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Organizational designs and innovation streams

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This article 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 architectural and/or discontinuous innovation. Based on in-depth, longitudinal data on 13 business units and 22 innovations, we describe 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 relatively more effective in executing innovation streams than functional, cross-functional, and spinout designs. Further, transitions to ambidextrous designs are associated with increased innovation outcomes, while shifts away from ambidextrous designs are associated with decreased innovation outcomes. We describe the nature of ambidextrous organizational designs—their characteristics, underlying processes, and boundary conditions. More broadly, we suggest that the locus of integration and degree of structural differentiation together affect a firm's ability to explore and exploit. We suggest that the senior team's ability to attend to and deal with contradictory internal architectures is a crucial determinant of a firm's ability to exploit in the short term and explore over time.

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1. Introduction

The challenge of managing both efficiency and flexibility is a fundamental concern to organizational scholars. Thompson (1967: 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 this fundamental insight (e.g. Eisenhardt and Martin, 2000; Rivkin and Siggelkow, 2003; He and Wong, 2004; Gilbert, 2005; O'Reilly and Tushman, 2008; Andriopoulous and Lewis, 2009). Innovation streams, the ability of a firm to host both incremental as well discontinuous innovation is one way to operationalize exploitation and exploration (Tushman and Smith, 2002; Benner and Tushman, 2003; Gibson and Birkinshaw, 2004). Note that there is much literature on organizational adaptation through venturing, alliances, acquisitions, and joint ventures (e.g. Van de Ven *et al.*, 1999; Ahuja *et al.*, 2008; Rothaermel and Alexandre, 2009). We focus here on general managers and innovation streams within business units and/or within single product corporations. The organizational designs required to deal with the strategic challenges associated with multiple innovation types are not well understood (e.g. Siggelkow and Levinthal, 2003; Gupta *et al.*, 2006; Ethiraj and Levinthal, 2009; Raisch *et al.*, 2009).

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

There has been much research on organizational ambidexterity (e.g. Gibson and Birkenshaw, 2004; Gupta *et al.*, 2006; Lavie and Rosenkopf, 2006; O'Reilly and Tushman, 2008; Raisch *et al.*, 2009). While ambidexterity is associated with short- and long-term organizational benefits (e.g. Gavetti and Levinthal, 2000; Nickerson and Zenger, 2002; Lubatkin *et al.*, 2006), it is unclear just what roles and processes constitute structural ambidexterity, how such designs operate, the relative effectiveness of this design, and its boundary conditions (e.g. Markides, 1998; Govindarajan and Trimble, 2005; Westerman *et al.*, 2006).[1]

We find that ambidextrous organizational designs are composed of an interrelated set of competencies, cultures, incentives, and senior team roles. This design is relatively more effective in hosting innovation streams than other designs employed. Those business units that switched to an ambidextrous design enhanced innovation outcomes, while transitions to cross-functional or spins outs were associated with decreased innovation outcomes. The use of ambidextrous designs to execute innovations was associated with the on-going performance of existing products. It appears that structural differentiation, targeted structural integration, and senior team integration are an integrated set of organizational mechanisms that facilitate exploration in the context of ongoing exploitation. Given these results, we discuss possible linkages between innovation streams, senior teams, and organizational designs in shaping a firm's ability to adapt over time.

1.1 Innovation streams and organizational adaptation

At the core of organizational adaptation is a firm's ability 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; Tripsas, 2009). Innovation streams are portfolios of innovation that include 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 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 (Rosenkopf and Nerkar,

[1]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 foster stretch, discipline, support, and trust (Ghoshal and Bartlett, 1997). We focus on structural ambidexterity.

2001; Benner and Tushman, 2002). 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 *et al.*, 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 (e.g. von Hippel, 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

