07-087

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September 8, 2006

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Abstract

This paper empirically explores the relations between alternative organizational designs and a firm's ability to explore as well as exploit. We operationalize exploitation and exploration in terms of innovation streams; incremental innovation in existing products as well as exploring into architectural and/or discontinuous innovation. Based on in-depth, longitudinal data on 13 business units and 22 innovations, we investigate the consequences of organization design choices on innovation outcomes as well as the ongoing performance of existing products. We find that ambidextrous organization designs are significantly more effective in executing innovation streams than functional, cross-functional, and spinout designs. Further, transitions to ambidextrous designs were associated with significantly increased innovation outcomes, while shifts away from ambidextrous designs were associated with decreases in innovation outcomes. We explore the nature of ambidextrous organizational designs – their characteristics, how they operate, and their boundary conditions. Given these results, we discuss the relations between streams of innovation, organizations designs, and the nature of organizational adaptation.

The challenge of managing both efficiency and flexibility is a fundamental concern to organizational scholars. Thompson (1967, p. 15) observed that balancing efficiency and flexibility is a “central paradox of administration”. Abernathy’s study of the auto industry indicated that sustained performance was rooted in a firm’s ability to move down a particular learning curve as well as create new learning curves (Abernathy, 1978). Similarly, Weick (1979) observed that organizational adaptation is rooted in creating “hypocritical organizations”; that is, building contradictory organizational architectures within a business unit. This notion of paradox is also reflected Quinn and Cameron’s (1988) work on building organizations that are capable of operating in multiple time frames and learning modes.

More recently, March (1991) argued that sustained organizational performance is associated with a firm’s ability to balance exploitation with exploration. March’s insight has triggered substantial research that supports his fundamental idea (eg. Spender and Kessler, 1995; He and Wong, 2004; Eisenhardt and Martin, 2000; Gavetti and Levinthal, 2000). Innovation streams, the ability of a firm to host both incremental as well discontinuous innovation is one way to operationalize exploitation and exploration (Gibson and Birkinshaw, 2004; Tushman and Smith, 2002).While organizational adaptation may be rooted in a firm’s ability to host innovation streams, the organizational designs required to deal with the paradoxical strategic challenges associated with multiple innovation types are not well understood (eg Gupta, Smith, and Shalley, 2006, Siggelkow and Levinthal, 2003; Westerman, McFarlan, and Iansiti, 2006).

What is the relationship between organization design choices and innovation streams? The organization design and innovation literature has contrasting perspectives on unit of analysis, design choices, as well as temporal sequencing (eg Dunbar and Starbuck, 2006). Where some scholars suggest that the appropriate unit of analysis is the firm (eg Gibson and Birkinshaw, 2004, Ghoshal and Bartlett, 1997), others argue that innovation requires distinct organizational designs to support contrasting innovation types (eg Donaldson, 1995; Bradach, 1998). This design literature has contrasting points of view regarding the benefits of cross-functional, functional, matrix, and spinout designs and innovation outcomes (eg Nadler and Tushman, 1997, Christensen, 1997; Wheelwright and Clark, 1992; He and Wong, 2004). Still others focus on the time dimension of designing for innovation. While some argue for designs that simultaneously support exploration as well as exploitation (eg Tushman and O'Reilly, 1997; Miles and Snow, 1978; Adler, Goldoftas, and Levine, 1999), others argue for the sequential attention to exploitation and exploration (eg. Brown and Eisenhardt, 1997; Siggelkow and Levinthal, 2003).

We contribute to this innovation and organization design literature by empirically describing the relations between alternative organizational designs and innovation streams in a sample of 13 business units[i]. These business units employed four distinct organization designs in service of improving existing products (exploitation) as well as innovating (exploration): functional (eg Nadler and Tushman, 1997), cross-functional (eg Wheelwright and Clark, 1992), spin outs (Christensen, 1997), as well as ambidextrous (Tushman and O'Reilly, 1997). We explore the relations between organization designs employed to managed innovation steams and innovation outcomes. Further, since we have longitudinal data, we are able to explore how designs evolve over time and how design transitions affect innovation outcomes.

There is much written on contextual (Gibson and Birkenshaw, 2004) as well as structural ambidexterity (eg Tushman and O'Reilly, 1997; He and Wong, 2004). There is, however, little empirical evidence on this complex design, how it evolves, and its impact on innovation outcomes (eg Westerman et al, 2006). We explore this design in some detail. We find that ambidextrous organizational designs are composed of an interrelated set of competencies, cultures, incentives, and senior team roles. This design is significantly more effective in hosting innovation streams than functional designs, cross-functional designs, and spinouts. Those business units that switched to an ambidextrous design significantly enhanced their innovation outcomes, while transitions to cross-functional or spins outs were associated with decreased innovation outcomes. Further, the use of ambidextrous designs to execute innovations was positively associated with the on-going performance of existing products. Given these results, we discuss linkages between types of innovation, organizational designs, and organizational adaptation.

Innovation Streams and Organizational Adaptation

At the core of organizational adaptation is a firm's ability to continue to exploit its current capabilities as well explore into future opportunities (March, 1991; Levinthal and March, 1993). One manifestation of a firm's ability to explore and exploit is its ability to initiate innovation streams (Katila and Ahuja, 2002; Tushman and Smith, 2002). Innovation streams are portfolios of innovation that include both incremental innovations in a firm's existing products as well as more substantial innovation that extend a firm's existing technical trajectory and/or move it into different markets (Abernathy and Clark, 1985; Eisenhardt and Tabrizi, 1995; Venkatrman and Lee, 2004). For example, Ray Stata and his senior team at Analog Devices were able to continue to incrementally innovate in their original modular components to military users even as they developed several innovations including analog and digital semiconductor chips over a 40 year period (Govindarajan and Trimble, 2005).

Innovation streams are unique to a firm and its history. For a particular firm, innovations differ from one another based on their technical departure from existing products and/or departure from existing markets (Abernathy and Clark, 1985; Henderson and Clark, 1990; Christensen, 1997). Incremental technical change extends the existing product's price/performance ratio through the continued exploitation and local search of an existing technological trajectory (Benner and Tushman, 2002; Rosenkopf and Nerkar, 2001). Architectural innovations add or subtract product subsystems or change the linkages between subsystems (Henderson and Clark, 1990; Baldwin and Clark, 2000). While architectural innovations may be technologically simple, they are difficult for incumbents to execute (Henderson and Clark, 1990). Discontinuous innovations involve fundamental technical change in a product's core subsystem (Ahuja and Lampert, 2001; Gatignon, Tushman, Smith, and Anderson, 2002). These innovations trigger cascading effects throughout the product (Tushman and Murmann, 1998). In the photography industry, for example, digital cameras were a competence-destroying shift from analog cameras. The switch to digital image capture affected all other camera subsystems (Tripsas and Gavetti, 2000).

Innovations also differ in their target market or customer. Market or customer differences are based on their distance from the focal firm's existing customers (Leonard-Barton, 1995). The least challenging market innovation involves selling to the firm's existing customer base. These innovations may be incremental line extensions or discontinuous, but as they are focused on existing customers, they represent a limited marketing/customer challenge to incumbents (eg Von Hipple, 1988, Christensen, 1997). New customer segments are more challenging to incumbents as they can not rely on existing customer input. This difficulty is accentuated in markets where there is no reliable information on customers and/or their preferences are different from a firm's existing customers (Leonard-Barton, 1995). These technology and market dimensions define an innovation space whose origin is the focal firm's existing product/market choices (see Figure 1). Where incremental innovation is associated with extending the existing technological trajectory to existing customers, non-incremental innovations are at points away from the firm’s technology/market origin.

Sustained performance in a particular product class is anchored in a firm’s ability to compete at multiple points in a firm’s innovation space-- in continual incremental improvements at the technology/market origin as well as innovation at one or more other points in a firm’s innovation space (March, 1991; McGrath, 1999). Yet exploitative and exploratory innovation are associated with fundamentally different task and environmental contingencies, different time-frames and search routines (Katila and Ahuja, 2002), and, as such, each requires their own distinct set of roles, incentives, culture and competencies (Bradach, 1997; Siggelkow and Levinthal, 2003; Sutcliffe, Sitkin, and Browning 2000; Bagahi, Coley, and White, 1999). Where exploitation is associated with tight controls, structures, culture, and disciplined processes, exploration is associated with looser controls, structures, and more flexible processes and search behaviors (Spender and Kessler, 1995; Quinn and Cameron, 1988; Burgelman, 1991; Duncan, 1976).

