Exploring the Interaction between Organizational Identity and Organizational Design in Technological Transitions

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August, 2013

PRELIMINARY DRAFT

I would like to thank Yaichi Aoshima, Mary Ann Glynn, Stine Grodal, Candice Jones, Kate Kellogg, Michael Pratt, Davide Ravasi, Michael Tushman, Wendy Smith, and participants at the Rhodes Symposium on Process Organization Studies for their valuable feedback on this manuscript.

Keywords: organizational design, ambidexterity, organizational identity, technological change
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Abstract

Research has suggested that organizational separation for new technology development increases the odds of a successful technological transformation by allowing the unit to establish its own distinct identity, unconstrained by the biases and routines of the core organization. At the same time, organizational identity research has shown that organizations benefit from a common, consistent set of internal beliefs about what the organization represents. Combined, these findings pose a dilemma: creation of a separate unit may maximize opportunities for exploration, but it also may create ambiguity or conflict about organizational identity. Through a comparison of FujiFilm’s and Polaroid’s reactions to digital imaging, we propose that establishing a separate new technology unit can cause dormant identity conflicts to surface, and reconciling those conflicts is critical to success.
When established firms attempt to navigate wholesale transitions from one core technology to another, the challenges are substantial. Existing research has suggested that some form of organizational separation for new technology development efforts increases the odds of a successful transformation by allowing the new technology unit to establish its own distinct identity, unconstrained by the assumptions, biases, and routines of the core organization (Christensen and Bower 1996; Tushman and O’Reilly 1996; Gilbert 2005). At the same time, organizational identity research has shown that organizations benefit from a common, consistent identity, with organizational members holding a shared set of beliefs about what characteristics are central to the organization (Pratt and Foreman 2000; Voss, Cable et al. 2006; Fiol, Pratt et al. 2009; Pratt and Kraatz 2009). Combined, these findings pose a potential dilemma for managers: when pursuit of a new technology is identity-challenging – when it deviates from the expectations associated with the organizational identity (cf. Tripsas 2009) – creation of a separate unit with its own distinct identity may, on the surface, maximize opportunities for exploration, but it also may create ambiguity or even conflict about organizational identity, resulting in suboptimal outcomes. More broadly, we lack an understanding of the relationship between organizational design choices and organizational identity in the context of technological transitions.

This paper addresses this gap through a detailed field-based study comparing the reactions of Fuji Photo Film and Polaroid to the emergence of digital imaging. Fuji and Polaroid were remarkably similar in both their initial film-based capabilities and their organizational approaches to digital imaging. When digital imaging was in its nascent stage, both firms had a dominant market presence in silver-halide film with strong technological expertise in chemistry. They both engaged in early exploration of electronic imaging through projects that were integrated within the core organization as part of their central corporate R&D labs. These integrated units engaged in activities that did not fit clearly with their organization’s identity, but in both cases, potential identity conflicts failed to surface at this juncture.

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1 The term “electronic imaging” (as opposed to “digital imaging”) was used by people early on since it was not clear whether images captured electronically would be digital or analog. In addition, “electronic still camera” referred to early cameras that were similar to electronic video cameras, but captured and stored still images.
However, when each company subsequently established a separate electronic imaging division that reported to the president, latent identity conflicts between those involved in electronic imaging and the core organization became salient at both organizations. The resolution of identity conflict, however, differed. At Fuji conflict was resolved through a process of questioning and debate about organizational identity that culminated in broadening the interpretation of organizational identity to explicitly include electronic imaging. At Polaroid, management maintained its narrow, hardcopy-focused identity, and conflict resulted in dysfunctional organizational dynamics, such that Polaroid failed to commercialize its proprietary digital imaging technologies in a timely fashion.

Based on this comparison, we develop a series of propositions that relate organizational design, organizational identity, and innovative outcomes. Innovative organizations are constantly experimenting with new ideas and engaging in commercial activities at the periphery of the organizational identity. We propose that as long as those projects are integrated within the core organization and positioned as exploratory – by, for instance, residing within the core organization’s R&D unit – potential identity conflicts are more likely to remain dormant. However, when those experimental activities are placed in a separate unit, they receive additional attention and gain legitimacy, causing potential identity conflicts to surface. Left unresolved, we argue that these identity conflicts can lead to dysfunctional organizational dynamics and are likely to hurt new technology development efforts. By broadening identity to encompass both core and new technology divisions, we suggest that efforts at selective coordination between these units are more likely to succeed. We also propose that organizations with a history of questioning and reinterpreting organizational identity are more likely to adapt identity to accommodate new technology. We conclude that choices about the appropriate organizational design for new technology development efforts should take into account the identity implications of the new technology.
Technological transitions, organizational design, and organizational identity

Technological change that requires a complete transition from an old technological regime to a new one is notoriously difficult. At a basic level, the culture and characteristics required for success in a core, stable business, such as relatively formal roles and centralized procedures, differ from those required to effectively manage emerging new-technology businesses, where flexibility and creativity are needed. The concept of using dual structures, one to exploit an existing, mature business and another to explore new businesses, has a long history in the organization’s literature (Burns and Stalker 1961; Thompson 1967; Duncan 1976). The fundamental premise is that an organic, flexible structure is appropriate for new, highly uncertain innovation environments, while an efficient mechanistic structure is better for core, stable units. Empirical studies have, for the most part, confirmed that some form of organizational separation optimizes the changes for success in the new regime (Tushman, Smith et al. 2010). Gilbert’s (2005) study of newspapers’ responses to the internet concluded that separation gave newspapers the benefit of opportunity framing in the internet unit, thus avoiding inertia in routines. At the same time the core newspaper organization maintained a threat framing enabling the allocation of significant resources to the new ventures. Drugstores and brokerage firms that created separate online units also had a more successful transition from bricks and mortar to online commerce (Westerman, McFarlan et al. 2006). The term ambidextrous has been used to describe this organizational design since it enables firms to simultaneously meet the needs of today’s and tomorrow’s businesses – in other words, to balance the trade-off between exploitation and exploration (Duncan 1976; Tushman and O’Reilly 1996) (March 1991; Levinthal and March 1993).

When creating a separate unit, a firm may still wish to leverage the core organization’s resources, in which case some form of integration between the core and new technology units is needed. Finding the right balance of differentiation and integration, however, is challenging (Lawrence and Lorsch 1967). Tushman and O’Reilly (1996) propose an ambidextrous organization design that has separate units with targeted integration at the level of the TMT. By maintaining a high level of differentiation, exploratory
units are still free to experiment and improvise, however selective integration ensures that opportunities for cooperation and sharing with the core business are not foregone. This structure requires a highly skilled TMT, capable of managing the inherent contradictions in the mindsets and strategies of the core and new businesses (Smith and Tushman 2005). Middle management can also provide important linkages between the core and new technology units when complementary assets retain their value in a technological transition (Taylor and Helfat 2009). Another alternative for finding the right balance is to initially separate to facilitate exploration, but follow with re-integration to enable coordination (Sigelkow and Levinthal 2003).

A potentially important consideration in the choice of organizational design is whether the new technology is encompassed by the existing organizational identity. By organizational identity, we mean a shared understanding on the part of organizational members about “Who we are.” Consistent with more recent identity scholarship (Gioia, Schultz et al. 2000; Corley and Gioia 2004), this definition assumes a higher degree of fluidity than Albert and Whetten’s (1985) original view of identity as what members consider core, enduring, and distinctive about an organization. While there are multiple aspects of identity, we focus on how a firm defines what business it is in – what Stimpert et al (1998) call a concrete identity. For instance Linco initially defined itself as a “digital photography company” (Tripsas 2009). Within an organization, beliefs, routines, procedures, and capabilities that are consistent with organizational identity develop over time and become self-reinforcing (Kogut and Zander 1996). Identity shapes managerial interpretations of the environment and serves as a guidepost for management when addressing issues such as what markets and technologies to invest in or what competitors to respond to (Prahalad and Bettis 1986; Dutton and Dukerich 1991; Markides 2000; Bouchikhi and Kimberly 2008; Livengood and Reger 2010). Thus identity is associated with a set of codes or expectations about what constitutes appropriate action (Hsu and Hannan 2005; Hannan, Polos et al. 2006). Activities that are inconsistent with those expectations create tension within the organization as members attempt to reconcile those actions with their own beliefs (Elsbach and Kramer 1996; Golden-Biddle and Rao 1997).
Some organizations have multiple identities, where different subgroups conceive of the organization differently. When sub-groups develop divergent identities that represent contradictory beliefs about what constitutes appropriate organizational action, negative interactions and intergroup conflict will likely ensue (Dougherty 1992; Glynn 2000; Pratt and Foreman 2000; Voss, Cable et al. 2006; Fiol, Pratt et al. 2009). For instance, the professional affiliation of employee subgroups often results in multiple organizational identities. “Intractable identity conflicts,” such as those between medical and administrative professionals in a hospital, can hurt organizational performance if left unresolved (Fiol, Pratt et al. 2009). In a survey of 113 nonprofit professional theatres, Voss et al. (2006) found that ticket sales were lower when artistic and administrative leaders disagreed about identity. Identity conflicts between subgroups can also stay dormant until triggered by particular events, as in the case of musicians and administrators at the Atlanta Symphony Orchestra (Glynn 2000).

