

INFORMATION TECHNOLOGY AND BUSINESS-LEVEL STRATEGY: TOWARD AN INTEGRATED THEORETICAL PERSPECTIVE¹

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*Information technology matters to business success because it directly affects the mechanisms through which they create and capture value to earn a profit: IT is thus integral to a firm's **business**-level strategy. Much of the extant research on the IT/strategy relationship, however, inaccurately frames IT as only a **functional**-level strategy. This widespread under-appreciation of the business-level role of IT indicates a need for substantial retheorizing of its role in strategy and its complex and interdependent relationship with the mechanisms through which firms generate profit. Using a comprehensive framework of potential profit mechanisms, we argue that while IT activities remain integral to the functional-level strategies of the firm, they also play several significant roles in business strategy, with substantial performance implications. IT affects industry structure and the set of business-level strategic alternatives and value-creation opportunities that a firm may pursue. Along with complementary organizational changes, IT both enhances the firm's current (ordinary) capabilities and enables new (dynamic) capabilities, including the flexibility to focus on rapidly changing opportunities or to abandon losing initiatives while salvaging substantial asset value. Such digitally attributable capabilities also determine how much of this value, once created, can be captured by the firm—and how much will be dissipated through competition or through the power of value chain partners, the governance of which itself depends on IT. We explore these business-level strategic roles of IT and discuss several provocative implications and future research directions in the converging information systems and strategy domains.*

Keywords: Management theory, information technology, information systems, competitive advantage, performance, technology management, IT capability, IT strategy

Introduction

A significant body of research has attempted to link firms' investments in information technology (IT) with overall com-

petitive advantage in the pursuit of superior performance (Kohli and Devaraj 2003; Melville et al. 2004; Piccoli and Ives 2005).² While there is clear evidence of a measurable correlational relationship between IT investment activities and

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²IT in this context refers to any form of computer-based information system, including mainframe, microcomputer, and intra/internet applications (Orlikowski and Gash 1994; Powell and Dent-Micallef 1997).

firm performance on several strategic dimensions (Barua et al. 1995; Francalanci and Galal 1998), the relationship is often found to be indirect, mediated by the effectiveness of implementation (Brynjolfsson and Hitt 1998; Mooney et al. 1996) and subject to severe measurement issues (Bharadwaj 2000).

Such observations of the indirect and diffuse impact of IT investment activity on firm or *business*-level performance should not be surprising since much of the extant research frames IT investment as a *functional*-level activity, often from an operational and/or project implementation perspective (Bakos and Treacy 1986; Henderson and Venkatraman 1993). For IT investments to offer a measurable improvement to firm-level performance, however, they must relate (causally and positively) to a firm's profit mechanisms (Drnevich and McIntyre 2010; Makadok 2010, 2011). This key dichotomy between the framing of IT investments as local functional-level activities and research scholars' expectation of identifying a statistically meaningful firm-level effect on overall financial performance (from variation in either the activity or the IT artifact itself) indicates a substantial and serious theoretical disconnect (as suggested in Bharadwaj et al. 2010). Unsurprisingly, this disconnection severely hinders the ability of management information systems (MIS) scholars to measure the business-level value of IT. This gap between functional investments and overall business value has been highlighted in the popular business press (Carr 2003, 2004) and must be bridged if MIS research is to credibly attribute causal impacts on profitability (or other metrics of firm performance) to IT effects. That bridge is possible because, as we will demonstrate, IT can, in fact, play several significant simultaneous roles, each with substantial performance implications, in a company's business-level strategy.