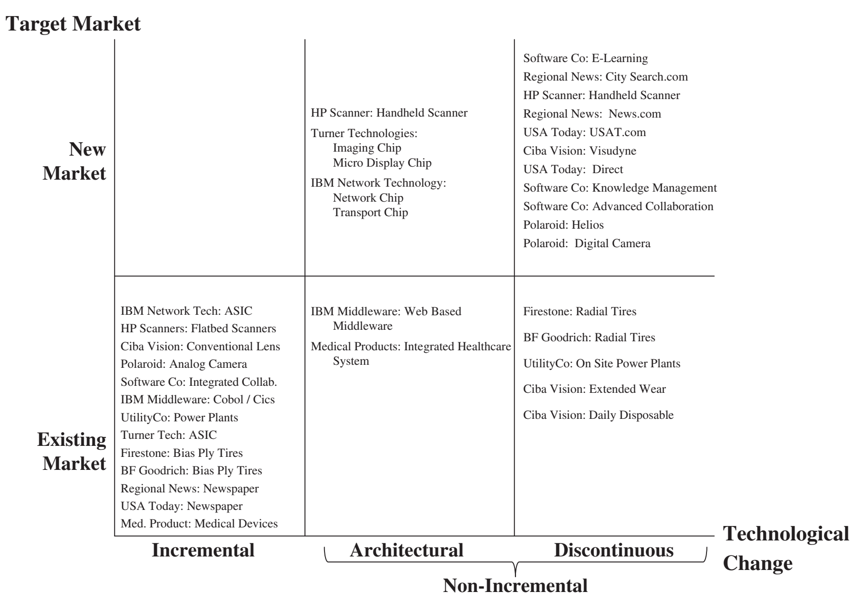


Figure 1 Innovation space

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 (see also Gatignon *et al.*, 2002).

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 (Sutcliffe *et al.*, 2000; Siggelkow and Levinthal, 2003; Ethiraj and Levinthal, 2009; Helfat and Peteraf, 2009). 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 (Duncan, 1976; Burgelman, 1991; Spender and Kessler, 1995; Quinn and Cameron, 1988).

1.2 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 of integration 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 only exploit current technologies or customers (Carroll and Teo, 1996; Christensen and Bower, 1996; Audia *et al.*, 2000; Hill and Rothaermel, 2003; 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, Markides (1998), Bhide (2000), and Foster and Kaplan (2001) 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 and/or at the corporate level of analysis.

A second view argues that effective innovation takes advantage of interdependencies across functional units and is accomplished through formal linking mechanisms. The extensiveness of these formal linking mechanisms is contingent on task interdependencies (Lawrence and Lorsch, 1967; Galbraith, 1973; Miles and Snow, 1978; Gresov, 1989; Donaldson, 1995; Nadler and Tushman, 1997). Research on cross-functional teams (e.g. Lawrence and Lorsch, 1967; Wheelwright and Clark, 1992), project management (e.g. Ulrich and Eppinger, 1995), and matrix designs (e.g. Miles and Snow, 1978; Spender and Kessler, 1995) are based on extending existing products in extant functional structures and innovating via formal cross-functional linking mechanisms. The locus of exploratory innovation occurs within these cross-functional teams and is managed by project leaders who report to the senior team.

A third organizational design approach to support both exploration and exploitation is a plural or ambidextrous organizational design. Building on contingency and paradox ideas (e.g. Lewis, 2000), ambidextrous designs build intra-organizational design heterogeneity that is consistent with the contrasting strategic requirements of exploration and exploitation. Ambidextrous organizational forms are composed of multiple integrated architectures that are themselves inconsistent with each other (Bradach, 1997; Tushman and O'Reilly, 1997; Sutcliffe *et al.*, 2000; Govindarajan and Trimble, 2005). Exploitative subunits are organized to be efficient, while exploratory subunits are organized to experiment and improvise. These highly differentiated, internally inconsistent, organizational designs create contrasting learning contexts within the business unit (Sutcliffe *et al.*, 2000; Ethiraj and Levinthal, 2009).

To buffer the more fragile exploratory unit from inertial forces associated with the historically dominant exploitative unit, these highly differentiated units are loosely coupled (Weick, 1979). Ambidextrous designs are similar to Wheelwright and Clark's (1992) autonomous designs. These highly differentiated organizational designs achieve linkage through senior team integration. Senior team integration is enacted through the senior team's behaviors and competitive framing (Gilbert, 2005; Smith and Tushman, 2005; Andriopoulous and Lewis, 2009; Helfat and Peteraf, 2009). Nonaka (1988), Bradach (1998), Adler *et al.* (1999), Nobelius (2003), and Gilbert (2005) provide evidence of organizational adaptation in the automotive, wireless, newspaper, and restaurant franchise businesses through ambidextrous organizational designs. The locus of exploratory innovation in ambidextrous designs is in highly differentiated exploratory units supported by strong senior team oversight.

