus also provides insight into new industry emergence. Linco was in a unique position in that it coemerged with the digital photography industry, creating an opportunity for the organizational identity and industry to be deeply intertwined. The firm was able to shape key aspects of the industry in its favor, such as the metric used for measuring digital film speed. Linco also had the opportunity to claim an identity much broader than its initial product line might normally have justified. If a tire producer were to attempt to define itself as "the automobile company" external constituents would likely be skeptical. But given the nascent stage of digital photography, Linco, initially just a memory card producer, was able to effectively establish itself as a digital photography company.

Although the primary focus of this research has been on understanding the implications of identity for adapting to technological change, it also has implications for the broader literature on organizational identity. The history of Linco's identity shift provides additional support for more dynamic views of identity put forth in recent empirical studies (Corley and Gioia 2004, Gioia and Thomas 1996, Ravasi and Schultz 2006). It extends prior findings about the role of identity ambiguity (Corley and Gioia 2004) by including not only measures of internal identity, but also external identity, finding that both identities become ambiguous at the onset of change efforts. The study also lends support to the notion that external identities are primary and constrain internal identities (Zuckerman 2008). Prompted by the addition of new financial analysts who categorized Linco differently, a new external identity began forming before a new internal identity, and internal identity finally solidified

in response to an external imperative in the form of an acquisition offer.

This study also documents the presence of inertial identity forces even in small, relatively young firms. Existing work typically characterizes new firms as unstable entities that opportunistically adapt in search of profit (Bhide 2000, Brown and Eisenhardt 1997, Rindova and Kotha 2001). In the case of Linco, its early, focused identity provided stability in the face of market and technological uncertainty. When change did occur, it followed the pattern of punctuated equilibrium, typically attributed to large, established organizations (Tushman and Romanelli 1985).

Like all studies, this one has limitations. Because it is based on a single case study, it is impossible to test counterfactuals. So, although we can draw conclusions about the process observed, we cannot attribute failure or success to any particular actions. In addition, many aspects of the Linco narrative are unique, limiting the generalizability of the findings, but also creating opportunities for future research as outlined below.

Implications for Future Research

An important question for future research is whether certain types of identities are better than others and under what circumstances. A broader identity imposes fewer constraints on what outsiders view as legitimate behavior by an organization, so organizations with generalist identities are thus better able to weather a range of environmental conditions without deviating from expectations (Hannan et al. 2003, Hsu and Hannan 2005). Broader identities also create flexibility for insiders because they confer "adaptive instability"—organizations can respond to environmental shifts without having to change identity (Gioia et al. 2000). For instance, by supporting a robust identity through the mission statement "healthy eyes for life" the president of Ciba Vision was able to take advantage of new technology for extended-wear and fashion lenses while continuing to participate in the conventional contact lens business (O'Reilly and Tushman 2004). Similarly, one might expect that newspaper organizations that conceived of themselves more broadly as media companies reacted more effectively to the Internet than those that viewed themselves as newspaper firms. On the other hand, if an identity is too diverse, it runs the risk of not fitting within the classification schemes of external constituents (Zuckerman et al. 2003). Highly diversified firms that straddled industry categories faced pressure from Wall Street analysts to de-diversify so that their stock could be more easily understood (Zuckerman 2000). How organizations should balance this trade-off is a promising topic for future work.

Another intriguing question is whether some types of identity changes are easier than others. In particular, might movement from a less coherent to a more coherent external identity be easier than moving between two distinct, coherent identities? Because emerging categories may exhibit a low level of coherence among external constituents early on (Zuckerman and Rao 2004) expectations for the category may be ambiguous. Digital photography was certainly at this stage when Linco went public. So when Linco began signaling movement toward memory, a more coherent category with a clearly recognizable set of financial analysts, the organization may have encountered less resistance than one might have expected given typical institutional pressures for conformance (Benner 2007, Zuckerman 1999). It would be fascinating to test whether this pattern holds more generally.

The relationship between strategy and identity also offers promise for future research. In a conference aimed at exploring the interrelationships between these two concepts, participants defined identity as "the theory members of an organization have about who they are" and strategy as "a theory of actions that the firm should take or can take" (Reger 1998, p. 103). In some sense a firm's identity is expressed through elements of strategy. But does that mean that a change in strategy implies a change in identity and vice versa? A better understanding of this relationship is needed. Another interesting topic is the relationship between the origins of strategy and the origins of identity. Recent work has explored where strategies come from (Gavetti and Rivkin 2007, Helfat and Lieberman 2002), but relating that work to identity would be promising.

Finally, the inertia associated with identity raises the question of how managers should best accomplish identity changes associated with new technology. What role might organization structure, for instance inconsistencies between informal and formal organization play (Gulati and Puranam 2009)? How might theories of dynamic capabilities inform our understanding of identity transformation (Adner and Helfat 2003, Augier and Teece 2009)? Linco's management made intentional efforts to shift the firm's identity away from digital photography. In other contexts, identity shifts may be more emergent (Burgelman 1994) and the change process would clearly differ. Research on the trade-offs of intentional vs. emergent processes would be welcome. Additional research on practical tools for implementing changes would also be valuable. Fiol (2002) noted the role of rhetoric in facilitating change. Managers might use using rhetoric to emphasize the continuity of some aspects of the organization in order to make shifts in identity easier to accept. For instance, management could focus on the fact that a firm remains "environmentally friendly" while shifting between concrete identities associated with product markets. Identity clearly has important theoretical and practical implications for firms managing technological change. Hopefully the insights yielded by this work will inspire additional research into the relationship between technological change and identity.

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Endnotes

[1]As noted by Brown et al. (2006), the terminology used in the organization behavior-based research on organizational identity is varied and inconsistent. Researchers have distinguished among (1) insiders' views of the organization (identity), (2) insiders' projections to outsiders about identity (intended image), (3) insiders' beliefs about how outsiders view the organization (construed image), and (4) how outsiders actually view the organization (reputation). Because I am concerned primarily with the first and last of these definitions, and because I also build on the sociology-based literature that uses the term identity more broadly, I have chosen the terms "internal identity" and "external identity" for clarity of exposition. In addition, although identity can be applied at multiple levels of analysis, in this paper the term always means organizational (not individual) identity.

[2]The names of all firms and individuals in this paper have been disguised.

[3]In practice identity takes a variety of forms ranging from concrete to abstract. Concrete expressions of identity frequently tie a firm to a particular product market, whereas abstract identities transcend products (Stimpert et al. 1998). Firms may invoke some combination of the two and can move between concrete and abstract identities. For instance, Koch Industries went from being an "oil and gas" company to being a "discovery" company (Barney 1998), and US West went from "not a telephone company" to "aggressive and competitive" to "a multimedia company" (Sarason 1998). In this study, I focus on concrete identities because, in the context of technological change, concrete identities are most likely to be affected, and the empirical setting involves a transition between two concrete identities.

[4]Flash memory products are solid-state devices based on a form of electronically erasable programmable read-only memory (EPROM). Flash memory is nonvolatile, meaning that it retains data even when its power source is removed. The cells within the flash memory can be either erased or reprogrammed by removing or adding electrical charge. All flash memory requires a controller chip to act as a "brain" in determining how data will be stored in the memory cells.

[5]Text analysis software, Atlas ti, was used to generate counts normalized for the total number of words in the text excerpt.

[6]Unless a specific source is noted, all quotations are from interviews that I conducted.

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