Thus, while creation of a new technology unit may be desirable from the perspective of facilitating exploratory behavior, organizational identity research implies a potential trade-off. If a new technology unit develops its own separate identity and engages in actions or holds beliefs that violate the expectations associated with the core organizational identity, conflict is likely to ensue. Research relating organizational design choices, organizational identity, and technological transitions, however is limited. O’Reilly and Tushman (2008) propose that ambidextrous structures are more likely to function effectively if an organization’s identity encompasses both the core organization and new technology unit, however they do not provide detailed empirical support for the proposition. We also know little about how or when inconsistencies between a new technology unit and the organizational identity become salient. Finally, we lack an understanding of why some firms are better than others at adapting organizational identity in the context of new technology. This paper addresses these gaps and develops a series of propositions that form the basis of a process model relating organizational design, organizational identity, and innovative outcomes.
Empirical Setting, Data and Methods

Digital imaging is the capture, transmission, storage and output of images in digital form. In contrast to analog cameras that expose silver halide film, digital cameras and scanners capture light using image sensors such charge-coupled devices (CCD) that convert it to binary data. Images are stored digitally on a variety of media such as flash memory or centralized “cloud” servers and are either viewed on an electronic display (such as a PC, TV, or mobile device) or printed using a variety of technologies including ink-jet printers, retail kiosks, or digital minilabs. Globally, the first consumer digital camera was released in 1989, and by 2002 global sales of digital cameras exceeded those of analog cameras.

The shift from analog to digital imaging provides an ideal setting for studying the interaction of organizational design and organizational identity in radical technological transitions, where a new technology completely substitutes for an old. Digital imaging was a radical change for photography firms along multiple dimensions; it was technologically competence-destroying, requiring expertise in fundamentally new disciplines such as microelectronics; it created new markets and business models, such as electronic storage and sharing of photos; it shifted the economics of production, enabling entry by firms that had not been able to enter due to the scale required to manufacture analog film cost effectively. It also had the potential to challenge the core identity of photography incumbents, particularly those with a strong presence in film, a product that had no logical analog in the digital world.

In-depth organizational histories of both Fuji and Polaroid were developed from a combination of field interviews, company archives, ex-employee personal archives, and public records. To obtain multiple perspectives and ensure an understanding of the organizational history, interviewees at both companies included a combination of current and ex-employees from multiple functional areas, from different levels of the organization, and from both the core film and electronic imaging businesses. For Fuji, a total of 16 in-person interviews were conducted in 2005 during two trips to the corporate headquarters in Japan and one trip to the US headquarters, with follow-up interviews and emails in 2006.
and 2007. Interviewees included the President and CEO, Chief Technology Officer, general manager and members of the electronic imaging division, ex-head of corporate R&D, and ex-director of human resources. For Polaroid, 20 interviews with 15 individuals were conducted in 1998-1999, and follow-up interviews were conducted in 2009. Interviewees included two ex-CEOs, three ex-heads of the electronic imaging unit, as well as engineers, marketers and strategic planners.

Company archival materials such as business plans and organization charts were obtained from both Fuji and Polaroid during visits to the companies as well as from the personal files of ex-employees. In addition, the Polaroid company archives were donated to the Harvard Baker Library Historical collection in 2006, providing access to additional internal documents. Internal documents were supplemented by publicly available data including complete sets of historical annual reports, business press coverage, proprietary research including The Future Image Report, Electronic Imaging News, and International Data Corporation (IDC), and analyst reports from Thomson One, which were available from 1983-2001 for Polaroid and from 1995 to the present for Fuji.

Data analysis involved three phases. First, for each firm, we constructed parallel timelines that mapped organizational design, organizational identity, and organizational dynamics from 1975, right before digital imaging exploration began, through 2001 (when Polaroid declared bankruptcy). Second, content analysis was used to supplement qualitative assessments of organizational identity and the TMT interpretation of electronic imaging. We examined the TMT’s identity claims as represented in annual reports. Prior research has shown that the letter to shareholders provides a good measure of managerial attention and beliefs about key issues (Fiol 1995; Abrahamson and Hambrick 1997; Kaplan 2008).

Representations about organizational identity in annual reports have also been shown to be consistent with internal company documents (Tripsas, 2009). While these reports represent the beliefs of the TMT, and not the entire core organization, the perspective of senior executives is particularly salient in that

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2 We analyzed the content of annual reports using MAXQDA software.
decisions about strategic direction and, in particular, responses to radical technological change, are highly influenced by the senior team. To measure organizational identity, we coded any statement describing the company or what management viewed as the company’s primary business. For instance, statements such as “We are an integrated ‘audio-visual information recording company’” and “our core business, which we define as instant photography,” were coded as identity claims. To capture the TMT interpretation of electronic imaging, we coded every reference to electronic or digital in connection with the words camera, photography, imaging, storage or output. We also coded technology-focused words such as microelectronics and image sensor. Finally, data were analyzed iteratively, looking for themes and relationships, until a point of theoretical saturation was reached (Glaser and Strauss 1967).

**Fuji versus Polaroid: Responding to Digital Imaging**

Fuji and Polaroid provide a good comparison in that they were about the same age, same size, and had similar capabilities when early forays into digital imaging first emerged. Fuji was founded in 1934, and Polaroid in 1937. By 1979, Fuji had sales of $1.491 billion and held about a 70% share of the Japanese film market while Polaroid had sales of $1.361 billion and held about a 75% share of the global instant film market. In addition, both firms had a strong history of investment in R&D, with Fuji spending about 6% of sales on R&D and Polaroid about 8%. The companies also had similar technical expertise, focused on specialty chemistry and manufacturing processes for producing film.

For Fuji and then Polaroid we next describe the evolution of organizational identity, and organizational dynamics for two time periods: first, the period in which initial integrated forays into electronic imaging took place, and second, the period after each firm established separate electronic imaging divisions that reported to the president of their respective organizations. In both cases potential identity conflicts did not emerge during the initial period. However, identity issues that had remained dormant became visible in the second period, once structural separation took place. In the case of Fuji, management resolved these potential conflicts by both modifying the description of the company’s
business, using the phrase “Imaging and Information,” and also systematically broadening the meaning of the label to encompass ongoing digital imaging efforts. The electronic imaging group’s efforts were viewed as a legitimate part of the organization and coordination across groups worked well. At Polaroid, top management maintained a less flexible identity, focused on high quality instant hardcopy, and inconsistencies between this identity and the efforts and beliefs of electronic imaging group resulted in conflict between the electronic imaging group and the TMT, a lack of coordination with the core business, product delays, and poor performance.

**Fuji 1975-1983: organizational identity and integrated electronic imaging efforts**

From 1975 to 1983 Fuji initiated a series of exploratory electronic imaging research projects that were integrated within its R&D organization. During this time period Fuji was also diversifying into markets for non-photographic materials that built on its technical expertise. To communicate the logic behind this breath of activity, the TMT broadened and modified Fuji’s identity claims over time, explicitly including diversified product lines within its descriptions of the company. In 1975, 85% of Fuji’s sales were from photography-related consumables and equipment. The 1975 annual report broke out sales into photographic film (43%), photographic paper and chemicals (18%) photographic equipment (17%), processing and printing services (8%), and other products (15%). At this point, the annual report did not include any identity claims describing what business the company was in, and letter to shareholders was focused on discussing the performance of photography-related businesses, with a brief mention of carbonless copying paper, magnetic tape, and presensitized (PS) plates for offset printing.