Innovation Streams and Organizational Designs

There are contrasting views on how to design organizations so that they can both explore as well as exploit. These views differ in the locus and timing of the exploratory innovation in the context of the firm’s exploitative innovation. One view argues that because of senior team and organizational inertia, liabilities of change, and existing customer preferences, incumbents can only exploit current technologies or customers (Carroll and Teo, 1996; Christensen and Bower, 1996; Hill and Rothaermel, 2003; Audia, Locke, and Smith, 2000; Campbell and Park, 2005). For example, Christensen’s (1997) research in the disk drive industry found that because of customer preferences and existing resource allocation processes, organizations evolved through the creation of independent spinouts and/or ventures (see also Burgelman and Sayles, 1986). Leifer et al (2000) found that the creation of radical innovation hubs and corporate venture units helped corporations escape the inertia of existing business units. Similarly, Foster and Kaplan (2001), Markides (1998), and Bhide (2000) argue that to overcome the limiting effects of senior team inertia and cultural lock-in, firms use alliances, acquisitions, and joint ventures to promote innovation. From this inertial perspective, the locus of exploratory innovation occurs outside the incumbent's organization.

A second view anchored on contingency ideas argues that effective organizational designs are aligned with strategic and/or technological imperatives (Donaldson, 1995; Nadler and Tushman, 1997; Miles and Snow, 1978; Gresov, 1989). Research on cross-functional teams (eg Lawrence and Lorsch, 1967; Wheelwright and Clark, 1992), project management (eg Ulrich and Eppinger, 1995), and matrix designs (eg Miles and Snow, 1978; Galbraith, 1973; Spender and Kessler, 1995) are based on firms extending existing products in extant functional structures and innovating via structural overlays. The locus of innovation in these contingency based ideas occurs within the firm's existing, historically rooted, functional organization design.

Informed by the literature on routines and switching routines (eg Weick, 1979; Nelson and Winter, 1982), another contingency-based design approach is rooted in switching organization designs over time. Duncan (1976) argued that organizations innovate by switching between organic structures during early phases of an innovation to mechanistic structures for the execution phase. The senior team's role is to institutionalize these dual designs and build senior team processes to deal with the conflicts and costs associated with switching designs over time. Brown and Eisenhardt's (1997) research in the global computer industry finds that business units develop streams of innovation through time-paced innovations that are sequentially executed. Brown and Eisenhardt (1998) and Eisenhardt and Tabrizi (1995) suggest that semi-structures and sequential attention to innovations permit organizations to change continuously rather than evolve through punctuated change. The role of the senior team in these switching models is to set the rules that permit the rhythmic switching between organization designs and innovation modes (see also, Siggelkow and Levinthal, 2003; Nickerson and Zenger, 2002).

A third organizational design approach to support exploration as well as exploitation is a plural or ambidextrous organizational design. Building on contingency and paradox ideas (eg Lewis, 2000), ambidextrous designs build intra-organizational design heterogeneity that match the complexities of the firm's strategic context. Ambidextrous organizational forms are composed of multiple integrated architectures that are themselves inconsistent with each other (Bradach, 1997; Tushman and O'Reilly, 1997; Sutcliffe, Sitkin, and Browning, 2000; Govindarajan and Trimble, 2005). Exploitative subunits are organized to be efficient, while exploratory subunits are organized to experiment and improvise. These highly differentiated organizational designs create fundamentally different learning contexts within the firm (Sutcliffe et al, 2000).

To buffer the more fragile exploratory unit from the historically dominant exploitative unit, these highly differentiated designs employ limited structural linkages (O'Reilly and Tushman, 2004). Ambidextrous designs are similar to Wheelwright and Clark's (1992) autonomous designs. These highly differentiated organizational designs achieve strategic linkage through senior team behaviors and strategic framing (Smith and Tushman, 2005; O'Reilly and Tushman, 2004; Gilbert, 2005).[ii] Nonaka (1988), Bradach (1998), Adler, et al. (1999), Gilbert (2005), and Nobelius (2003), provide evidence of organizational adaptation in the automotive, wireless, newspaper, and restaurant franchise businesses through ambidextrous organizational designs.

While there is substantial literature on the benefits of balancing exploration with exploitation (eg Siggelkow and Levinthal, 2003; Lubatkin, Simsek, Ling, and Veiga, in press; He and Wong, 2004), there are contrasting and inconsistent results on those organization designs that facilitate this balance. These contrasting points of view differ in terms of the locus and timing of the exploratory innovation in the context of exploitative innovation. To empirically address the relation between alternative organization designs and innovation streams, we identified 13 business units attempting to manage streams of innovation. We describe the organization design choices employed by these firms (ie cross-functional, spin-out, functional, and ambidextrous) and compare the relative performance of these alternative designs in hosting innovation streams. Because we have data on these business units over time, we are also able to explore the consequences of switching designs over time. Finally, as the literature on structural ambidexterity is limited, we also explore the characteristics, roles, and processes associated with this distinct organizational design.

METHODS

Sample

Our research design employed a multi-case design in which we observed a series of independent cases over time in service of developing greater insight into the relations between innovation streams and organizational designs (eg. Yin, 1984; Eisenhardt, 1989; Van de Ven et al, 1999; Langley, 1999). We employed these qualitative techniques to gather rich data on alternative organization designs and on the relations between organization designs and innovation outcomes. These longitudinal data also allowed us to explore the relations between design transitions and innovation outcomes (see also Siggelkow, 2001).

We used the business unit as our unit of analysis because this is the level within multi-divisional firms where senior teams deal with the challenges of developing innovation streams (see also Brown and Eisenhardt, 1997; Adler et al, 1999).[iii] Because our objective was to explore the relations between organization design and innovation streams, we sought out general managers who had managed or were attempting to manage existing products as well as at least one innovation. We gathered in-depth data on 22 innovations within 13 business units. Of these business units, seven implemented two or more innovations during the period studied. These business units competed in nine distinct industries (see Table 1)[iv].

Our data permitted us to explore design shifts in service of a particular innovation. Innovation episodes are defined by the organizational design(s) employed in service of a given innovation. Of our 22 innovations, 11 evolved through at least one organization design transition. In each of these 11 cases, the business unit introduced (or attempted to introduce) an innovation with a particular organization design. These business units then shifted organizational designs during the period studied. Organization design transitions initiate subsequent innovation episodes. For example, HP's Scanner Division's attempt to introduce handheld scanners (even as it continued to support its existing flatbed scanners) involved three innovation episodes. Episode 1 was a five-year period where the firm employed cross-functional teams within its existing functional design. Innovation episode 2 was initiated after a new general manager implemented an ambidextrous design. Episode 3 was initiated after the general manager spun handheld scanners out of his division and reintroduced a functional structure.

Our 22 innovations were associated with 34 innovation episodes (see Table 1). Including multiple design episodes for a given business unit provides insight into the impact of different organizational designs on innovation outcomes while holding the innovation and larger organizational context constant. These data also help us explore the nature of these design transitions and the differential impacts of design shifts over time.

Data Collection

We collected data through semi-structured interviews supported by archival data. For 10 of the 13 business units, we interviewed 4 to 12 informants including the business unit's general manager and innovation manager. For the remaining three business units, the introduction of radial tires at BF Goodrich and Firestone, and digital cameras and medical imaging at Polaroid, we relied principally on detailed written material prepared by other researchers (Sull, 1999; Tripsas & Gavetti, 2000). For these three firms we conducted in-depth interviews with the researchers involved in the primary data collection. We supplemented these data with four interviews with principals at Polaroid as well as with an interview and archival research in the tire industry (eg Blackford and Kerr, 1996)[v]. In total, we conducted 96 interviews.

Our interviews included targeted questions to understand innovation type, organizational designs employed, and innovation outcomes. To understand innovation type, we asked questions that explored the technology and target markets of the innovation with respect to the existing product (e.g. Tushman and Smith, 2002). To understand organization design, we explored aspects of the business unit's senior team roles, reporting relations, decision making processes, and culture (e.g. Wheelwright and Clark, 1992; Christensen, 1997; Lawrence and Lorsch, 1967; Nadler and Tushman, 1997). For example, we asked informants about whether innovation was located in a distinct unit, the physical location of the unit, and explored the extent to which the innovating unit had a culture, rewards, and competencies distinct from the rest of the business unit. We also gathered data on the role of the innovation manager, his/her relationship with the general manager, and whether he/she was on the senior team. Finally, we gathered data about the performance of the innovation and the existing product. We focused on three aspects of the innovation: the extent to which the organization was able to learn about the new technology, learn about new markets, as well as the innovation's overall commercial success (Levitt and March, 1988) [see Appendix]. We also gathered data on the existing product's ongoing revenue and market share.