Another form of ambidexterity are those organizational designs that temporally switch between organic designs for exploration and mechanistic designs for exploitation (Duncan, 1976). For example, Brown and Eisenhardt's (1997) research in the global computer industry finds that business units develop innovation streams through time paced, sequentially executed architectures. In this switching version of ambidexterity, the locus of innovation also resides with the senior team. These senior teams legitimate these inconsistent designs and build in the senior team processes to deal with the conflicts associated with switching designs across innovation types (see also Nickerson and Zenger, 2002; Siggelkow and Levinthal, 2003).

While there is substantial literature on the benefits of balancing exploration with exploitation (e.g. Rivkin and Siggelkow, 2003; Lubatkin *et al.*, 2006; Raisch *et al.*, 2009), there are contrasting results on those organization designs that facilitate this balance. These contrasting points of view differ in terms of the locus of integration and the timing of the exploratory innovation in the context of exploitative innovation. To empirically explore the relations 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 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 describe the characteristics, roles, and processes associated with this distinct organizational design.

2. Methods

2.1 Sample

Our research employed a multi-case design in which we compared a series of independent cases to generate insight into the relations between innovation streams and organizational designs (e.g. Yin, 1984; Eisenhardt, 1989; Langley, 1999; Van de Ven *et al.*, 1999). These qualitative techniques provided rich descriptive data on alternative organization designs and on the relations between organization design choices and innovation outcomes. These longitudinal data also allowed us to explore the relations between design transitions and innovation outcomes (see also Siggelkow, 2001).

In order 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.[2] 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).[3] As this is a convenience sample, we are only able to induce patterns on the relations between alternative

[2]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.

[3]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.

Table 1 Sample description

Company/existing product	Number of innovations	Innovation episode	Performance[a]	Existing product performance	Industry	Dates	Number of interviews
HP Scanners							
Flat bed scanners	1	Handheld scanner (A)	2.25	Steady	Electronics	Jan 1991–Mar 1996	7
		Handheld scanner (B)	4.75	Improving		Oct 1996–Mar 1998	
		Handheld scanner (C)	2.67	Improving		Aug 1998–Apr 1999	
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	Improving		1999–2000	
Ciba vision							
Conventional lens	3	Daily disposable	5	Improving	Eye Care	1992–1997	10
		Extended wear	5	Improving		1992–1997	
		Visudyne (A)	5	Improving		1992–1997	
		Visudyne (B)	5	Improving		1997–2002	
USAToday							
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)

Table 1 Continued

Company/existing product	Number of innovations	Innovation episode	Performance[a]	Existing product performance	Industry	Dates	Number of interviews
Medical Products Co.							
Medical devices	1	Integrated Healthcare System	2.5	Steady	Health care	1994–1999	4
IBM Network Technology							
ASIC	2	Transport chip (A)	4.56	Declining	Semiconductor	Mar 1999–Mar 2000	10
		Transport chip (B)	4.56	Improving		Mar 2000–Sep 2000	
		Network chip (A)	4.56	Declining		Mar 1999–Mar 2000	
		Network chip (B)	4.56	Improving		Mar 2000–Sep 2000	
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 2000–Dec 2001	12
		Knowledge management	3.17	Declining		Jun 2000– Dec 2001	
		E-learning	2	Declining		Jun 2000–Dec 2001	
Secondary sources							
Firestone[b] } Bias ply tires	1	Radial tires	1.44	Declining	Tires	1970–1976	1
BF goodrich[b] } Bias ply tires	1	Radial tires	2.78	Declining		1970–1976	
Polaroid[c]							
Analog camera	2	Helios (A) (high-resolution medical imaging)	2	Steady	Photography	1986–1988	4
		Helios (B)	1.67	Declining		1988–1996	
		Digital camera (A)	2	Steady		1980–1989	
		Digital camera (B)	2.33	Declining		1990–1996	
Total 13	22	34			9		96

[a]Performance: a composite scale (1–5) based on technology learning, market learning, and commercial success.

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

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

designs and innovation outcomes. Our results are exploratory and suggestive, and a range of rival hypotheses cannot be ruled out. While our sample is limited, it is, however, unusually strong in its access to senior teams and their design choices over time.

Our longitudinal 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 5-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.

2.2 Data collection

We collected data through semi-structured interviews supported by archival data. For 10 of the 13 business units, we interviewed 4–12 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 and 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 (e.g. Blackford and Kerr, 1996).[4] In total, we conducted 96 interviews.