The following year, revenue from individual non-photographic product lines was separated out for the first time in the Annual Report. Sales in 1976 were categorized as: amateur sensitized products such as color film, photographic paper, photographic chemicals (47%), cameras (12%), motion picture products (5%), graphic arts films and pre-sensitized printing plates (13%), x-ray film and processors (11%), microfilm (3%), magnetic tape (4%), and carbonless copying paper (5%). The growth of non-
photography categories, made clear by the breakout, prompted management to add a narrative at the beginning of the annual report describing how management conceived of the company and explaining the rationale for its diversification activities.

“Our Fuji Photo Film Co., Ltd is Japan’s largest maker of photosensitized material, with a major share of the domestic market for film…the company’s early growth focused on the manufacture of photographic film, paper, equipment and chemicals…the technological capabilities of the firm in the photosensitized materials field have allowed it to move into related areas such as carbonless copying paper, magnetic tapes and presensitized plates for offset printing…contributing to the growth of the Company.” (Fuji Film 1976 AR)

Over the next few years, management continued to refine its identity claims, searching for a succinct way to clarify the unifying logic of Fuji’s presence in both photographic and non-photographic recording materials. The 1978 annual report explained,

“The main business of Fuji Photo Film has always been in the photographic field, but in recent years the company has been diversifying beyond the boundaries of this industry. The direction of our diversification however, has always followed a consistent course in that new areas of operations have been directly or indirectly related to photographic materials or production technology. The phrase which best sums up our activities is ‘audio-visual information recording,’” (italics added, Fuji Film 1978 Annual Report, p.8).

The company also projected these new identity claims at industry trade shows noting “At the 1978 Photokina we emphasized the fact that we are an integrated ‘audio-visual information recording’ company, displaying developing equipment and magnetic tapes along with film and cameras.” (Fuji Film 1978 Annual Report p.8).

In the 1979 Annual Report management shifted its description slightly, stating, “In the 1960’s we consciously redefined our business, broadening it from ‘photographic’ to ‘image’. This covers all aspects of visual, audio and other types of information or ‘image’ recording.” (italics added, Fuji Photo Film Annual Report, 1979 p.8). A new corporate logo was introduced in 1980 along with the phrase “total image information company” to describe the company’s business, and the 1981 annual report emphasized the importance of maintaining Fuji’s, “position as a pioneer in the development of systems for image information recording” (Fuji Photo Film Annual Report, 1981, p.12). By 1983 magnetic media had grown to represent 12% of sales (from 4% in 1976), and management put forth a narrative describing the
evolution of Fuji’s identity, for the first time in the letter to shareholders noting, “Since the founding of Fuji Photo Film Co., Ltd. in 1934 as a manufacturer of photosensitized materials, we have continually sought out fresh opportunities by entering new fields such as photo-related equipment and magnetic recording materials. Today Fuji film is an integrated image information company.” 

Thus, Fuji’s organizational identity evolved incrementally throughout this time period, and was relatively broad, in that it extended beyond photography and silver halide materials. At the same time, it was also focused, in that the emphasis was on recording materials, albeit across a range of market applications.

This organizational identity was reflected in how management interpreted the opportunities afforded by electronic imaging. The 1979 annual report was the first to mention electronic imaging, and it emphasized that “Electronics…offers potential in photography as we develop photosensitive materials which eliminate the use of silver” (p.9). In fact, the head of corporate R&D from the 1970’s noted in a 2006 interview that, given high silver prices, the initial motivation for research into electronics was to use electronic technologies to reduce silver halide consumption in film. The ties between electronics technologies and recording media were further emphasized when the letter to shareholders first mentioned electronics in 1981 stating, “A dominant theme [of our R&D] has been the design of hybrid products which incorporate a range of chemical, optical-imaging and electronic technologies.”(p.3) The focus on hybrid systems that combined electronics and recording media was reinforced in 1983 the letter to shareholders “We will further strengthen our involvement in electronics…Fuji Film will be responding to the emerging needs for new image information systems by pursuing the hybridization of electronics with its own fine chemical, microengineering and optic technologies.” (p.6) 

In contrast, the actual content of some of the electronic imaging research projects during this period extended beyond the materials-focused organizational identity. These initial forays into digital imaging took the form of multiple exploratory R&D efforts that were integrated within the core film
organization’s corporate R&D structure. In 1975 basic research for a digital radiography system began, culminating in the Fuji Computed Radiography (FCR) system, which shipped in 1983. FCR recorded x-ray images on a reusable imaging plate (as opposed to film), converted the image to digital signals, processed it with imaging software, and then output the image onto specialized film. Although FCR had a recording materials component – film – the hardware for FCR, which Fuji originally sold for about $1 million, was at a completely different price point from anything else that Fuji had developed, and required a fundamentally different sales process and business model.

The first electronic still photography project ran from 1977-78, and in 1980 two projects focused on developing a video camera were initiated, one in Japan and one joint with a Silicon Valley-based start-up. Electronic still cameras and video cameras incorporated semiconductor image sensors, were to be used for image capture, and did not necessarily involve any image recording media or materials. A magnetic disk project was aimed at displaying pictures on a TV as opposed to creating hardcopy. To support these efforts, five Fuji engineers were sent to study semiconductor technology at Tohoku University’s semiconductor institute for about two years. A separate research facility to house electronic imaging efforts, the Miyanodai Technology Development Center, was opened in 1981, and the digital radiography project, the video camera project, and microelectronics and semiconductor research teams were moved there.

The potential challenges to the identity posed by these projects, did not emerge as a contentious issue. One reason for the lack of conflict was that research activities were not highly visible. “The only reason we survived early on was that no one cared what a group of 10 to 20 people in the research lab were doing,” commented one engineer who worked on the development of FCR. Another reason for the lack of conflict was the research culture. As a research laboratory, exploration was the norm, and the group felt empowered to embark on research opportunities without explicit consideration of the identity implications. “We saw no barriers to going into a new area. We were ready to go into digital areas as a fundamental attitude,” said the 1980 head of the corporate research lab. Team members therefore felt
validated. “Even though they had silver halide backgrounds, senior management was very supportive of electronic imaging research,” commented an early project member.

In aggregate these exploratory efforts resulted in significant technical achievements in new domains. For instance, Fujifilm applications for patents in classes related to semiconductors went from 7 from 1970-1975 to 118 from 1976-1984. In addition several electronic still camera prototypes formed the technical basis for products commercialized in the late 1980’s.

**Fuji 1984-2001: Structural separation and identity dynamics**

In 1984 Fuji created separate Equipment/Hardware, and Electronic Imaging units that had profit and loss responsibility and reported to the president. The Fuji Computed Radiography development team became part of the equipment division. The electronic imaging division, which had about 30 people, included individuals who had been working on Fuji’s exploratory electronic camera projects and microelectronics research, engineers from Toshiba, and about 5 marketing people.

About one year after the establishment of a separate electronic imaging division, a group of middle managers at Fuji began a series of discussions questioning the identity of the company. The group met about once a month, and in January 1989 completed a report for senior management in which they argued that although the name of the company was Fuji Photo Film, the core of the company was not just photography/imaging, but also specialty chemistry. The report included a diagram that represented the company as two intersecting circles, imaging and specialty chemistry, and suggested that if one believed that imaging was the dominant circle, then developing new technological expertise to deliver imaging solutions made sense. But if one believed that Fuji’s specialty chemistry technical expertise was the dominant circle, then the logical response to digital imaging was not to master new technologies for imaging, but instead to apply the company’s chemical expertise in new markets. Since the TMT had established a separate electronic imaging division, it appeared to the group that the TMT believed imaging should be dominant. They argued that the TMT should, instead, consider moving in the direction
of new applications for Fuji’s chemical expertise. At the time, the TMT rejected the idea of chemistry being dominant, but surfacing the question of identity resulted in ongoing efforts by the TMT to clarify how digital imaging fit within the company’s identity.