We triangulated the perspectives of multiple informants and wrote a mini-case for each business unit. These mini-cases were organized around the business unit's design and design transitions. As design transitions initiated a subsequent innovation episode, we induced innovation episodes from these mini-cases. To ensure that we accurately captured the phenomena and to deal with any discrepancies between interviewees, we shared our analyses with key informants to confirm and/or adjust our interpretations. In order to assess the characteristics associated with each innovation episode, we asked between two and four other researchers to read the cases and code each innovation episode for innovation type, organizational design employed, and innovation outcomes. The coders then met to compare their coding. Where there were discrepancies, we worked together to clarify the characteristics of each case. If necessary, we returned to key informants for clarification.

We categorized innovation type for each of our 22 innovations in terms of technological and customer differences from the organization's existing product. To assure accuracy in categorizing innovation type, we discussed these placements with key informants. Figure 1 lists the 13 existing products at the origin and locates each innovation in this innovation space. These 22 innovations are well distributed across this innovation space by differences from the extant product's technology and target markets. [vi]

Based on Wheelwright and Clark (1992), Christensen (1997), and Tushman and O'Reilly (1997), we categorized the organizational designs employed into four types: functional, cross-functional [cross-functional teams embedded within a functional design], spin-outs [distinct innovation unit without general manager control and/or senior team support], or ambidextrous [distinct innovation unit with general manager control and senior team support]. For our innovation outcome measures, coders rated each of the three innovation outcome dimensions (technological learning, market learning and market success) on a scale of 1-5. Interrater reliability across these innovation outcome variables was above .77 indicating substantial convergence among coders. Because of the high reliability across coders, we created innovation outcome scales by averaging across coders. Since market success, market learning and technology learning were highly correlated ($.74<r< .96$), we created a five point innovation performance scale using all three outcome dimensions (reliability $\alpha =.90$).[vii]

RESULTS

Innovation Streams

Innovation streams are composed of incremental innovation in an existing product as well as at least one non-incremental innovation. These streams are anchored by the business unit’s existing product. Each of our business units had a general manager who was responsible for building and sustaining leadership in a particular product class. For example, Glen Bradley was responsible for Ciba Vision (Novartis’ eye care business) and Phil Faraci was responsible for HP’s scanner business. Each of these general managers had an ongoing business with its own set of competitive challenges for the existing product line (see lower left cell in Figure 1). For example, HP’s Scanner division was under competitive pressure to bring costs down and raise quality in its existing flatbed scanners.

Beyond innovating in the existing product, each of the 13 business units also initiated at least one non-incremental innovation. Six initiated a single innovation during the course of our research. Seven business units initiated multiple innovations; five initiated two innovations, and two (Ciba Vision and Software Co.) each initiated three innovations. For example, between 1992 and 2000, Ciba Vision developed daily disposables, extended wear lenses, and a radical pharmaceutical product to halt the progress of a debilitating eye condition even as it continued to incrementally innovate in conventional lenses. There are no significant differences in innovation outcomes between those organizations that focused on single innovations versus those that initiated multiple innovations (t= .42, p= .68). Neither the pursuit of multiple innovations nor a focus on single innovations affected innovation outcomes.

The 22 innovations are spread throughout the innovation space in Figure 1. Our sample includes 16 discontinuous innovations as well as 7 architectural innovations [see footnote vi]. Discontinuous innovation episodes are no more or less successful than the architectural innovation episodes (t= .54, p=.58). Further, seven innovations were targeted to existing markets and 15 to new markets. There are no significant differences between innovation episodes targeted to existing customers versus those targeted to new markets (t = .71, p = .50)

For this sample of firms, innovations are found throughout the innovation space, there are no overall performance consequences of innovation type, and the number of innovations does not affect innovation outcomes. We now explore alternative organization design choices employed and the consequences of these design choices on innovation outcomes. As 11 innovations involved multiple innovation episodes, we also explore the consequences of shifting organizational designs evolved over time.

Innovation Streams and Alternative Organizational Designs

Ambidextrous Organizational Designs: Of the 34 innovation episodes, 15 employed ambidextrous organizational forms (see Table 2). USAToday illustrates the phenomena of ambidextrous organizational designs. We gathered data on USAToday from 1995 through 2001. Tom Curley had been President and Publisher of USAToday since 1991. Created in 1983, USAToday had been profitable, high-performing unit of the Gannett Corporation since 1993. In 1995, under pressure from newsprint costs and national competition as well as emerging competition from web-based news sources, Curley articulated a network strategy based on leveraging news gathering/editorial capabilities through multiple media.

In 1995, Curley promoted Lorraine Cichowski from the USAToday's Money section to run a spin-out on-line news product. As general manager of USAToday.com, Cichowski was made a member of Curley's senior team. Cichowski built a distinct organization for her on-line business. She hired staff from outside USAToday and built a fundamentally different set of structures, roles, incentives and culture all dedicated to instantaneous news. Indeed, 80 percent of On-Line's news did not come from the newspaper. On-Line was housed on its own floor, physically separate from the newspaper. By 2000, even though USAToday.com was profitable, it was losing staff because of funding constraints. The newspaper continued to drain resources from the emerging on-line franchise. Cichowski never had the senior team's support for her on-line business. Because of Curley's ambivalent support and active resistance from her peers, Cichowski pushed to be completely separated from USAToday and from Curley's emphasis on profitable growth. This highly differentiated organization without strong senior team integration was coded as a spin out (USAToday.com (A)).

Because Curley wanted to leverage his editorial group through the web, in February 2000 Curley replaced Cichowski with Jeff Webber, then the VP of circulation. At this juncture Curley also replaced 40 percent of his senior team, including his editorial director. This revised senior team fully supported Curley's network strategy and Webber's role in that strategy. Webber built a new senior team in USAToday.com even as he kept his organization distinct from the newspaper. Under Cichowski, there were no linking mechanisms between the paper and .com. To achieve leverage across editorial platforms, Webber initiated editorial meetings within Curley's senior team and weekly lower level cross-platform editorial meetings. Further, Curley shifted the senior team incentives so that they all had common bonus incentives based on both web-based and print growth. This highly differentiated organization with targeted editorial linkages and strong senior team integration was coded as an ambidextrous design (USAToday.com (B)).

While we defined ambidextrous designs as highly differentiated organizational designs with strong senior team integration, cross-case analyses provides greater clarity on this design (see Table 3). Twelve of the 15 innovation units were physically separate from the existing organization. For example, in the HP Scanner Division, the portable scanners were developed and marketed in a location physically separate from the flatbed organization. Similarly, Ciba Vison's Visudyne product was developed in Germany, while the conventional lens business was centered in Atlanta. Each innovation had a dedicated innovation manager who had the freedom to design their unit with distinct competencies, cultures, and processes. For example at CitySearch within Regional News, 32 of its 35 employees came from outside the company. This highly differentiated unit built its own entrepreneurial culture and incentive system.

In these ambidextrous designs, integration was achieved through a range of formal linking mechanisms. Innovation managers reported to either the general manager or to a senior team member. The general managers acted as ambidextrous managers in that they hosted both exploratory as well as exploitative subunits. We identified ambidextrous managers in each of the business units. In every case the ambidextrous manager was the senior person in the business unit or corporation (general manager, president, or CEO).[viii] In seven of these nine business units, the ambidextrous manager articulated an overarching aspiration that encompassed both exploration as well as exploitation. For example at Ciba Vision, Glen Bradley's "Healthy Eyes for Life" was an aspiration that encompassed the conventional lens business as well as daily disposables, extended wear lenses, and their pharmaceutical product.

Each innovation manager had their own dedicated resources and staff. Further, in every case the innovating unit leveraged specific resources from the existing organization through targeted integration mechanisms. For example at USA Today.com (B), editorial teams composed of editors from the .com and paper units leveraged editorial content across platforms. Similarly at Ciba Vision, cross-product teams met to share material science capabilities from their conventional lens products to accelerate progress in their daily disposable and extended wear products.

Beyond targeted structural integration, ambidextrous managers provided substantive and symbolic support for the non-incremental innovation. For example, in HP's Scanner Division, Phil Faraci was clear with his senior team that both the flat bed as well as the portable scanners had to be successful. Faraci initiated a reward system such that if either product did not succeed, no one on his team would get a bonus. In each of the seven cases where we had data, the senior teams were assessed on a common-fate reward system. In every case the general manager met frequently with the innovation manager. In IBM's Middleware group, for example, though the innovation manager did not formally report to the general manager, she met frequently with the senior team and had direct access to the general manager.

Finally, in six of seven cases where the ambidextrous manager was a general manager in a multidivisional firm, the manager to whom the general manager reported had a crucial role in this structure. This meta-manager created the context within which the ambidextrous manager could legitimately both explore and exploit. These meta-managers provided the resources, coaching, and political support across the corporation and with the ambidextrous manager's peers. For example, Chris King at IBM Network Technology could not have been successful had not John Kelly, the Technology Group Executive, provided visibility and support for King with both his and her skeptical peers.