Our interviews included targeted questions to understand innovation type, organizational designs employed, and innovation outcomes. To understand innovation

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

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. Lawrence and Lorsch, 1967; Wheelwright and Clark, 1992; Christensen, 1997; Nadler and Tushman, 1997). 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 categorical data on the existing product's ongoing revenue and market share.

We integrated these archival data and the perspectives of our multiple informants and wrote a mini-case for each business unit. These mini-cases were organized around the business unit's design and, where appropriate, 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, the case writer and coders worked together to clarify the characteristics of each case. If necessary, we returned to key informants for clarification.

Using these methods, 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.[5]

We categorized organization design choices based on the business unit's structure, allocation of responsibilities for the existing product and the innovation(s), and reporting relations. This set of business units employed four types of organizational designs during the period we studied: functional designs ($N=5$), cross-functional designs (cross-functional teams embedded within functional designs) ($N=9$),

[5]HP Handheld Scanners are in two locations in Figure 1 because the type of innovation shifted from architectural to discontinuous during the period studied. There are no overall performance consequences of innovation type and the number of innovations does not affect innovation outcomes.

spin-out designs (distinct innovation unit without general manager control and/or senior team support) ($N=5$), and ambidextrous designs (distinct innovation unit with general manager control and senior team support) ($N=15$). We observed 12 designs transitions. These transitions were all between these four organizational designs.

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 0.77 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 ($0.74 < r < 0.96$), we created a five point innovation performance scale using all three outcome dimensions (reliability $\alpha = 0.90$).[6] We also coded the performance of the existing product during each innovation episode as either improving, steady, or declining.

Given these data, we explore alternative organization design choices employed and the association between these design choices and innovation outcomes. As 11 innovations involved multiple innovation episodes, we also explore the consequences of shifting organizational designs evolved over time.

3. Results

3.1 Innovation streams and alternative organizational designs

3.1.1 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 build an 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 online business. She hired staff from outside USAToday and

[6]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.

Table 2 Innovation streams and alternative organization designs

Cross-functional design	Spin-outs	Functional design	Ambidextrous design
• HP Scanners: handheld scanner A	• USA Today: USAT.com A	• IBM Network Tech: Network Chip A	• HP Scanners: handheld scanner B
• Regional News: News.com B	• Polaroid: Digital cameras B	• IBM Network Tech: transport chip A	• USA Today: USAT.com B
• Turner Technologies: micro display A	• HP Scanners: handheld scanner C	• Polaroid: Helios A	• USA Today: Direct B
• Turner Technologies: imaging A	• USA Today: direct A	• Polaroid: Digital cameras A	• Regional News: News.com A
• Firestone: radial tires	• CIBA Vision: Visudyne B	• Medical products: integrated health care system	• Turner Technologies: micro display B
• BF Goodrich: radial tires			• Turner Technologies: imaging B
• Software Co: E-learning			• IBM Network Tech: network chip B
• Software Co: knowledge management			• IBM Network Tech: transport chip B
• Software Co: advanced collaboration			• 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
$N=9$	$N=5$	$N=5$	$N=15$

built a fundamentally different set of structures, roles, incentives, and culture all dedicated to instantaneous news. Indeed, 80% of online news did not come from the newspaper. Online 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 online franchise. Cichowski never had the senior team's support for her online 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 targeted linking mechanisms or 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 he replaced Cichowski with Jeff Webber, the then VP of circulation. At this juncture Curley also replaced 40% 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 dotcom. To achieve leverage across editorial platforms, Webber initiated editorial meetings within Curley's senior team and weekly lower level cross-platform editorial meetings. Furthermore, 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 coded ambidextrous designs as highly differentiated organizational designs with senior team integration, cross-case analyses provides greater clarity on this design and its associated mechanisms (see Table 3). Physical separation seems to be important. Out of the 15 innovation units, 12 were physically separate from the existing organization. For example, in the HP Scanner Division, the portable scanners were developed and marketed in a location several miles from the flatbed organization. Similarly, Ciba Vison's Visudyne product was developed in Germany, while the conventional lens business was centered in Atlanta. This physical separation may provide the freedom for the exploratory unit to experiment without interference from the exploitative unit.