As discussed earlier, although the TMT had used the broad label “Integrated Image Information Company” in 1983, the meaning behind the label had been somewhat narrow, referring primarily to Fuji’s presence in photographic and non-photographic recording media. In 1985, after the electronic imaging division was established, the TMT explicitly broadened the label’s meaning, introducing the slightly altered phrase “Imaging and Information” (I&I) to describe its business. The 1986 letter to shareholders explained,

“Responding to the rapid process of the age of high technology, the Company recently unveiled “I & I”—Imaging & Information as its corporate concept. Guided by this concept, it is working to broaden the world of imaging, …. This refers not only to further developing conventional technology and systems. It also means an innovative approach to the development of imaging and information systems incorporating a broad spectrum of technologies and designed for a wide variety of applications. This includes, for example, the field of computerized image processing.”

I&I remained the phrase used by the TMT to describe the company throughout this period, and following the dialogue with middle management over the organizational identity, management systematically expanded the meaning of I&I over time to incorporate digital imaging. In 1992, the letter to shareholders explicitly linked I&I to digital images stating, “We are developing uses for the [thermal printing] technology… not only in the reproduction of photographs but also in the output of digitized images. In this way, we are broadening the scope of the imaging and information (I&I) concept,” and the 1995 Annual Report included a section about digital imaging with the heading “Broadening the Horizons of I&I” (italics added, Fuji Film 1985 annual report).

The specific definitions of the two terms, “imaging” and “information” were also expanded over time. In 1996, the letter to shareholders stated, “‘Imaging’ means to capture, or take images,” but in 1997 that became “ ‘Imaging’ refers to the constant challenge of [not only] developing, capturing, [but also] recording and reproducing systems that produce images.” Similarly in 1996 information was defined as,
“the creation of a variety of image manipulation systems combining electronic imaging and computer technologies,” and in 1997 the definition expanded to “‘Information’ refers to …combining electronic imaging and computer technologies to create a broad range of systems in various fields that facilitate [not only] the quick and easy manipulation, [but also] transmission, and utilization of high-quality images.”

The articulation of a broad I&I identity that explicitly encompassed the efforts of the electronic imaging division resulted in strong support for the efforts of the division throughout the organization. Top management signaled this support in the 1985 Annual Report letter to shareholders, which highlighted the FUJIX TV photo system, an electronic imaging product as, “The most notable product introduction in 1985 … Combining the outstanding image quality of silver-halide photography and electronics technologies, the system reproduces photographic images on the television screen.” (Fujifilm 1995 Annual Report). The shared I&I identity helped ensure electronic imaging had adequate funding. In 1990 Fujifilm Microdevices, Inc. a separate subsidiary was established to continue CCD image sensor R&D and to build CCD manufacturing capability. Hirozo Ueda, who spearheaded the creation of the microelectronics subsidiary said in a 2004 interview, “I&I stands for our basic policy... That this [development of the CCD] is consistent with our policy was very helpful within the company to get resources.” (Technology Management 2004).

Throughout the organization, there was little resistance to digital imaging efforts. “When Fuji shifted resources to digital imaging, most people didn’t question it. They thought it was a natural direction as an imaging company,” commented the ex-director of Human Resources who spent 32 years at Fuji. An engineer who worked on digital camera development starting in 1979 and continued in the separate division said that his team conceived of their job as “imaging regardless of the technology used to deliver it,” and that other parts of Fuji were highly cooperative. For instance, digital camera sales activities were coordinated with other Fuji divisions: the magnetic tape sales subsidiary for consumer electronics retailers, and a combination of the analog camera sales force and Fuji’s major film distributors for the photography channel.
From both a technological and commercial standpoint, Fuji had a successful initial transition to digital imaging. Although Fuji’s first electronic (not digital) camera, commercialized in 1987, was not a success, in 1989 the company introduced the first consumer digital camera in the industry. By 1997, Fuji had introduced 14 more digital camera models, and in 1998 introduced its first model with a Fuji-manufactured CCD. From 1985 to 1995 Fuji applied for 531 patents related to semiconductors. By 1999 Fuji’s microelectronics subsidiary had developed a proprietary honeycomb-shaped CCD that captured significantly more light than competing technologies, enabling users to take pictures in lower light settings without a flash. A camera with the honeycomb CCD was launched in 2000, at which point Fuji held about 20% share of the global digital camera market, and the electronic imaging division had grown to about 400 engineers.

**Polaroid 1981-1989: organizational identity and integrated electronic imaging efforts**

Polaroid’s organizational identity was deeply intertwined with the legacy of its founder, Edwin Land, who had invented many of the basic technologies behind Polaroid’s instant cameras and film. Land believed that Polaroid was fundamentally an instant photography company, and given his iconic status as the organization’s leader, no one questioned this (Wensberg 1987; McElheny 1998). When Eastman Kodak announced plans to enter the instant photography market in 1976, the threat served to reinforce Polaroid’s focused identity. In a New York Times interview at the time Land commented, “This [instant photography] is our very soul that we are involved with. This is our whole life. For them it’s just another field.” (New York Times, 4/28/76). In addition, the presence of a tangible referent can more deeply instantiate an organizational identity (Ravasi and Canato 2010) so the common public use of the word “Polaroid” to refer to an instant photo may have further ingrained the identity throughout the organization.

In contrast to Fuji, where diversification resulted in explicit ongoing efforts to redefine the organizational identity to include those activities, at Polaroid the approach was to make clear that, despite
diversification, instant photography was still the core organizational identity. Land had always opposed diversification, but in 1980, William McCune, who took over for Land as CEO, initiated a re-organization in which he established a separate Diversified Products group. He explained the motive for diversification in the 1980 the letter to shareholders, noting the goal “to explore fields which are new for Polaroid such as batteries and the commercial chemical business.” At the same time, he emphasized that “instant photography…will be the primary focus of our efforts in the foreseeable future (Polaroid 1980 Annual Report, p.8). Land was also quite vocal, and the trade press at the time reported, “In a rare series of interviews,… Land made it clear that he does not intend to allow anyone at Polaroid to devote too much of its resources to diversification.” (Business Week, 3/2/81). In the 1981 Annual Report, a corporate profile was added to the front of the report, and it mentioned diversified products, however in contrast to Fuji, no attempt was made to include those products in a broader vision of the company. The profile stated, “Polaroid Corporation designs, manufactures and markets worldwide a variety of products based on its inventions primarily on the photographic field. These include instant photographic cameras and films, light polarizing filters and lenses, and diversified chemical, optical and commercial products.” In the 1981 letter to shareholders, McCune minimized the importance of diversification stating, “we do not expect non-photographic products to make significant contributions to our sales in the near term. However we are convinced that there may be [not “will be”] substantial future opportunities for us in areas of business new to Polaroid.”

Even after McCune replaced Land as Chairman of the Board in 1982, diversification efforts were still described as peripheral to the organization. The 1982 annual report’s summary of the Diversified Products group consisted of a page labeled “Other Operations,” and included a variety of products ranging from batteries to industrial urethane materials used in belts for high-volume printers. In 1983 Polaroid entered the magnetic media market (video cassette tape and floppy disks), and created a new division, Magnetic Media and New Business to replace the Diversified Products group. But again, in contrast to Fuji, no attempt was made to incorporate this group within the organizational identity. The
1984 letter to shareholders stated, “the company continues to invest in research into magnetic media, fiber optics, thin film diagnostics and other diversification activities outside of photography, but…The major portion of our resources are going into strengthening and diversifying our core business which we define as instant photography and allied imaging techniques for producing instant prints or transparencies,” (Polaroid Annual Report, 1984, p.3), and this sentiment was reinforced in the 1985 letter: “It is our intention that Polaroid remains the leader in providing novel, cost-effective instant imaging systems for the world’s permanent records,” (Polaroid Annual Report, 1985, p.2).

Despite the fact that sales of magnetic media had reached an estimated 5-10% of Polaroid’s sales by 1986 (BT Alex Brown 9/16/86), it had never become a legitimate part of Polaroid’s organizational identity, and in 1987 the company restructured the business, moving the videotape product line to the Consumer Products Business Unit and the floppy disk sales to a subsidiary. Polaroid also reduced its research investment in the area. The decision was explained in the 1987 annual report, “We concluded that we could not risk the substantial investment in magnetic memory systems for the several more years needed to achieve commercialization in an uncertain storage industry and at the same time devote more resources to our primary imaging efforts.” The following year Polaroid discontinued its floppy disk product line, and the videotape business stagnated.