Functional, Cross-Functional, and Spin-Out Designs: Where 15 innovation episodes were initiated through ambidextrous designs, 19 were executed with other organizational designs (see Table 2). Nine innovation episodes were initiated through cross-functional teams embedded in the existing functional organization. For example at Software Co., e-learning, advanced collaboration, and knowledge management products were developed through dedicated cross functional teams. Similarly, handheld scanners at HP were initially executed through cross-functional teams.

Five innovation episodes were executed in spin-out designs. Spin-outs are characterized by highly differentiated units but without the general manager's and/or the senior team's support. These spin-outs varied by the level in the hierarchy to which the innovation manager reported. In two cases, USA Today .com (A) and Polaroid's digital camera (B), the innovation manager reported to the general manager. For example, Polaroid created a distinct unit with a dedicated innovation manager and team, and significant resources to commercialize digital cameras. This unit was physically separate from the analog camera unit and was able to develop its unique structure and culture to execute this innovation. In both cases, however, the innovation managers were not actively supported by the general manager and faced resistance from the senior team.

For three other spin-outs, the innovation was separated from the existing business unit and spun out to the corporate level of analysis. For example, at USAToday Direct (A) and HP Handheld Scanner (C), the innovation manager reported to a level so high in the corporation that he/she received little substantive support. USAToday Direct (A) was initiated in 1990 by Gannett's chairman Allen Neuharth. He created a distinct, physically separate organization and hired an external team to launch USAToday's television product. Because of the range of issues on Neuharth's corporate agenda, USAToday Direct was not integrated within USAToday or within the larger Gannett Corporation. In contrast, Visudyne (B) was spun out of Ciba Vision because it could not leverage Ciba Vision's technological or market capabilities. Visudyne (B) was spun into Novartis' pharmaceutical business unit where it could take advantage of its sales channels and R&D capabilities.

Five innovation episodes were executed within the business unit's existing functional design. Polaroid's digital camera (A) and IBM's network and transport chips (A), for example, were executed within the existing functional organization. In these functional designs, the senior teams took responsibility for the ongoing development of the existing products as well as responsibility for the innovations. At IBM's Network Technology group, for example, the general manager and her team took full responsibility for commercializing the more mature ASIC chips as well as the network and transport chips (both architectural innovations targeted to new markets).

Design Choices and Innovation Outcomes

To what extent are these organization design choices associated with innovation outcomes? For the 34 innovation episodes, we compared the overall innovation outcomes of ambidextrous designs with other design choices (see Table 4). Ambidextrous designs are significantly more effective in hosting innovations than the other designs employed (F(3,30)=8.88, p<.01) [ix].

These overall innovation outcome results may be affected by the 12 design transitions in our sample. In contrast, eleven business units employed a single organization design in service of innovation streams. Ten of these 11 stable designs were either ambidextrous or cross-functional designs. There were no examples of spin-outs used as a stable organization design to execute innovation streams (see Table 4). While ambidextrous and cross-functional designs were equally stable designs, they had contrasting impacts on innovation outcomes. Those business units with stable ambidextrous designs had significantly more effective innovation outcomes that those firms that employed stable functional or cross-functional designs (t=8.95, p< .01).

For example, over a three year period, IBM's Middleware business used an ambidextrous design to successfully nurture its emerging web-based product even as it maintained its ongoing Cobol product. Similarly, between 1992 and 1997, Glen Bradley and his team at Ciba Vision built an ambidextrous business unit that effectively hosted three innovations. In contrast, those firms employing cross-function designs to execute innovation streams were unable to successfully execute non-incremental innovations. For example, over a six year period, Firestone attempted to initiate radial tires in the same organization that also made bias-ply tires. This cross-functional team approach to implement a discontinuous technical change led to strong cultural, political and community resistance and ultimately to failure. Similarly, Software Co.'s attempt to initiate e-learning, advanced collaboration, and knowledge management in its traditional functional organization with a cross-functional overlay was associated with sustained underperformance over an 18 month period.

Design Transitions and Innovation Outcomes

While these overall results are suggestive, further insight into the relations between alternative designs and innovation outcomes is gained when business units shift designs in service of a given innovation. Eleven of our 22 innovations involved multiple innovation episodes and associated design transitions (see Table 5). Such longitudinal data for a given firm and innovation reflects a firm's ability to learn (or not learn) over time. These data provide direct insight into the relations between alternative design choices and innovation outcomes[x].

For example in HP's Scanner division, an initial set of architectural innovations targeted to new markets (handheld scanners) was executed with a cross-functional design. Despite substantial technical and market potential, this design could get neither senior management support nor support from the rest of the scanner organization. After five years of underperformance in handheld scanners, a new general manager was appointed. This new general manager made both handheld and flat-bed scanners priorities for the division, created a distinct unit for the handheld product, and put a highly credible manager in charge of the handheld scanners. This innovation manager was made a member of the general manager's team. This innovation manager, in turn, moved his handheld unit away from the flatbed organization and created culture, roles, and processes that were consistent with the highly uncertain portables business and were fundamentally different from the cost-oriented flatbed unit. The new general manager changed the incentives on his senior team such that they only achieved their bonus targets if they succeeded in both the flatbed and the handheld businesses. This shift to an ambidextrous design was associated with the rapid progress in HP's handheld product as well as increased performance in its flatbed business.

What drives these designs transitions and to what extent are these transitions associated with different performance contexts? We compared the average innovation performance of those business units initiating design transitions to the innovation performance of those business units without design transitions. While those business units that initiated design transitions had less effective innovation outcomes prior to their transitions (2.98) than those that did not initiate design transitions (3.51), this difference is not significant (t= .96, p= .35) [see Table 5]. While differences in innovation outcomes were not associated with design transitions, performance declines in the business units' existing products were associated with design transitions. Those firm initiating design transitions did so in the context of performance declines in the existing product in 75% of the cases (versus in 45% of the cases with no design transitions) [Chi-Square = 2.64, p= .10]. For these firms initiating innovation streams, it appears that design transitions are driven less by performance shortfalls in the innovative product than by performance declines in the existing product.

Perhaps design transitions are associated with enhanced innovation outcomes independent of the type of design change? For the set of 12 transitions, we compared innovation outcomes pre versus post design transition. While the average change in innovation outcomes across these transitions is .54, this difference is not significantly different from zero (t= 1.30, p= .22)[see Table 6]. Design change, by itself, is not associated with significant changes in innovation outcomes. If there are no overall innovation outcomes associated with design transitions, does the type of design transition affect innovation outcomes? Table 6 provides data on the number of exits from and movements to each design employed as well as the change in innovation performance associated with each type of design transition.

Ambidextrous designs are the most frequent design destination. Eight of the 12 transitions involved movement to an ambidextrous design. These shifts to ambidextrous designs were associated with significant increases in innovation outcomes (change in innovation performance of 1.16, t= 2.81, p< .01). Firms moved to ambidextrous designs in the context of performance crises. Seven of these eight ambidextrous transitions were associated with a decline in the performance of the existing product. Each of these design transitions was associated with a change in innovation manager. In half of the cases, these transitions were associated with changes in the general managers.

In contrast, three business units shifted their organization design away from ambidextrous designs. At Regional News, its News.com innovation was initiated with an ambidextrous organization. After four years, however, News.com was reintegrated back into the newspaper organization. In contrast, in both HP’s Scanner division and at Ciba Vision, successful discontinuous innovations targeted to new markets were spun-out from their host business units. These shifts away from ambidextrous designs were associated with decreases in innovation performance (change in innovation performance of -1.06) [see Tables 5 and 6]. While transitions to ambidextrous designs were driven by performance shortfalls, transitions away from ambidextrous designs took place in the context of steady or improving performance in both the existing and innovative products.

While ambidextrous designs were an attractive design destination for firms initiating innovation streams, functional designs were the least attractive destination. In no case did a business unit move to this design. In contrast, where functional designs were initially employed in five cases, in four of these cases this design was abandoned in the context of performance crises in either the existing product and/or the innovation. Transitions away from functional design had no overall impact on innovation outcomes. Business units transitioned to either cross-functional or spin-outs designs in 4 of 12 design transitions. These transitions were associated with decreases in innovation outcomes (average performance change -.71), while the five shifts away from these designs were associated with increases in innovation outcomes (average performance change 1.91).

In all, while there were no overall innovation performance impacts of design transitions, the type of design transition had important impacts on innovation outcomes. Shifts to ambidextrous designs were associated with significant positive shifts in innovation outcomes in contrast to shifts to all other design options (1.16 versus -.71, respectively; t= 2.72; p< .02). Shifts from ambidextrous designs were associated with declines in innovation outcomes while shifts from cross-functional designs and spin-outs were associated with increased innovation outcomes. Shifts to ambidextrous designs and shifts from cross-functional designs and spin-outs were triggered by performance crises. It may be that managers are pushed to learn about more complex organizational forms under crisis conditions. In contrast, shifts away from ambidextrous designs took place in the context of steady and/or improving innovation outcomes. It may be effective innovation outcomes trigger pressure to move from complex ambidextrous designs to more simple (yet less effective) organization designs.