Each innovation had a dedicated innovation manager. There does not appear to be a pattern in the internal or external sourcing of these innovation managers. Out of 15 innovation managers, 8 came from within the unit and 7 were recruited externally. These innovation managers had the freedom to design their unit with distinct competencies, cultures, and processes. Each innovation manager also had their own dedicated resources and staff. For example at CitySearch within Regional News, an externally recruited innovation manager recruited 32 of her 35 employees from outside the company. This highly differentiated unit built its own

Table 3 Characteristics of ambidextrous organizational designs

	Physically distinct unit	Ambidextrous manager	Innovation manager[a]	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)	Yes	GM	Inside	None	Local paper for global village	Editorial	Joint bonus / common fate
Direct (B)	Yes		Outside				
Regional News							
City Search.com	Yes	Pubisher	Outside	-	Primary information source for city	HR/Finance editorial advertising	Individual incentive and joint bonus
News.com (A)	No		Outside				
Polaroid							
Helios (B)	Yes	CEO	Outside	-	None	Sales	N/A
Turner Technology							
Micro (B)	Yes	GM	Inside	Yes	Be in top 10 manufacturers of semiconductors within 3 years	Mfg.	N/A
Imaging (B)	Yes		Inside				
IBM Network Tech							
Network (B)	No	GM	Outside	Yes	#1 supplier of Network Tech by 2000	Mfg./ Sales	Joint common fate
Transport (B)	No		Outside				
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, re-spected public utility	Marketing	Company based stock options
Ciba Vision							
Extended wear	Yes	GM and Head of R&D	Inside	Yes	Healthy eyes for life	R&D / Mkt.	Joint / common fate
Daily disposable	Yes		Inside				
Visudyne (A)	Yes		Inside				

[a]Inside and outside refers to whether the manager came from inside or outside the business unit. N/A = data not available.

entrepreneurial culture and incentive system distinct from Regional News' culture and incentives.

In these ambidextrous designs, integration was achieved through a range of formal roles. In 14 of the 15 cases, the innovation managers reported to the general manager.[7] 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).[8] Beyond these formal roles, integration was also achieved through an overarching aspiration. 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.

These 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 and the portable scanners had to be successful. Faraci spent relatively more time with the more exploratory portable scanners unit and 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.

Beyond this senior team integration, in every case the innovating unit leveraged specific resources from the existing organization through targeted integration mechanisms. For example, while USAToday.com (B) was distinct and separated from the USAToday newspaper, editorial teams composed of editors from the dotcom 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.

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

[7]In three of these cases, the innovation manager co-reported to the R&D manager as well as the general manager.

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

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.

3.1.2 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. For cross-functional designs, the innovation's locus of integration was with a project manager who was not a member of the senior team.

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, USAToday.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).

3.2 Design choices and innovation outcomes

To what extent are these organization design choices associated with differential 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 relatively more effective in hosting innovations than the other designs employed (innovation performance of 4.27 versus 2.69). These overall innovation outcome results may be affected by the design transitions in our sample. 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. The innovation outcomes of those business units employing stable ambidextrous designs (4.83) was twice that of those units employing stable cross-functional designs (2.41).

While all our senior teams espoused exploration and exploitation strategies, they executed these strategies via contrasting structures. At Ciba Vision, over a 5-year period, the general manager and his team built an ambidextrous business unit that effectively hosted three innovations. In contrast, despite strong senior leadership support, at Software Co. over an 18-month period and at Firestone over a 6-year period, attempts to initiate exploratory innovation through cross-functional teams was associated with strong cultural, political and community resistance, and ultimately to failure.

Simple functional designs were not a stable organization design; four of the five functional designs shifted to ambidextrous designs. The single stable functional design at Medical Products was roughly half as effective in hosting innovations as stable ambidextrous designs (innovation outcomes of 2.50 versus 4.83). It seems that the senior team integration is a necessary but not sufficient condition to host innovation streams.

3.3 Design transitions and innovation outcomes

Further insight into the relations between alternative designs and innovation outcomes is gained when business units shift designs in service of a given innovation.

Table 4 Organization designs and innovation outcomes

	Cross-Functional Design	Spin-Outs	Functional Design	Ambidextrous Design	Total
Design transi-tions	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)	

Out of our 22 innovations, 11 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.[9]