Our objective in this paper is to eliminate the disconnection between functional-level IT investment and business-level value. We seek to do so through developing the argument that, while IT investments are integral to operations at the functional-level of the firm, they also play a substantial (and largely under-theorized) role in *business*-level strategy—facilitating improved firm performance through enhancing current non-digital capabilities and enabling new digital capabilities to create and capture value. Our premise is that investments in IT and complementary (digitally connected) organizational capabilities fundamentally alter the set of business-level strategic alternatives and value-creation opportunities that firms may pursue, as well as change the relative attractiveness of pursuing those options on both a risk and reward basis. Such IT-based capabilities also determine how much of the value from these opportunities, once created, can be captured and accrue to the firms' owners in the form of superior financial returns over time. Additionally, IT-based capabilities can help defend this value against competitor,

supplier, and customer encroachment (e.g. Porter 1980, 2008) via isolating mechanisms such as dedicated assets and causal ambiguity (Symeonidis 2003; Thomadsen and Rhee 2007; Walker 2007). These elements of value creation and capture are the essential features of business-level strategy. At the same time, the nature of information technology itself clearly creates challenges for the scientific measurement of the fruits of IT investments—challenges not present for traditional long-term investments in competitive advantage. Improving the theoretical clarity of the role of IT in business-level strategy, as we develop in this study, should help scholars in both the MIS and Strategy disciplines to improve the methodology and consistency of empirical support for continued research on the IT-strategy relationship (Kohli and Devaraj 2003; Melville et al. 2004; Piccoli and Ives 2005).

We proceed in this paper as follows. First, we begin the process of rethinking and redeveloping strategic management theory for the MIS context by defining several key constructs and deriving research questions of interest for the integration of the MIS and Strategy fields. Second, we explore these questions by theorizing the role and implications of IT in business-level strategy through each of its major theoretical perspectives, developing separate detailed sections to introduce each theory perspective and to discuss the implications of integrating the theory with the contributions of IT. Third, we offer a discussion of several provocative implications of integrating the Strategy and MIS fields. We then conclude with a discussion of future research directions in the converging MIS and Strategy domains.

Rethinking and Redeveloping Strategic Management Theory for MIS

While research on the drivers of firm-level performance is quite prevalent in the strategic management literature (for reviews of this body of work, see Armstrong and Shimizu 2007; Newbert 2007, 2008), research with an IT-specific context or theorizing is extremely limited (for a few exceptions, see Drnevich and Kriauciunas 2011; Pavlou and El Sawy 2006; Tippins and Sohi 2003). We believe that part of this gap, as alluded to earlier, comes from a lack of theoretical integration between the MIS and Strategy literatures. We pursue this integration by first defining several key constructs and research questions that are central to both fields.

Definitions and Key Questions for Achieving Integration

We begin by defining *strategy* and specifying two of the core constructs in business-level strategy, *resources* and *capa-*

bilities, in an MIS-relevant context. In the subsequent section, we theorize how the investment in IT resources and the related deployment of IT-enhanced ordinary capabilities, or new IT-enabled dynamic capabilities (Drnevlch and Kriaiunas 2011; Winter 2003) affects business-level strategy.

We define the construct of *strategy* as a set of management decisions regarding how—through choice of industry, firm configuration, resource investments, pricing tactics, and scope decisions—to balance the firm's tradeoffs between being efficient (reducing cost) and being effective (creating and capturing value) to achieve its objectives (Drucker 1954, 1966; Holmstrom and Tirole 1989; Williamson 1991). Making this decision is rarely simple, however, as a host of factors, including the level of variability in the environment in which the firm operates, complicates management's ability to strike the optimal balance between these two strategic orientations. In higher-variability environments, for example, performance may be maximized by the firm moving toward higher effectiveness and lower efficiency (e.g., investing in IT-based flexibility to respond to a rapidly changing environment, even if it means higher costs in the short run). Conversely, in lower-variability environments, performance may be improved by emphasizing efficiency over effectiveness (i.e., investing in technology to exploit economies of scale and experience, through focusing on operating at the lowest possible cost, even though such replication and routinization of core activities renders a firm vulnerable to disruptive innovations from competitors).

We consider the construct of *resources* defined as

stocks of available factors that are owned or controlled by the firm [that can be]...converted into final products or services by using a wide range of other firm assets and bonding mechanisms such as technology, management information systems, incentive systems, trust between management and labor, and more (Amit and Schoemaker 1993, p. 35).