The focus on instant hardcopy was also evident in the TMT interpretation of digital imaging. In a 1999 interview McCune, ex-CEO, reflected back on that time and said,

“The idea of getting into the hardware business…to try to get into digital cameras as an enterprise... I thought that was silly…I felt that one had to take advantage of digital imaging concepts to improve the versatility and quality of instant photography.”

Confidential memos among members of the TMT, and communications to employees, also reflected this perspective. An April 1985 memo from a member of senior management proposing a script for the annual shareholder meeting stated, “with [electronic] image processing you can alter the form of the image…whatever that form may be, hardecopy images will be indispensable” (Baker Library Historical Collection EI 1f2). The memo included a hand-drawn diagram of an electronic imaging system with
“instant hard copy” at the center of the vision, symbolic of top management’s perspective (see Figure 1). A TMT memo from 1987 expanded on this interpretation stating “Electronic imaging is a technology, not a business. Polaroid is not trying to be in the consumer electronics business, rather we continue to look at ways thru the use of new technologies to make IP [Instant Photography] attractive.” (Baker Library Historical Collection EI 1f7). Another TMT memo from 1987 clearly positioned electronic imaging as an adjunct to the core business. “Electronic imaging is a technology that is broadening the application of our core business – instant quality hard copy” (Baker Library Historical Collection EI 1f8). In June, 1988 the internal employee newsletter quoted, Booth, the CEO, as saying, “We expect electronics to drive – not drive out demand for instant, hard-copy prints.” Public statements also document this perspective. The letter to shareholders in 1987 said, “In both [direct-imaging photographic products and electronic imaging] fields, our primary focus is the generation of high-quality hard copy prints.”

------------- insert figure 1 about here --------------

After a hostile takeover attempt in 1988-89 was thwarted, management engaged in a visioning process which culminated in a decision to explicitly broaden the company’s identity from instant photography to imaging, including non-photographic, non-silver halide output. But high quality hardcopy output was still the defining feature of the company. In 1989, meetings were held throughout the company, and the employee newsletter summarized the message in an article titled, “Plans for Polaroid’s ‘total imaging’ future shared companywide.” The article noted, “President Mac Booth [said] in a videotaped speech, ‘Our vision is to be the dominant company in high-quality original-print imaging.’” (Baker Library Historical Collection EI 2f5). The instant hard copy identity was reflected in many of the shared beliefs held by top management at this time. These beliefs included the notion that customers valued an instant hardcopy output and wanted ‘photographic’ quality, as well as a commitment to a razor/blade business model (Tripsas and Gavetti 2000).
During the period 1981-1989 members of the Electronic Imaging group developed a completely different set of beliefs from the TMT about electronic imaging opportunities, and were at odds with the organization’s core instant hardcopy identity. Like Fuji, Polaroid’s initial electronic imaging efforts were integrated within the R&D organization. In 1981, McCune had established a formal electronic imaging group that consisted of technical personnel and reported to the VP of engineering and research, who also managed core film research. The group was led by a Polaroid veteran who was an officer of the company and had previously been running a 1200 person division. By 1985 the group had about 300 people and 9 subunits, each reporting to the electronic imaging group head: Optics, Fiber Optics, Amorphous Silicon, Electrical Engineering, Electronic cameras, Imaging software, Product development, Disk drives, and Microelectronics. The microelectronics effort was the largest and culminated in the opening of a microelectronics laboratory in 1986 after an up-front investment of about $30 million and with an operating budget of $10 million/year. The head of the lab was a long time Polaroid employee, but about 80 of the 90 or so microelectronics lab employees were new hires.

Some projects that the electronic imaging group worked on fit well with the notion of Polaroid as a hardcopy output company. These included the “Printer in the Field” concept, a portable electronic instant camera/printer combination, and Helios, a medical imaging system that could produce instant images on a new carbon-based dry film material using lasers. Both of these projects had “instant quality hard copy” as a key component. The group also commercialized some exploratory niche products that combined electronics and hard copy output, such as image recorders that could generate instant photo prints, slides or transparencies from computer or video sources.

However many actions and beliefs of the electronic imaging group directly contradicted the perspective of the TMT. A broad range of technologies without a clear relationship to hardcopy output were under development, in particular research on imaging software, fiber optics, and image sensors at the microelectronics lab. The group also commercialized an electronic (not digital) still camera in 1989, but it was expensive and only about 3000 units were ever sold, primarily by Hadland Photonics, a
European company that sold the camera as part of a military surveillance system. Since the group was populated with outsiders who did not have a historical Polaroid imprint, its members developed a different interpretation from that of the TMT about what electronic imaging implied for Polaroid. In contrast to the TMT view of electronic imaging as “a technology, not a business” this group laid out plans for a broad-based presence in multiple parts of the broader electronic imaging system. A 1983 electronic imaging group planning document listed Polaroid’s weaknesses in electronic imaging, including, “value system that focuses on high quality hard copy and has little value for video display…[and] current strategy to make profit on software only.” The document went on to describe what Polaroid’s goals in electronic photography should be, including, “to generate profits from both hardware and media sales…. to be the driving force in the development of a high resolution electronic still camera with a start-of-the-art sensor (1 million or more pixels)”

These conflicting beliefs, however, did not surface as problematic at this point. Since the electronic imaging group was integrated into the R&D organization, projects were viewed as experimental despite the commercialization of some products. In addition, since these efforts were positioned as technical, management did not perceive a conflict. In a 1999 interview, an ex-CEO said, “the microelectronic center was a research kind of a thing…we had some justification that we would make some sensors and do some things that would make it pay for itself a little bit. But it was thrust as mostly development research.” At the end of this period, Polaroid’s technical accomplishments were significant. For instance, the number of patents in classes related to semiconductors increased from 5 in 1975-1979, to 16 from 1980-1984 to 32 from 1985-1989, including a patent on a method for using rectangular rather than square pixels on an image sensor to improve color recovery.

**Polaroid 1990 – 2001: Structural separation and identity dynamics**

In 1990 electronic imaging moved out of the corporate R&D labs when Polaroid created 4 new divisions that reported to the CEO: Consumer/Family, Business, Science-Technology, and Electronic
Imaging. Helios, the digital medical imaging project became part of the Science-Technology division, and the remainder of the original electronic imaging group, including the microelectronics lab, became the electronic imaging division. A new head was appointed - another long-time Polaroid employee, but new hires were brought in to fill key positions such as the newly-established marketing function. In 1993 another re-organization created three divisions: 1. Photography, which included family, business, and technical imaging, 2. Hi-resolution imaging, which included Helios medical and graphic arts systems, and 3. Imaging Media and Peripherals, which included the electronic imaging division as well as media products such as magnetic tape. That same year the Microelectronics Lab was sold to MIT. In mid-1994 an outsider from Digital Equipment Corporation was hired to run the electronic imaging division, and given profit and loss responsibility.

Once electronic imaging was broken out as a separate division reporting to the president, conflicts between the efforts of the division and the organizational identity became visible. The TMT continued to its view Polaroid’s business as hardcopy output. In his remarks at the annual shareholders’ meeting in May, 1990, Sheldon Buckler, executive VP, Office of the CEO said, “Polaroid sees itself as a broad-based imaging company…all of our businesses are bound together by a single corporate strategic foundation that focuses on growth in the hard copy imaging field.” (Baker Historical Collection EI1-f2). The perspective continued under the new CEO, Gary DiCamillo, an outsider with a consumer marketing background, who arrived in 1995 and described the core of company in a 1997 interview stating, “What are we? What are we good at? We’re pretty good at creating images instantly,” (Rosenbloom 1997 p.12).

As a result, tensions escalated between the electronic imaging division and the TMT. Tripsas and Gavetti (2000, p.1155) describe this period of Polaroid’s history “as one of cognitive dissonance between senior management and the newly hired members of the Electronic Imaging Division.” One of the first projects initiated by the newly-formed division was a stand-alone digital camera project. Building on technology developed for the abandoned “Printer in the Field” camera/printer project, the group had a working 1 megapixel digital camera prototype in 1992. Attempts to move the prototype to the
commercialization stage however were continually rejected by the TMT. The electronic imaging division felt that regardless of what they proposed, management was reluctant to proceed with a product that did not have hardcopy output. The head of marketing for electronic imaging commented, 

“We got the name as the Presentation R Us Kids. We used to come in every week… and they [top management] would always say no. Tell us to go study something...I didn’t have the skill set to align these senior guys…. we went through humongous exercises in getting new strategies and new mission statements…and all this intellectual stuff doesn’t mean a hill of beans at the end of the day…in a crisis mode people go to whatever discipline they have…here are guys in crisis and what do they know? Instant film.”