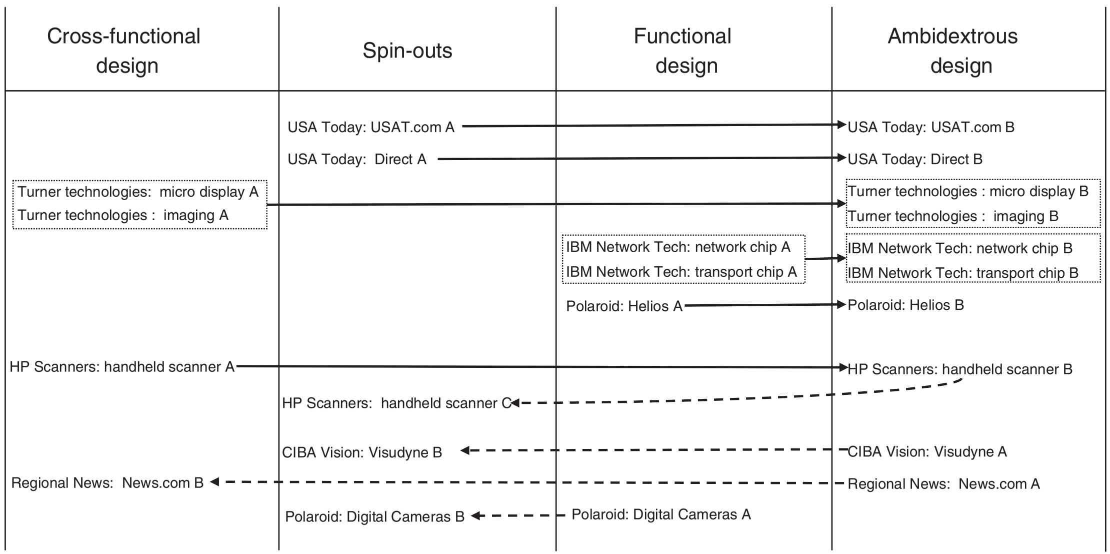
For example, in HP's Scanner division, an initial set of architectural innovations targeted to new markets (handheld scanners) was executed with a cross-functional design. Despite substantial technical and market potential, this design could get neither senior management support nor support from the rest of the scanner organization. After 5 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. 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) (see Table 5). It may be that innovation performance shortfalls trigger these design transitions. It also appears that performance declines in the business units' existing products are 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). It appears that design transitions are triggered by performance shortfalls in either the innovative or existing product.

While design transitions are associated with performance shortfalls, to what extent does the subsequent design choice affect innovation outcomes? Perhaps design transitions are associated with enhanced innovation outcomes independent of the type of

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

Table 5 Design transitions and performance context



Performance context:	Innovation outcomes	Existing product decline
Design transition (n=12)	2.98	75%
Stable design (n=11)	3.51	45%

Table 6 Design transitions: innovation performance change

	Ambidextrous	Functional	Cross-functional	Spin-outs	Overall innovation performance change
n	8	0	1	3	12
To:	1.16	—	−1.09	−0.58	0.54
n	3	4	3	2	12
From:	−1.06	0	2.01	1.77	0.54

design change? For the set of 12 transitions, we compared innovation outcomes pre versus post design transition. The average change in innovation outcomes across these transitions is 0.54 (see Table 6). Design change, by itself, is associated with a small increase in innovation outcomes. But 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 increases in innovation outcomes (change in innovation performance of 1.16). This increase in innovation outcomes is more than twice that of all design transitions (.54). 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 4 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 designs 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 −0.71), 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 small innovation performance impacts of design transitions, the type of design transition had important impacts on innovation outcomes. Shifts to ambidextrous designs were associated with positive shifts in innovation outcomes in contrast to shifts to all other design options (1.16 versus −0.71, respectively). Shifts from ambidextrous designs were associated with relatively large declines in innovation outcomes while shifts from cross-functional designs and spin-outs were associated with relatively large increases in 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.

3.4 Organization designs and the performance of existing products

In the context of innovation streams, what is the impact of organizational design choices on the performance of existing products? It may be that the adoption of ambidextrous organizational designs hurt the performance of existing products. Table 7 categorizes the performance of the existing product over the periods studied by type of organization design employed to execute innovation streams. Those existing products that 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, $P = 0.01$). It may be that uncoupling the exploitative product from the exploratory product provides the context and focus to invigorate the exploitative product.