Organization Designs and the Performance of the Existing Product

In the context of innovation streams, **w**hat is the impact of organizational design choices on the performance of the existing product? It may be that the adoption of the ambidextrous organizational design hurts the performance of the existing product. Table 7 categorizes the performance of the existing product over the periods studied by type of organization design used to execute innovation streams. Those existing products that either held steady or increased in performance employed ambidextrous designs in service of innovation streams in 14 of 21 cases. In contrast, those business units whose existing products declined in the context of innovation streams used ambidextrous designs in one of 13 cases. Ambidextrous designs are positively associated with the on-going performance of existing products (Fisher's Exact Test, p = .01). In contrast, the use of functional, cross-functional, or spin-out designs, to execute innovation streams is inversely associated with the performance of existing products. It may be that uncoupling the exploitative product from the exploratory product provides the context and focus to invigorate the exploitative product.

Finally, to excel at innovation streams, firms must be able to successfully innovate even as they continue to exploit their existing products. To directly explore the relations between organization designs and innovation streams, we categorized those innovation episodes that were above the median in innovation outcomes and had steady or improving performance in the existing product versus those innovation episodes that did not excel in both innovation and in the performance of the existing product. We then explored the design choices employed in each category. Ambidextrous designs were employed in 14 of 15 cases where firms were able to explore as well as exploit. While not all ambidextrous designs are stable or effective in driving innovation streams (eg Polaroid: Helois (B)), this design dominates all other designs employed in executing streams of innovation. In no case were functional or cross-functional designs able to sustain both incremental as well as non-incremental innovation. At Ciba Vision, however, the Visudyne innovation was initiated in an ambidextrous design and successfully spun-out to the larger parent organization

DISCUSSION

One important determinant of a firm’s ability to adapt is its ability to both explore and exploit (March, 1991; He and Wong, 2004). We operationalized exploration and exploitation in terms of innovation streams—portfolios of innovations that incrementally build on existing products as well as extend the business unit’s franchise through either architectural and/or discontinuous innovation. These innovations may be targeted to existing or new markets. Innovation streams present substantial organizational challenges since the roles, incentives, culture, processes, and competencies required to exploit existing products stunt a firm's ability to explore new products/markets. Worse, the potential cannibalization of the existing products by exploratory innovations triggers active resistance to exploration. This research explored how organization design choices affected a business unit's ability to deal with the contradictory strategic and organizational requirements of exploration and exploitation.

We selected our sample of 13 business units based on their explicit attempts to manage innovation streams. These organizations managed between one and three innovations even as they continued to exploit their existing products. The 22 innovations were distributed throughout the innovation space. These innovation streams are consistent with the work of Brown and Eisenhardt (1997), Adler, Goldoftas, and Levine (1999), and Venkatraman and Lee (2004) on the importance of multiple product innovations as a source of competitive advantage. There were no differences in innovation outcome between business units that managed only one innovation compared to those that attempted multiple innovations. Contrary to Barnett and Freeman (2001), we did not find that firms experienced performance losses when they attempted to initiate multiple product introductions.

This research explored the impact of alternative organizational designs on the firm's ability to innovate as well as nurture existing products. For these 13 business units and their 34 innovation episodes, the organization designs employed to manage these innovation streams had significant impacts on the performance of the existing products as well as the innovations. It appears that the locus of exploratory innovation makes a difference in hosting innovation streams (see also Westerman et al, 2006). Organizational designs where the locus of exploratory innovation was with the general manager and the senior team were significantly more effective than those designs where the locus of innovation was either lower in the firm or distant from the unit's senior team. For example, in cross-functional teams inertial forces impeded exploratory innovation, where in spin-outs the innovation lacked senior team support. It may be that active general manager involvement and engaged senior teams are better able to make trade-offs associated with exploration and exploitation than cross-functional and/or spin-outs designs.

What are ambidextrous organizational designs and how do they work? The 15 ambidextrous designs were characterized by an interrelated set of characteristics that together facilitated innovation streams. These designs were composed of distinct units, each with their own innovation manager and their own aligned roles, incentives, linkage mechanisms, competencies, and cultures. Each innovation manager reported to an ambidextrous manager and/or to the senior team. These ambidextrous managers provided the support, energy, and common fate senior team incentives for exploitation as well as exploration.

In multi-divisional firms, meta-managers, managers to whom the ambidextrous manager reported, were crucial in setting the context within which ambidextrous and innovation managers could succeed. As ambidextrous designs were controversial in the larger corporation, meta-mangers provided the political, social, and financial support to the ambidextrous manager. Beyond these three senior team roles, the distinct units had targeted structural linkages with the exploitative unit. In every case, the distinct units had structural linkages to specific domains in the existing organization. These targeted linkages allowed the business unit to leverage common resources across innovation types. It may be that this set of interrelated roles, incentives, linking mechanisms, and cultures better describe ambidextrous designs than simple structural characteristics (see also Rivkin and Siggelkow, 2001).

The role of the ambidextrous manager was particularly crucial. Such designs put a premium on senior teams that can handle the contradictions associated with multiple learning modes (Denison, Hooijberg, and Quinn, 1995; Smith and Tushman, 2005; Lewis, 2000; Gilbert, 2005). Ambidextrous managers had the cognitive and behavioral flexibility to act consistently inconsistent--supporting both variance increasing as well as variance decreasing behaviors in their organizations (Denison et al, 1995). When the general manager emphasized exploitation at the expense of exploration (eg HP Scanner (A)) or the reverse (eg. IBM Network Technologies (A)), the ability to host innovation streams suffered. This capacity to be consistently inconsistent was facilitated by the ability of the ambidextrous manager to articulate and behaviorally support an overarching aspiration within which exploitation and exploration made sense.

Our data on design transitions suggest that performance pressures drove managers to shift their firm's design over time. Transitions to ambidextrous designs occurred in the context of performance shortfalls. It appears that managers learned how to employ ambidextrous designs under crisis conditions. In seven of eight innovation episodes where low performing business units shifted to ambidextrous designs innovation performance increased. While firms can learn to design for innovation streams under performance pressure, it also appears that organizational slack is associated with shifts away from ambidextrous designs. These shifts away from ambidextrous designs were, in turn, associated with innovation performance declines. It may be that absent performance crisis, inertial pressures push managers and their firms to more simple designs.

Finally, it appears that learning to host innovation streams is enhanced by changes in the business unit's senior team. Every shift to ambidextrous designs was associated with a change in the innovation manager. If the general manger was not changed, his/her behaviors did. For example, in IBM's Network Technology Division as the network and transport chips flourished under Chris King's simple functional organization design and entrepreneurial senior team, its more mature ASIC business suffered. Under pressure from her boss to drive short and long-term innovation, King shifted her own style, the composition of her senior team, and organization structure. King recruited a new, more process oriented manager to run the ASIC business even as she kept the network and transport businesses separate. She changed her focus from simply entrepreneurial performance to both entrepreneurial as well as disciplined performance.

We found, then, that ambidextrous designs are defined by an interrelated set of roles, structures and senior team processes, and are positively associated with innovation streams. Cross-functional teams, functional designs, and spin-outs are less fertile contexts for innovation streams. We had one successful spin-out after the incremental innovation was initiated in the business unit. The pharmaceutical product at Ciba Vision was spun out to Novartis' pharmaceutical division. As this product was able to leverage the larger corporation's pharmaceutical research as well as its physician-oriented sales force, its performance increased after the design transition. When innovations have no technology or market leverage within the host business unit they are spinout candidates (eg Hill and Rothaermel, 2003). If, in contrast, there is the ability to leverage either customers or technology within the business unit, then ambidextrous designs appear to be more effective than other organizational designs in hosting innovation streams.

What do these results suggest for the debates on the nature of organizational evolution and change (eg Barnett and Carroll, 1995; Weick and Quinn, 1999; Van De Ven et al, 1999; Pettigrew et al, 2001)? The selectionist approach argues that inertial forces are so strong that incumbent organizations either get selected out of the environment or evolve through spinouts or through corporate venturing (eg Christensen, 1997; Barnett and Freeman, 2001). The incremental approach to evolution argues that firms are not trapped by inertial forces and can evolve through paced, continuous, incremental change (eg Brown and Eisenhardt, 1997). The punctuated equilibrium approach argues that organizations evolve through periods of incremental change punctuated by discontinuous change (Romanelli and Tushman, 1994). Ambidextrous designs, where highly differentiated units both explore and exploit may permit a business unit to evolve through both incremental as well as punctuated change.