By the time Polaroid released its 1 megapixel camera in 1996, over 40 competing products were on the market, and despite receiving technical awards, it did not perform well.

The electronic imaging division was also unable to obtain TMT support for external relationships. In 1992 the group formed a partnership with IBM to develop a digital camera that would store images on a mobile handheld IBM PC. A prototype was shown in January 1993 at the CES (Consumer Electronics Show). Then senior management imposed what members of the division considered unrealistic conditions for continuing the relationship. One member of the team explained “it became a hurdle that you had to get IBM to sign up and throw $8 million at this thing to carry forward the program…It was sort of like being told by the Wizard of Oz to go get the broomstick of the Witch of the West.” The partnership with IBM was abandoned.

Cooperation with other parts of Polaroid, while perceived as important, was also unproductive. A 1990 article about the microelectronics lab in the internal employee newsletter quoted a senior microelectronics manager saying, “Our success and the success of Polaroid in the electronic imaging arena depend on two-way cooperation between the microelectronics lab and other Polaroid organizations… For example,…the microelectronics lab frequently turns to Polaroid’s mechanical engineers from outside the lab for packaging design, prototype packages, and assembly fixtures.” (Baker Library Historical Collection). Unfortunately members of the electronic imaging division felt a lack of cooperation from other areas, and in private interviews expressed frustration. The lead technical engineer
for the digital camera project described the type of problems he faced, “I would ask [the film R&D group] for clarifications to be made for this film to match the characteristics of electronic exposure as opposed to optical exposure… ‘who are you’ they would respond. They saw the group as parasites because we were not bringing in any money.”

Senior management efforts at targeted integration were also not well received. The TMT initially insisted that sales of electronic imaging products be handled by the instant photography sales force despite protests from the electronic imaging division that its high-priced product-line was targeted at different channels. Eventually, when the division became a profit and loss center in 1995, it established its own US sales forces for digital cameras, although internationally it continued to share the instant photography sales force. In contrast to digital camera efforts, Helios, the carbon-based dry-process medical imaging system received ongoing support from senior management, at the expense of other electronic imaging projects. A journalist at the time wrote, “That project [Helios], say several former Polaroid employees, has limited R&D funding available for other electronics ventures.” The first Helios system shipped in 1993 and an effort to utilize the same technology in the graphic arts industry was initiated. Unfortunately, sales of Helios did not materialize as expected, and after incurring substantial losses, the division was sold in 1996.

To further improve profitability, DiCamillo, the new CEO as of 1995 also cut R&D, and by 1998 only about 50 people doing digital imaging research remained. Work on high quality output technologies continued, but ink-jet printer research had been stopped due to the TMT’s focus on photographic quality. Digital camera development was outsourced to Asian ODMs (Original design manufacturers) and fifteen cameras were announced between 1997-2001. This approach had some success, and building on the strength of the Polaroid brand name the firm gained significant share at the low end of the US market with a 36% share of entry-level VGA resolution (under 1 megapixel) cameras in 2000 according to International Data Corporation, however, this growth was not sufficient to compensate for shrinking sales of instant cameras and film, and Polaroid declared bankruptcy in 2001.
A Grounded Model of Organizational Design, Identity, and Innovation

Based on this comparison of Fuji and Polaroid, we next develop a series of propositions that form the basis of a framework relating organization design choices, organizational identity, and innovation outcomes. These propositions are summarized in Figure 2, and Tables 1, 2, and 3 provide representative summary data from the preceding narrative in support of each proposition.

Both Fuji and Polaroid made early forays into digital imaging by establishing integrated electronic imaging groups that were part of their corporate R&D organizations. At the time of these initiatives, Fuji management had articulated an organizational identity that extended beyond photography to include products such as magnetic tape, yet was still focused on the recording of information – image or other. Polaroid’s instant photography legacy was strong, and during this period, the TMT defined the company as an instant hardcopy company. Within the electronic imaging units, actions and beliefs that were inconsistent with the core organizational identity emerged in each firm, including the commercialization of the Fuji Computed Radiography system and an electronic camera at Polaroid. Yet conflicts did not surface, and both firms were able to facilitate exploration without confronting identity conflicts. By “hiding’ within the corporate research lab, activities were either not noticed, or were viewed as exploratory and therefore exempt from the expectations of everyday operations.

Proposition 1: By keeping technological exploration integrated within the core organization (e.g. as a subgroup with R&D), identity conflicts are more likely to remain dormant, facilitating exploratory initiatives that are identity-challenging.

While the roots of identity conflict were present at both Fuji and Polaroid when their electronic imaging efforts were located within the R&D organizations, once separate units were formed, identity conflicts surfaced at both companies. Whereas R&D projects might fly under the radar, once a separate unit was established, members throughout the organization took note. Separation gave the new units a
degree of status, and as such, they posed a stronger threat to the core organization. At Fuji, a debate about identity ensued as a group of middle managers questioned the company’s imaging identity and proposed that Fuji shift and become a specialty chemicals company. At Polaroid, creating a separate unit surfaced inconsistent beliefs about what products should be developed and what business models were appropriate, resulting in a protracted period of clash between the TMT and the electronic imaging unit.

Proposition 2: Creation of a separate new technology division increases the likelihood that latent identity conflicts, if they exist, will surface within the organization.

Fuji and Polaroid management responded differently to the identity challenge posed by electronic imaging. Fuji management was able and willing to modify organizational identity to encompass electronic imaging, whereas Polaroid exhibited rigidity. We propose that each firm’s prior experience managing identity contributed to these reactions. Before digital imaging was a major force, Fuji management had engaged in an ongoing process of questioning and modifying claims about the organization’s identity in order to create a cohesive whole that included growth in new non-photographic markets such as magnetic tape and carbonless copying paper. Fuji replicated this approach in order to incorporate digital imaging within the umbrella of the organization, using the phrase “Imaging and Information” to describe the company’s domain, and then engaging in what Gioia, Schultz and Corley (2000) call “adaptive instability,” systematically expanding the meaning of the label to explicitly encompass digital imaging. In contrast to Fuji, Polaroid’s TMT had a history or reinforcing its narrow organizational identity when expanding into new markets. Throughout the 1980’s, magnetic tape and other non-photographic applications of Polaroid technology were positioned as marginal, and not a part of the company’s core. This rigid commitment to a focused organizational identity continued when management evaluated the implications of electronic imaging technology. The response to electronic imaging was to ask how a hardcopy output company could take advantage of electronic imaging – as opposed to asking whether Polaroid should become something other than a hardcopy output company. They did stretch Polaroid’s identity beyond instant photography, but still persisted in a focus on high
quality hardcopy. Conflicts between the core organizational identity and the beliefs and actions of the electronic imaging unit were therefore not resolved.

Proposition 3: Organizations with a history of adapting organizational identity are more likely to modify organizational identity effectively in the face of major discontinuities.

At Fuji, electronic imaging was explicitly included within the organizational identity, and as a result, the electronic imaging unit held a legitimate position within the organization. Selective coordination and integration was successful, resulting in a productive new technology unit in terms of both technologies and products. In contrast, Polaroid’s hardcopy identity implied a set of beliefs, such as the razor/blade business model and the need for photographic quality, that was inconsistent with the beliefs of the electronic imaging division. The resulting discord permeated the EI division’s relationships with other parts of the organization and hurt overall performance.

Proposition 4: Establishing an organizational identity that encompasses both the core and new technology units improves the likelihood that selective coordination between the core and new technology units will be effective.

Proposition 5: Conflict between the identity of the core organization and a differentiated new technology unit creates dissonance and inhibits the ability of the new technology unit to leverage appropriate linkages.