Such resources are therefore tangible, profit-producing assets that *can* be transferred from firm to firm (i.e., bought and sold) without significant loss of value. *IT resources* thus encompass (1) the tangible resources that make up the physical IT infrastructure components, (2) the human IT resources that represent the technical and managerial IT skills, and (3) the intangible IT-enabled resources such as knowledge assets (Bharadwaj 2000, p. 171) that are general enough for their value to survive a change in ownership. IT resources may consist of human, relational/social, and/or technology components, all of which interact with, and can hold implications for, the other components (Ross et al. 1996). Analy-

zing an organization's overall IT resource base thus involves system-level analysis of the resource value and not merely an accounting of the tangible hardware assets.

We also define the construct of *capabilities* as

a firm's capacity to deploy *Resources*, usually in combination, using organizational processes, to effect a desired end. They are information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's *Resources* (Amit and Schoemaker 1993, p. 35).

Such capabilities are therefore intangible, profit-producing assets that *cannot* be transferred from firm to firm (i.e., bought and sold) without significant loss of value (Amit and Schoemaker 1993). *IT capabilities* thus represent both (1) the firm's ability to mobilize and deploy its IT-based resources, creating value in combination with other resources and capabilities (Bharadwaj 2000, p. 171), and (2) the firm-specific IT-enabled knowledge and routines that improve the value of non-IT resources. IT capabilities may be further subcategorized (e.g., design of IT architecture versus delivery of IT services) (Feeny and Willcocks 1998) within this framework of limited transferability. These classifications also reflect Barney's (1991, p. 101, following Daft 1983) broader, more inclusive definition of firm resources (i.e., encompassing the construct of capabilities) for profit creation as the "assets, capabilities, processes, information, and knowledge controlled by the firm," and Amit and Schoemaker's (1993) key generality- and severability-based differentiation between the constructs of resources (which are generally valuable to multiple firms, as well as potentially tradable as individual assets) and capabilities (which are specific to a single firm and non-tradeable except through acquisition of the entire firm).

IT investments can, on their own merits, comprise a tangible resource (e.g., IT assets) or an intangible capability (e.g., IT or digitally enhanced current ordinary or IT or digitally enabled new dynamic capabilities and the organizational routines they encompass). Such IT investments can influence a firm's strategy through affecting both its efficiency and effectiveness, as well as providing critical information that either increases the value of making investments in other resources or capabilities or steers management toward more effective decision making. From this perspective of the integral relationship between IT investments and strategy, we derive two key questions for managers integrating IT into business-level strategy to form the focus of this paper:

- (1) How can a firm create and capture value from its IT investments in the context of its existing strategy?
- (2) To what extent should the firm change its strategy because of the direct contributions of existing IT investments, the information created from them, or the availability of future IT investment options?

Information Technology and Business-Level Strategy

Over several decades, numerous studies in both the MIS and Strategy fields have tried to theorize the character of, and examine business-level value attributable to, IT investments. Work on this topic in the MIS area is quite prevalent, with several hundred studies on the “business value of IT” documented in review articles (Kohli and Devaraj 2003; Melville et al. 2004; Piccoli and Ives 2005). These repeated examinations document the contributions of IT not solely as assets (a resource value reflected on the balance sheet, as well as potentially contributing to income and cash flow) but also as enablers of capabilities (whose effects are reflected in the income and cash-flow statements, but not valued in the balance sheet) and focus on comparing the value of the investments to their costs.

Conversely, research on the IT-performance link in the strategic management literature has been fairly limited. Such work has viewed IT investments as a means of increasing the firm’s competitive advantage (Miller 2003; Powell and Dent-Micallef 1997; Zott 2003) or as a necessity to avoid a disadvantageous position (Mata et al. 1995). Parallel theoretical perspectives on the “advantage or necessity” question in the MIS literature occurred earlier and at least as extensively (e.g., Barua and Lee 1991; Clemons and Kimbrough 1986). Empirical studies comparing the performance of IT-intensive firms to their peers have, however, struggled with inconsistent outcomes. Among the many studies that find clearly positive returns, some find clearly mixed results for the IT-performance relationship (Barua et al. 1995; Barua and Lee 1991; Francalanci and Galal 1998) and some find a clearly negative relationship (Lee and Barua 1999; Loveman 1994). Yet other studies show that the realization of IT gains, although documentably positive in their potential, are largely subject to organizational implementation issues unrelated to the technology itself (Brynjolfsson and Hitt 1998; Mooney et al. 1996; Nolan and Croson 1995) that inhibit capture of IT-attributable benefits by the firm’s owners (e.g., Brynjolfsson 1993). Further, retrospective methodological analysis (Bharadwaj 2000) suggests that many prior studies may be