Ambidextrous designs create the opportunity for multiple learning contexts as well as multiple change modes. Exploitation is driven by a regime of continuous, incremental change anchored on a given technical/customer trajectory. In contrast, exploration is a learning mode driven by variability from which senior team makes strategic bets. If such bets are made, such as extended wear lenses at Ciba Vision, these bets may be coupled with punctuated change in units uncoupled from the exploitative unit. Thus at USAToday, Curley and his team made a bet on instantaneous news. This bet was associated with discontinuous changes in their .com unit even as these changes were uncoupled from ongoing incremental change in the newspaper. It may be that business unit adaptation is rooted in these complex organizational designs that, in turn, host multiple learning environments and change modes.

Our focus has been on the relations between organizational designs and innovation streams. While our results are suggestive, there are several important caveats that limit this research. Most fundamentally, our results are based on a convenience sample of 13 product-oriented firms. Our results may be idiosyncratic to this sample of product-centered firms. Subsequent research would be strengthened by a larger, more representative product and service oriented samples. Further, our premise was that at the business unit level of analysis, organizational adaptation is rooted in innovation streams. We, in turn, selected our sample based on these innovation streams. It may be that innovation streams are not crucial to long-term business unit fate and that ambidextrous designs are less effective than other more simple strategies/organizational forms in facilitating organizational adaptation. For example, simple functional designs may be more successful than more complex organizational designs for product substitution events and/or for sustained incremental innovation.

Finally, it may be that beyond the meta-manager, characteristics of the larger corporations help or hinder ambidexterity (eg Gibson and Birkinshaw, 2004). We have no data on how corporate contexts, such as history, culture, and corporate leadership in our five multidivisional corporations affected the ambidextrous managers and their teams. Future research could explore the role of senior leadership and corporate contexts in shaping dynamic capabilities within business units (eg Adner and Helfat, 2003; Kaplan, Murray, and Henderson, 2003; Smith and Tushman, 2005).

CONCLUSION

Our paper has explored the role of alternative organizational designs in shaping innovation streams. The locus of innovation appears to be an important determinant of innovation streams. Those innovation streams actively managed by the senior team were more successful that innovation streams managed by either below or above the senior team. We found that business units that employed ambidextrous designs were able to explore and exploit simultaneously. In contrast, those business units that employed other organizational designs experienced difficulties in either exploiting their existing products or in exploring into either architectural and/or discontinuous innovations. Leaders and their firms appear to learn about these more complex designs under performance crisis conditions. These results highlight the role of senior teams, organizational designs, and building into business units the internal contradictions necessary to simultaneously explore and exploit. It may be that organizations evolve through continuous, incremental innovation in exploitative units as well as through punctuated change in those differentiated exploratory units.

Organization designs do impact a firm’s ability to explore and exploit. We found that organizations can effectively host innovation streams through ambidextrous organizational designs. It may be that dynamic managerial capabilities are built through complex organizational designs and through senior teams that can handle the contradictory strategic issues involved in simultaneously exploiting and exploring (Adner and Helfat, 2003). Future research could more fully explore the role of organizational designs and the characteristics of senior teams that permit firms to deal with strategic contradictions associated with innovation streams.

Endnotes

[i] There is much literature on enhancing organizational adaptation through internal corporate venturing, alliances, acquisition, and joint ventures at the corporate level of analysis (eg Van de Ven et al, 1999; Leifer et al, 2000). We focus on general managers and innovation streams within business units and/or within single product corporations.

[ii] In contrast to structural ambidexterity, contextual ambidexterity builds in the capabilities to explore and exploit throughout the firm (Gibson and Birkinshaw, 2004). This contextual ambidexterity is rooted in designing organizations that support stretch, discipline, support, and trust (Ghoshal and Bartlett, 1997).

[iii] Our sample also includes six single product corporations. As with business units, these senior teams had to deal with innovation streams in their particular product class.

[iv] Our analyses include only those business units managing an innovation stream. Our data base also included two organizations managing substitution events for an existing product. Because these firms were not managing innovation streams, we excluded them from these analyses

[v] Our interview with Charles Pilloid, Goodyear's president during the radial era, helped contextualize our data from Goodrich and Firestone.

[vi] HP Handheld Scanners are in two locations in Figure 1 because the type of innovation shifted from architectural to discontinuous during the period studied.

[vii] Market success is included only in the cases where the product was already commercialized. Three of the innovation episodes had not introduced a product to the market.

[viii] At Ciba Vision, the general manager shared this role with his head of R&D.

[ix] These results may be confounded by differences across firms in our sample. It may be that some firms are better able to execute complex designs than others. Indeed, firms are not evenly distributed across cells in Table 4. For example, Ciba Vision is a consistently high performer in driving innovation streams, while Polaroid and Software Company are consistently low performers. To help untangle firm specific effects we ran a regression with firm dummies. To assess the differential innovation effects of ambidextrous designs with respect to other designs, we created dummy variables for each design option. These analyses are consistent with those in Table 4 (results are available from authors). After

controlling for heterogeneous firm competencies, there is a positive association between ambidextrous organization designs and the execution of innovation streams.

[x] These within firm/innovation transitions also help deal with endogeneity issues associated with cross-sectional analyses.

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APPENDIX

We assessed the performance of non-incremental innovations by evaluating the extent to which the business unit was able to learn about the new technology and/or market as well as the innovation's commercial performance against plans (Levitt and March, 1988). We considered three aspects of performance: market success, technology learning, and market learning.

Market success. The market success of the innovation applies only to the innovations already in the marketplace at the completion of our data gathering. We define market success based upon the metrics used by our informants, and triangulated this measure of success using qualitative data in the interviews with various informants in each company. We coded market success on a 1-5 scale, where one means a highly unsuccessful product and five means a highly successful product.

Technology learning. We define learning as both the acquisition of the skills and knowledge and the action based on this knowledge (Garvin, 2000; Edmondson, 1999). Technology learning is defined as acquiring competence to make informed decisions and to practice behaviors based on knowledge with regard to the design, manufacture, and delivery of the product. We coded technology learning on a 1-5 scale, where one indicates low levels of learning .

Market learning. The challenges for understanding a target market can be quite different from understanding the product technology (Christensen, 1997). Market learning is defined as acquiring competence to make informed decisions based on knowledge with regard to the selection of the target market, the tailoring of the product to that market, and the pricing, distributing, and promoting of the product in that market.

We coded market learning on a 1-5 scale (as above).

Table 1: Sample Description

Company/Existing Product	Number of Innovations	Innovation Episode	Performance[1]	Existing Product Performance	Industry	Dates	Number of Interviews
HP Scanners							
Flat Bed Scanners	1	Handheld Scanner (A)	2.25	Steady	Electronics	Jan 91 - Mar 96	7
		Handheld Scanner (B)	4.75	Improving		Oct 96 - Mar 98	
		Handheld Scanner (C)	2.67	Improving		Aug 98 - Apr 99	
Regional News							
Newspaper	2	News.com(A)	3.42	Steady	Media	1995 - 1999	11
		News.com(B)	2.33	Steady		1999 - 2000	
		CitySearch.com	4.67	Steady		1999 - 2000	
Turner Technologies							
ASIC Chip	2	Micro Display Chip (A)	1.63	Declining	Semiconductor	1997 - 1999	7
		Micro Display Chip (B)	3.42	Improving		1999 - 2000	
		Imaging Chip (A)	2.25	Declining		1997 - 1999	
		Imaging Chip (B)	4.00	Improving		1999 - 2000	
Ciba Vision							
Conventional Lens	3	Daily Disposable	5.00	Improving	Eye Care	1992 - 1997	10
		Extended Wear	5.00	Improving		1992 - 1997	
		Visudyne (A)	5.00	Improving		1992 - 1997	
		Visudyne (B)	5.00	Improving		1997 - 2002	
USA Today							
Newspaper	2	USAT.com (A)	3.42	Declining	Media	1995 - 2000	8
		USAT.com (B)	4.39	Steady		2000 - 2001	
		Direct (A)	1.67	Declining		1990	
		Direct (B)	4.25	Steady		2000 - 2001	
Utility Company							
Power Plants	1	On-Site Power Plants	4.56	Steady	Energy	1986 - 1995	11

Continued on next page

Sample (cont.)