---------- insert Table 3 about here ----------

Alternative explanations

A number of factors other than creation of a new technology division might have caused latent identity conflicts to surface. One possibility is that sales of new technology products grew large enough to attract attention. This sort of emergent shift in identity has been shown to happen in other firms, most notably Intel, where sales of microprocessors became large enough that senior management finally took note, and the TMT recognized that the organization was no longer a memory company (Burgelman 1994). At both Fuji and Polaroid, however, sales of electronic imaging products were insignificant when separate
units were formed, and identity conflict surfaced long before sales became significant at either firm. Increased funding levels might also bring attention to the new technology efforts, and be a primary driver of identity conflicts emerging. While we did not have access to the allocation of R&D budgets over the entire time period, at Polaroid interview data indicate that the number of employees in the electronic imaging group reached a peak in 1989-1990, the years before and after the separate division was established, and declined after that, a sign that funding was decreasing, not increasing. At Fuji, the number of employees did increase when a separate division was formed, with the addition of 5 marketing employees, but the overall number of researchers did not increase significantly until a few years after the separate division was established, implying that funding was not the primary drive of identity conflict emerging.

In addition, factors other than identity conflicts clearly contributed to the differences in overall performance at Fuji and Polaroid. In particular, Polaroid had less of a financial cushion than Fuji in that sales of Polaroid cameras and film had been declining for many years and were continuing to shrink during the time period in which electronic imaging was being developed. In contrast, the size of the 35mm film market was still growing through 2001. Performance difference may also have been related to county of origin. Based in Japan, Fuji, had a different set of human resource policies, cultural norms, and investor expectations. We do not claim that these differences were not important, merely that the resolution of identity conflicts was also a contributing factor in Fuji’s superior performance relative to Polaroid.

**Discussion and Conclusions**

This study explores how the interaction between organizational design choices and organizational identity influences a firm’s ability to make a complete transition from one technological generation to a radically different one. Based on a detailed comparison of the responses of Fuji Photo Film and Polaroid
to digital imaging, a set of propositions relating organizational design, identity, and technological change are developed, making a number of contributions.

First, we propose a relationship between organizational design choices and the surfacing of identity conflicts. While separation of a new technology unit has many benefits, as articulated in the existing literature, we show that separation can also make identity conflicts, if they exist, visible by drawing attention to the unit. This heretofore unacknowledged side effect of separation can have severe consequences for the new technology unit. Before creating a separate unit, managers should therefore evaluate whether a new technology is identity-challenging, and if so, decide whether the organization is prepared to confront identity dynamics. If managers want to explore new technologies that might be identity-challenging, but are not yet ready to address identity issues, then integration might make more sense. In the cases of both Fuji and Polaroid, creation of electronic imaging units that were integrated within the core film organization’s research lab created the freedom to explore, but kept identity conflicts from surfacing, thus insulating the development efforts. In sum, separation too early can actually be counterproductive since it draws attention to the new technology unit and causes identity conflicts to surface.

Second, this study provides empirical evidence that a common identity facilitates targeted coordination between a new technology unit and the rest of the organization. In making the transition from one technological generation to another, the inter-temporal transfer or redeployment of capabilities and complementary assets can play an important role (Helfat and Peteraf 2003; Helfat and Eisenhardt 2004; Taylor and Helfat 2009; Taylor 2010). But if a new technology unit is perceived by the rest of the organization as illegitimate, accomplishing this sort of transfer is difficult, as exemplified by the experience of Polaroid. In contrast, when the new technology unit is viewed as an integral part of the organization, as with Fuji, coordination is more readily accomplished.
Third, this study sheds light on the trade-off between broad and narrow identities. The advantage of a broad, robust identity is that it allows for a greater range of interpretations of what constitutes legitimate behavior (Padgett and Ansell 1993). In the context of an emerging industry with high uncertainty, that flexibility can prove advantageous since it is difficult to predict what technical paths and applications will bear fruit. For instance, Polaroid’s narrow identity as a high quality hardcopy output company might have worked out well if the Helios medical imaging system had been a commercial success or if the technology to develop a “printer in the field” digital camera/printer combination had been feasible at an earlier date. But given the uncertainty associated with each project, this narrow identity was risky. When the projects failed, Polaroid’s identity did not accommodate other digital imaging opportunities. In addition, when the context is changing rapidly, different hierarchical levels might receive different market signals (Gavetti 2004). A broader identity might have given the electronic imaging division the flexibility to respond to signals and move in directions that were not predictable ahead of time. On the other hand, too broad an identity can make it difficult for outsiders to categorize and evaluate a firm (Zuckerman 2000). But early in an industry’s emergence categories are less coherent and category expectations less well-defined (Zuckerman and Rao 2004), so the penalty for having too broad an identity might therefore be minimized in nascent industries.

Finally, this study implies a more emergent, incremental type of identity fluidity than implied by prior research. Previous models of identity change have proposed that a primary trigger for a shift in identity is a perceived inconsistency between outsider and insider views (Dutton and Dukerich 1991; Elsbach and Kramer 1996). Gioia, Schultz, and Corley (2000, p.74) note, “as a consequence of its interrelatedness with image, organizational identity becomes dynamic and mutable.” Other studies have emphasized senior team efforts to change identity in a radical way, such as from a technology-driven to market-driven company (Fiol 2002; Nag, Corley et al. 2007), or from a digital photography company to a memory company (Tripsas, 2009). In the case of Fuji however, identity was dynamic and mutable early on, in response to organic growth and incremental expansion into new markets. Fuji did not change
identity so much as it expanded it, and when Fuji did need to undertake a more radical transformation – a shift to digital imaging – it was able to position the change as yet another incremental addition, despite the fact that it implied the long term replacement of Fuji’s core film business.

Future lines of inquiry also arise from this study. While a large body of work has explored identity change dynamics (Reger, Gustafson et al. 1994; Gioia and Thomas 1996; Fiol 2002; Corley and Gioia 2004; Ravasi and Schultz 2006), the role of organization design in facilitating or inhibiting the change process is not well understood. This study suggests that organizational design choices might provide an important signal of the validity of an identity change process. The broadening of Fuji’s identity to explicitly encompass digital imaging was triggered by the creation of a separate unit. But senior management efforts to diffuse this broader identity throughout the company and with outsiders may have also been facilitated by the creation of that unit. The establishment of a separate division may have given critical credibility to the expanded the meaning of “Imaging and Information.” Since both insiders and outsiders can be slow to internalize a shift in identity -- e.g. some stock market analysts continued to evaluate Linco, a producer of digital camera memory cards, as a digital photography company at a point when about 20% of sales came from USB flash drives (Tripsas 2009) -- understanding how organizational design choices might accelerate identity change efforts is a valuable topic for future research. Along these lines, rather than view organizational identity as simply a constraint that organizations fall victim to, research should further explore how management of organizational identity can instead be an important lever and source of advantage as firms evolve.

One limitation of this study is that the setting is a high-technology arena in which separate R&D groups exist and play a significant role. R&D organizations generally have a more exploratory culture, and are therefore likely to be more tolerant of exploration at the boundaries of identity. So integration within corporate R&D may have had less of a downside than integration of innovative efforts in a non-technical organization. Examining the relationship between organizational design, identity and innovation
in a less technical setting is important for generalizing the conclusions of this study beyond firms that have an R&D function.

This study examined autonomous new technology units with some level of integration, however other options include the creation of a spin-off company or a completely separate division with no integration. In fact, the consulting firm McKinsey had recommended complete separation to Polaroid. Ex-CEO Booth explained, “They [McKinsey] wanted a separate business totally. Its own research, its own marketing, its own manufacturing. It could be in California…we never accepted this because we said jeez, we’re got the same customers…we’ve got so much technology that’s servicing both fields… Financially we can’t afford to be that redundant.” Clearly complete separation would have sacrificed leveraging the significant resources of the core organization, but with no need for integration, identity conflicts and the associated discord between the new technology division and the core organization would have been lessened. Future work to understand the trade-offs involved in total structural separation for identity-challenging technological transitions would be welcome.

We have focused on the implications of identity-challenging technology for internal organization structure. Alliances are also an important source of technological exploration for many firms (Khanna, Gulati et al. 1998; Ahuja 2000; Katila and Mang 2003; Rosenkopf and Almeida 2003). An interesting extension of this work would be to examine the implications for alliances and other external relationships that are formed to develop identity-challenging technologies. Should these relationships somehow be structured differently to keep identity conflicts from surfacing? How might multi-firm research consortia differ from one-to-one relationships in terms of the visibility of identity conflicts?