Table 7 Existing product performance by organization design

	Improving	or	Steady	Declining	
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)	**14**	Regional News: News.com (A), City Search.com USA Today: USAT.com (B), Direct (B) UtilityCo: on-site power plants	Polaroid: Helios (B) **1**	**15**
Non-ambidextrous design	HP Scanner: Handheld scanner (C) CIBA Vision: Visudyne (B)	**7**	HP Scanner: handheld scanner (A) Regional News: News.com (B) Medical products: integrated health care system Polaroid: Helios (A), Digital Cameras (A)	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**	Total **34**

Fisher's exact test, $p = 0.01$

4. Discussion

One important determinant of a firm's ability to adapt is its ability to both explore and exploit (March, 1991; Levinthal and March, 1993). 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 to what extent organization design choices are associated with 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 *et al*., (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 association between alternative organizational designs and the firm's ability to innovate as well as nurture existing products. For these 13 business units and their 34 innovation episodes, alternative organization designs had differential associations with performance outcomes for both existing and new products. Contrary to Davis and Marquis' (2005) notion that firm characteristics are not important predictors of organizational outcomes, it appears that senior team integration and structural differentiation together make a difference in hosting innovation streams (see also Westerman *et al*., 2006). Senior team integration appears to be a necessary but not sufficient condition to host innovation streams.

Organizational designs where the locus of exploratory innovation was with the general manager and the senior team were relatively 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. But this senior team locus of innovation is not sufficient. Active senior integration coupled with structural differentiation was associated with innovation streams. In no case were functional designs able to effectively host innovation streams.

While we defined ambidextrous designs as those designs that coupled high structural differentiation with targeted structural linkage and senior team integration, our data provided more insight into the underlying mechanisms, roles, and processes associated with this design. The 15 ambidextrous designs were characterized by an interrelated set of characteristics that together facilitated innovation streams. These designs were composed of physically separate and distinct units, each with their own innovation manager and their own internally consistent incentives, competencies, and cultures. Each innovation manager reported to an ambidextrous manager and/or to the senior team. These ambidextrous managers provided the personal support and energy for their dual strategies, an overarching aspiration, and employed common-fate senior team incentives to motivate exploitation as well as exploration (see also Jansen *et al.*, 2009).

In those 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 (see also Taylor and Helfat, 2009). This set of interrelated leader behaviors, roles, incentives, linking mechanisms, and cultures better describe ambidextrous designs than simple structural characteristics (see also Rivkin and Siggelkow, 2003).

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 *et al.*, 1995; Lewis, 2000; Gilbert, 2005; Smith and Tushman, 2005). When the general manager emphasized exploitation at the expense of exploration [e.g. HP Scanner (A)] or the reverse [e.g. 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 [see also Tripsas (2009)].

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. Compared to other designs employed, ambidextrous designs were associated with relatively enhanced ability to explore and exploit. Cross-functional teams, functional designs, and spin-outs are less fertile contexts for innovation streams. We identified 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 this design transition. When innovations have no technology or market leverage within the host business unit they are spinout candidates (e.g. 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 relatively 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 the role of senior teams in shaping their firm's fates (e.g. Barnett and Carroll, 1995; Van De Ven *et al.*, 1999; Weick and Quinn, 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 (e.g. 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 (e.g. 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. If so, the senior team must have or develop the cognitive and behavioral flexibility to balance (as opposed to trade-off) search and stability; to act consistently inconsistent—supporting both variance increasing as well as variance decreasing behaviors in their organizations (Rivkin and Siggelkow, 2003; Andriopoulous and Lewis, 2009; Smith and Tushman, 2005).

Ambidextrous designs create the opportunity for multiple learning contexts as well as multiple change modes (see also Westerman *et al.*, 2006). 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 dotcom 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. Thus our results are only suggestive. Furthermore, 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. Furthermore, 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 more effectively executed through extra-firm action (e.g. Rothaermel and Alexandre, 2009). Or, innovation streams may not be crucial to long-term business unit fate and that ambidextrous designs are less effective than other more simple organizational designs in facilitating organizational adaptation. For example, simple functional designs may be more successful than more complex organizational designs for product substitution events.

Finally, it may be that beyond the meta-manager, characteristics of the larger corporation help or hinder ambidexterity (e.g. 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 as well as at the corporate level of analysis (e.g. Adner and Helfat, 2003; Kaplan *et al.*, 2003; Kleinbaum and Tushman, 2007; O'Reilly and Tushman, 2007).

5. Conclusion

Our article has explored the role of alternative organizational designs in shaping innovation streams. The locus of innovation and the degree of structural differentiation appear to be important determinants of innovation streams. Those innovation streams actively managed by the senior team were relatively more successful that innovation streams managed by either below or above the senior team. But this senior team integration was not sufficient to host innovation streams. 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 exploring into 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.

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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 innovation outcomes: 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 (Edmondson, 1999; Garvin, 2000). 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).