Company/Existing Product	Number of Innovations	Innovation Episode	Perfor-mance[1]	Existing Product Perfor-mance	Industry	Dates	Number of Interviews
Medical Products Co.							
Medical Devices	1	Integrated Healthcare System	2.50	Steady	Health Care	1994 - 1999	4
IBM Network Technology							
ASIC	2	Transport Chip (A)	4.56	Declining	Semiconductor	Mar 99 - Mar 00	10
		Transport Chip (B)	4.56	Improving		Mar 00 - Sep 00	
		Network Chip (A)	4.56	Declining		Mar 99 - Mar 00	
		Network Chip (B)	4.56	Improving		Mar 00 - Sep 00	
IBM Middleware:							
COBOL / CICS	1	Web Based Middleware	4.83	Improving	Software	1998 - 2000	11
Software Co.							
Integrated Collaboration	3	Advanced Collaboration	2.67	Declining	Software	Jun 00 - Dec 01	12
		Knowledge Management	3.17	Declining		Jun 00 - Dec 01	
		E-Learning	2.00	Declining		Jun 00 - Dec 01	
Secondary Sources							
Firestone[2] Bias Ply Tires	1	Radial Tires	1.44	Declining	Tires	1970 - 1976	1
BF Goodrich[2]	1	Radial Tires	2.78	Declining		1970 - 1976	
Polaroid[3]							
Analog Camera	2	Helios (A) (High Resolution Medical Imaging)	2.00	Steady	Photography	1986 - 1988	4
		Helios (B)	1.67	Declining		1988 - 1996	
		Digital Camera (A)	2.00	Steady		1980 - 1989	
		Digital Camera (B)	2.33	Declining		1990 - 1996	
TOTALS: 13	22	34			9		96

[1] Performance = a composite scale (1 - 5) based on Technology Learning; Market Learning; and Commercial Success.

[2] Data for Goodyear, Firestone and Goodrich innovations are principally from Sull (1999).

[3] Data for Polaroid innovations are principally from Tripsas and Gavetti (2000).

Table 2: Innovation Streams and Alternative Organization Designs

Cross-Functional Design	Spin-Outs	Functional Design	Ambidextrous Design
• HP Scanners: Handheld Scanner A • Regional News: News.com B • Turner Technologies: Micro Display A • Turner Technologies : Imaging A • Firestone: Radial Tires • BF Goodrich: Radial Tires • Software Co: E-Learning • Software Co: Knowledge Management • Software Co: Advanced Collaboration	• USA Today: USAT.com A • Polaroid: Digital Cameras B • HP Scanners: Handheld Scanner C • USA Today: Direct A • CIBA Vision: Visudyne B	• IBM Network Tech: Network Chip A • IBM Network Tech: Transport Chip A • Polaroid: Helios A • Polaroid: Digital Cameras A • Medical Products: Integrated Health Care System	• HP Scanners: Handheld Scanner B • USA Today: USAT.com B • USA Today: Direct B • Regional News: News.com A • Turner Technologies : Micro Display B • Turner Technologies : Imaging B • IBM Network Tech: Network Chip B • IBM Network Tech: Transport Chip B • CIBA Vision: Visudyne A • Polaroid: Helios B • Regional News: City Search.com • IBM Middleware: Web Based Middleware • UtilityCo: Power Plants • CIBA Vision: Extended Wear • CIBA Vision: Daily Disposable
N = 9	N = 5	N = 5	N = 15

Table 3: Characteristics of Ambidextrous Organizational Designs

	Physically Distinct Unit	Ambidextrous Manager	Innovation Manager[1]	Meta Manager	Overarching Aspiration	Targeted Structural Integration	Senior Team Incentives
HP Scanner Handheld (B)	YES	GM	Inside	YES	NONE	MIS/HR/ Finance	Joint Bonus
USA Today .Com (B) Direct (B)	YES YES	GM	Inside Outside	NONE	Local paper for global village	Editorial	Joint Bonus / Common Fate
Regional News City Search.com News.com (A)	YES NO	Publisher	Outside Outside	—	Primary information source for city	HR/Finance Editorial Advertising	Individual Incentive and Joint Bonus
Polaroid Helios (B)	YES	CEO	Outside	—	NONE	Sales	N/A
Turner Technology Micro (B) Imaging (B)	YES YES	GM	Inside Inside	YES	Be in top 10 manufacturers of semiconductors within 3 years	Mfg.	N/A
IBM Network Tech Network (B) Transport (B)	NO NO	GM	Outside Outside	YES	#1 supplier of Network Tech by 2000	Mfg./ Sales	Joint Common Fate
IBM Middleware Web Middleware	YES	GM	Inside	YES	"Beat BEA"	Software R&D	Common team Incentives
Utility Co. On-Site Power Plant	YES	GM	Outside	YES	A value creating, respected public utility	Marketing	Company based stock options
Ciba Vision Extended Wear Daily Disposable Visudyne (A)	YES YES YES	GM & Head of R&D	Inside Inside Inside	YES	Healthy Eyes for Life	R&D / Mkt.	Joint / Common Fate

[1] Inside & Outside refers to whether the manager came from inside or outside the business unit.

NOTE: N/A = Data not available.

Table 4: Organization Design and Innovation Outcomes

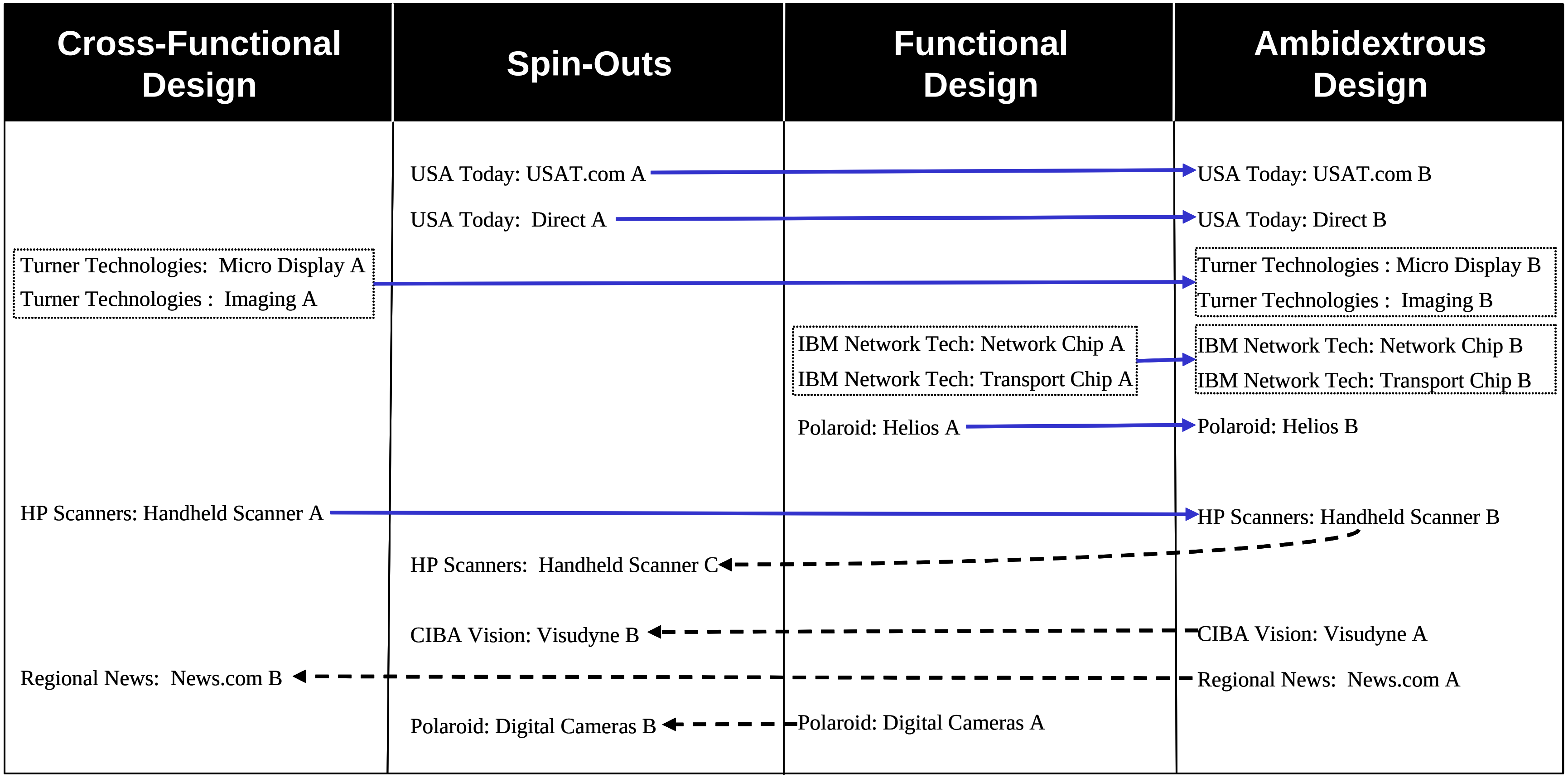
	Cross-Functional Design	Spin-Outs	Functional Design	Ambidextrous Design	Total
Design Transitions	HP Scanners: Handheld Scanner A Regional News: News.com B Turner Technologies: Micro Display A Turner Technologies : Imaging A	USA Today: USAT.com A Polaroid: Digital Cameras B HP Scanners: Handheld Scanner C USA Today: Direct A CIBA Vision: Visudyne B	IBM Network Tech: Network Chip A IBM Network Tech: Transport Chip A Polaroid: Helios A Polaroid: Digital Cameras A	HP Scanners: Handheld Scanner B USA Today: USAT.com B USA Today: Direct B Regional News: News.com A Turner Technologies : Micro Display B Turner Technologies : Imaging B IBM Network Tech: Network Chip B IBM Network Tech: Transport Chip B CIBA Vision: Visudyne A Polaroid: Helios B	**23**
Stable Designs	Firestone: Radial Tires BF Goodrich: Radial Tires Software Co: E-Learning Software Co: Knowledge Management Software Co: Advanced Collaboration		Medical Products: Integrated Health Care System	Regional News: City Search.com IBM Middleware: Web Based Middleware UtilityCo: Power Plants CIBA Vision: Extended Wear CIBA Vision: Daily Disposable	**11**
	Innovation Performance: Total = 2.27 (9)	Innovation Performance: Total = 3.02 (5)	Innovation Performance: Total = 3.12 (5)	Innovation Performance: Total = 4.27 (15)	**34**
	Stable Designs = 2.41 (5)	Stable Designs = None	Stable Designs = 2.50 (1)	Stable Designs = 4.83 (5)	