Wholesale technological transitions are difficult, but when they challenge the core identity of an organization they take on an added level of complexity. Previous recommendations, such as creating ambidextrous organizational structures, require a new lens under these conditions. We hope that future
research on how to best accomplish technological change will consider the identity implications of new technology as a critical factor in determining the appropriate course of action.
Figure 1: A process model of organizational design, organizational identity, and new technology development

P1
Integration of new technology unit within core business → Potential identity conflicts unarticulated → Facilitation of exploratory technological initiatives that are identity – challenging

P2
Structural separation of new technology unit → Latent identity conflicts surface

P3
History of fluid, adaptive identity → Management more likely to modify identity and resolve conflicts
History of rigid, non-adaptive identity → Management less likely to modify identity, so conflicts are not resolved

P4
Selective linkages between core and new technology units are more likely to work

P5
Selective linkages between core and new technology units are less likely to work
Figure 2: Image from 1985 Polaroid senior management memo describing the electronic imaging strategy.
Table 1. Representative data supporting proposition 1: Potential identity conflicts existed, but failed to surface when electronic imaging groups were integrated within corporate R&D

<table>
<thead>
<tr>
<th>Org Structure</th>
<th>Top Management Team interpretation of electronic imaging reflects identity</th>
<th>Electronic Imaging group interpretation of electronic imaging conflicts with identity</th>
<th>Organizational dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji 1975-1983</td>
<td>Identity focused on materials for “imaging and information recording”</td>
<td>Group was developing electronic still cameras, video cameras, semiconductors, and a system to display images on a TV</td>
<td>Conflict did not surface • Ongoing funding • Prototypes of electronic cameras developed • Commercialized: Fuji Computed Radiography (FCR) • “No one cared what a group of 10 to 20 people in the research lab were doing” (FCR developer)</td>
</tr>
<tr>
<td>Electronic Imaging Unit integrated within corporate R&amp;D</td>
<td>“Electronics...offers potential in photography as we develop photosensitive materials which eliminate the use of silver.” (Fuji 1979 Annual Report, p.9)</td>
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<tr>
<td>Polaroid 1980-1989</td>
<td>Identity focused on “instant hardcopy”</td>
<td>“Goal...to be the driving force in the development of a high resolution electronic still camera.”</td>
<td>Conflict did not surface • Ongoing funding • Unit grew from 6 to 300 people • Commercialized: Video printers, image recorders, scanners, electronic still camera</td>
</tr>
<tr>
<td>Electronic Imaging Unit integrated within corporate R&amp;D</td>
<td>“to try to get into digital cameras as an enterprise...I thought was silly.” (ex-CEO, McCune, interview)</td>
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</table>
Table 2 Representative data supporting proposition 2:
Creation of structurally separate new technology divisions coincided with the surfacing of identity conflicts that had been previously dormant

<table>
<thead>
<tr>
<th>Structural separation of electronic imaging units</th>
<th>Potential identity conflicts surface</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fuji, 1984</strong></td>
<td></td>
</tr>
<tr>
<td>New, separate divisions reporting to the president were formed:</td>
<td>Middle managers begin monthly meetings to debate future identity</td>
</tr>
<tr>
<td>• Hardware/equipment (Fuji Computed Radiography)</td>
<td>Meetings culminate in a White paper recommending that Fuji become a specialty chemical, not an imaging company</td>
</tr>
<tr>
<td>• Electronic imaging</td>
<td></td>
</tr>
<tr>
<td>• Magnetic tape</td>
<td></td>
</tr>
<tr>
<td>• Optical equipment</td>
<td></td>
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</tbody>
</table>

| **Polaroid 1990**                                | Ongoing conflict between the TMT and EI division: |
| New, separate divisions reporting to the president were formed: |                                     |
| • Consumer/Family | • “We used to come in every week [proposing commercialization of a digital camera]...and they [TMT] would always say no...I didn’t have the skill set to align these guys.” (Head of Marketing, Electronic Imaging) |
| • Business | • “What we had was a constant fight with the senior executive management in Polaroid for five years... We constantly challenged the notion of the current business model, the core business, as being old, antiquated.” (newly hired member of Electronic Imaging) |
| • Science-Technology division (Helios medical imaging) | • Relationship with IBM to develop digital camera abandoned in 1993 |
| • Electronic imaging division | • Imaging Media and Peripherals (electronic imaging and magnetic media) |
| 1993 re-organization creates | |
Table 3 Representative data supporting propositions 3, 4, and 5:
Fuji had a history of adapting identity, modified identity claims to include electronic imaging, and experienced TMT support for electronic imaging and productive coordination among units. Polaroid had a history of reinforcing a narrow, rigid identity, did not modify identity claims to resolve conflicts with the EI division, and experienced a lack of TMT support for electronic imaging and dysfunctional dynamics.

<table>
<thead>
<tr>
<th>Evolution of Organizational identity pre-structural separation of electronic imaging</th>
<th>Evolution of organizational identity after structural separation of electronic imaging</th>
<th>Organizational dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji management promoted a flexible, adaptive identity to accommodate diversification.</td>
<td>Fuji management modified identity claims to explicitly include electronic imaging</td>
<td>Ongoing funding: “that this [development of the CCD sensor] is consistent with our policy was very helpful within the company to get resources.” (Corporate R&amp;D head)</td>
</tr>
<tr>
<td>• 1978 “the phrase which best sums up our activities is ‘audio visual information recording’</td>
<td>• 1985 “Imaging and Information” phrase introduced.</td>
<td>Members of the EI unit felt supported and legitimate: Our job was “imaging regardless of the technology used to deliver it.” (digital camera development engineer)</td>
</tr>
<tr>
<td>• 1977 “In the 1960’s we consciously redefined our business, broadening it from ‘photographic’ to ‘image.’ This covers all aspects of visual, audio and other types of information or ‘image’ recording.</td>
<td>• 1986 “I&amp;I...includes, for example, the field of computerized image processing”</td>
<td>Shared sales force was effective</td>
</tr>
<tr>
<td>• 1981 “a pioneer in the development of systems for image information recording”</td>
<td>• 1992 “We are developing ...technology...in the output of digitized images. In this way we are broadening the scope of the I&amp;I concept.”</td>
<td>Achieved 20% global share of digital cameras by 2000</td>
</tr>
<tr>
<td>• 1982 “Fuji Film is an integrated image information company”</td>
<td>• 1996 “Imaging means to capture or take images”</td>
<td>• EI division members felt isolated and ostracized within the organization: “They [film R&amp;D] saw the group as parasites” (digital camera development engineer)</td>
</tr>
<tr>
<td>(Fuji Film annual reports)</td>
<td>• 1997 “Imaging refers to [not only] the constant challenge of developing, capturing, [but also] recording and reproducing systems that produce images.”</td>
<td>• Shared sales force did not work</td>
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<td></td>
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<td>• Digital cameras commercialized late</td>
</tr>
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<td></td>
<td></td>
<td>• By 1998 only 50 people left in digital imaging R&amp;D (after a high of about 300)</td>
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</tbody>
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Polaroid management reinforced a rigid, narrow instant photography identity despite diversification.

| Polaroid management maintained a narrow instant hardcopy company identity |
|---|---|---|
| • 1976 “This [instant photography] is our very soul.” (Edwin Land in New York Times) | • 1990 “all of our businesses are bound together by a single corporate strategic foundation that focuses on growth in the hard copy imaging field.” (1990 shareholder meeting script, office of CEO) | • EI division members felt isolated and ostracized within the organization: “They [film R&D] saw the group as parasites” (digital camera development engineer) |
| • 1980 “instant photography will be the primary focus of our efforts in the foreseeable future” (McCune, letter to shareholders) | • 1997, “What are we? …We’re pretty good at creating images instantly.” (CEO DiCamillo) | • Shared sales force did not work |
| • 1984 “our core business...we define as instant photography and allied imaging techniques for producing instant prints or transparencies” McCune letter to shareholders) | | • Digital cameras commercialized late |
| • 1989 “Our vision is to be the dominant company in high-quality original-print imaging” (CEO Booth in employee newsletter) | | • By 1998 only 50 people left in digital imaging R&D (after a high of about 300) |
References