Total: F (3, 30) = 8.88 (p<.01)

Stable Designs: t (df, 9) = 8.95 (p<.01)

(Cross-Functional and Functional
vs. Ambidextrous Designs)

Table 5: Design Transitions and Performance Context



Performance Context:	Innovation	Existing Product Decline
Design Transition (n=12)	2.98	75%
Stable Design (n=11)	3.51	45%
	t = .96 (p = .35)	chi square = 2.64 (p = 0.10)

Table 6: Design Transitions: Innovation Performance Change

	AMBIDEXTROUS	FUNCTIONAL	CROSS-FUNCTIONAL	SPIN-OUTS	Overall Innovation Performance Change
n TO:	8 1.16**	0 —	1 -1.09	3 -.58	12 .54 (NS)
n FROM:	3 -1.06	4 0	3 2.01	2 1.77	12 .54 (NS)

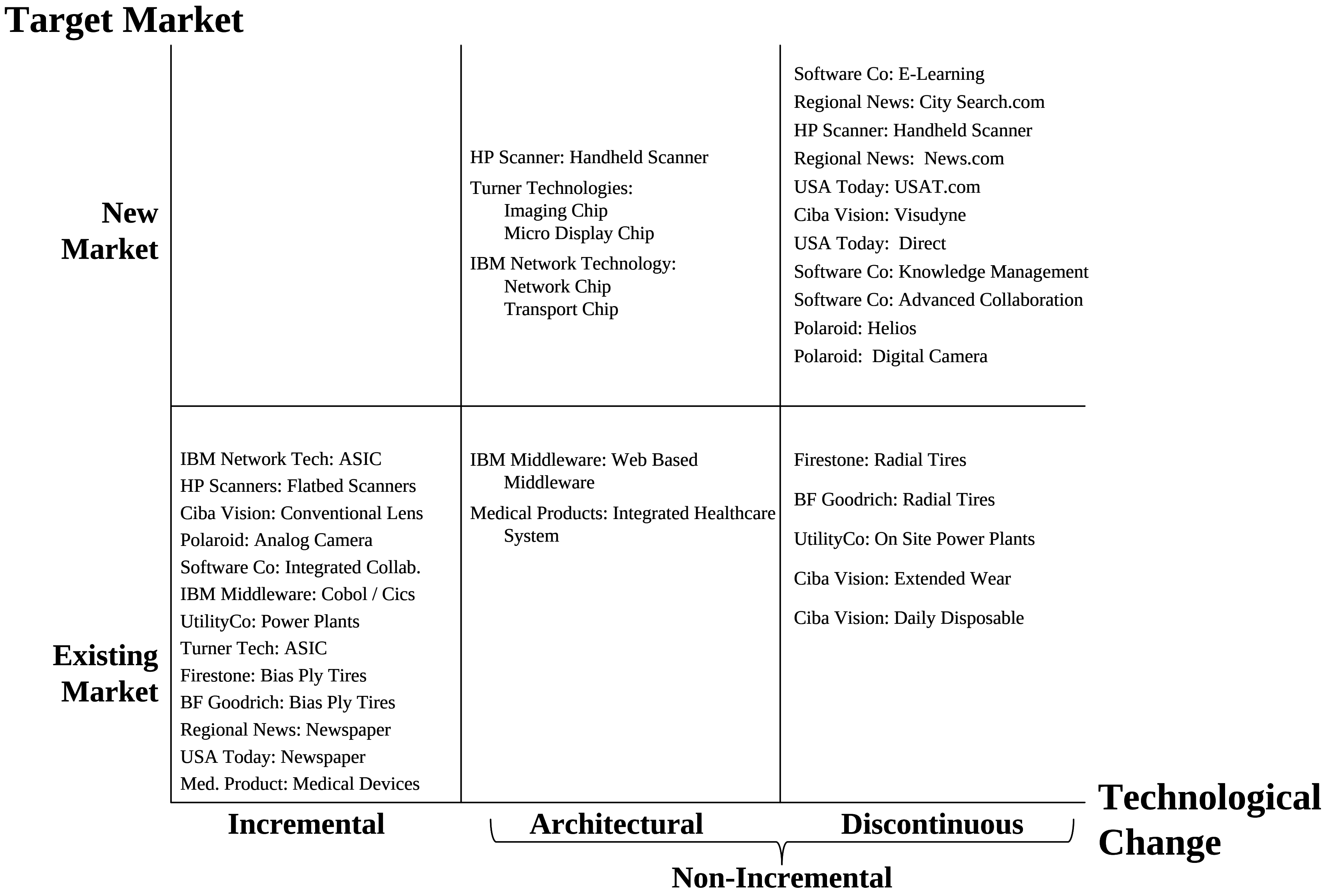
** p < .01

Table 7: Existing Product Performance by Organization Form

	Improving or Steady	**Declining**	Total
Ambidextrous Design	HP Scanner: Handheld Scanner (B) Turner Technologies: Micro Display (B), Imaging (B) CIBA Vision: Extended Wear, Daily Disposable, Visudyne (A) IBM Middleware: Web Based Middleware IBM Network Tech: Network Chip (B), Transport Chip (B) Regional News: News.com (A), City Search.com USA Today: USAT.com (B), Direct (B) UtilityCo: On-Site Power Plants **14**	Polaroid: Helios (B) **1**	**15**
Non-Ambidextrous Design	HP Scanner: Handheld Scanner (C) CIBA Vision: Visudyne (B) HP Scanner: Handheld Scanner (A) Regional News: News.com (B) Medical Products: Integrated Health Care System Polaroid: Helios (A), Digital Cameras (A) **7**	Turner Technologies: Micro Display (A), Imaging (A) USA Today: USAT.com (A), Direct (A) IBM Network Tech: Transport Chip (A), Network Chip (A) Software Co: Adv. Collab., Knowledge Mgmt., E-Learning Firestone: Radial Tires BF Goodrich: Radial Tires Polaroid: Digital Cameras (B) **12**	**19**
	21	**13**	**34**

Fisher's Exact Test, p = .01

Figure 1: Innovation Space



	Incremental	Architectural	Discontinuous
New Market		HP Scanner: Handheld Scanner Turner Technologies: Imaging Chip, Micro Display Chip IBM Network Technology: Network Chip, Transport Chip	Software Co: E-Learning Regional News: City Search.com HP Scanner: Handheld Scanner Regional News: News.com USA Today: USAT.com Ciba Vision: Visudyne USA Today: Direct Software Co: Knowledge Management Software Co: Advanced Collaboration Polaroid: Helios Polaroid: Digital Camera
Existing Market	IBM Network Tech: ASIC HP Scanners: Flatbed Scanners Ciba Vision: Conventional Lens Polaroid: Analog Camera Software Co: Integrated Collab. IBM Middleware: Cobol / Cics UtilityCo: Power Plants Turner Tech: ASIC Firestone: Bias Ply Tires BF Goodrich: Bias Ply Tires Regional News: Newspaper USA Today: Newspaper Med. Product: Medical Devices	IBM Middleware: Web Based Middleware Medical Products: Integrated Healthcare System	Firestone: Radial Tires BF Goodrich: Radial Tires UtilityCo: On Site Power Plants Ciba Vision: Extended Wear Ciba Vision: Daily Disposable