misleading because of measurement issues in quantifying the IT artifact as well as level-of-analysis problems that confound any direct IT/performance relationship. Several studies also attempt to discern the reasons behind these conflicting rate-of-return observations across this body of research (e.g., Kohli and Devaraj 2003; Melville et al. 2004; Piccoli and Ives 2005). While these meta-studies clearly identify many of the potential weaknesses and limitations in the collective literature base on the context of the IT-performance relationship, none to date has offered a clear integration of IT investments with the major theory perspectives in business-level strategy and their underlying causal profit mechanisms.

Makadok (2010, 2011) offers a useful categorization of the major theories in strategic management, organized by *causal profit mechanism*—the means through which money moves from a customer to the firm, net of the cost of providing the goods or services rendered, in the face of competitive pressures. This categorization views strategic management’s numerous theories through four perspectives (*collusion, governance, competence, and flexibility*) with a focus on the profit mechanism by which any given factor can create a measurable economic profit for the firm (Makadok 2011). Extending and integrating this business-level theory classification system to the MIS domain will enable future scholars to more effectively theorize and empirically measure firm value causally attributed to IT. For example, in order for a study to promise the theoretical expectation of measuring IT’s business value, the IT artifact (or its derived capability) to be examined must be specifically related to one or more of a firm’s profit mechanisms. In the following sections, we offer specific suggestions for extending and integrating strategic management’s major theory perspectives, along with their associated underlying profit mechanisms, to a variety of types of IT activities. In doing so, we also take the opportunity to discuss the implications of integrating IT and business-level strategy in each of the four perspectives, explicitly tying in research outcomes from MIS. Because theoretical MIS research has evolved in parallel to strategic management theory, with limited or delayed cross-pollination, this integration effort is of critical importance to each field. Such an approach enables scholars in both fields to focus on how investments that create specific IT-based capabilities (e.g., superior information, knowledge creation and transfer, faster response speed, etc.) create economic profit for the firm.

We offer Table 1 as an illustration of this integration of the core concepts of business-level strategy major theory perspectives with IT through the context of the prior Strategy and MIS literatures. We then develop and discuss this integration of IT and business-level strategy in each of the four following sections on *collusion, governance, competence, and flexibility*.

Table 1. Integration of Strategy's Theoretical Perspectives[†] with MIS Research

Theory Perspective	Core Theories	Profit Mechanisms	Intellectual Heritage	Integration of Theory Perspective with MIS Research
Collusion/ Coordination	Structure- Conduct- Performance, I/O Economics	Bainian Market- Power Rents (<i>Tacit collusion to restrain rivalry and restrict entry</i>)	Bain 1956, 1959; Mason 1939, 1949; Modigliani 1958; Porter 1980, 1985; Sylos Labini 1956	Brynjolfsson & Smith 2000, 2001; Clemons et al. 1996; Copeland & McKenney 1988; Thatcher & Pingry 2004; Vitalie 1986; Weitzel et al. 2006
Governance	Transaction Cost Economics, Agency Theory	Coaseian Transactional- Efficiency Rents (<i>Efficient allocation of resources to create and capture value</i>)	Coase 1937; Alchian & Demsetz 1972; Jensen & Meckling 1976; Williamson 1976	Bakos & Brynjolfsson 1993a, 1993b; Clemons et al. 1993; Croson & Jacobides 1997; Gurbaxani & Whang 1991; Karrake 1992; Kern et al. 2002; Lee et al. 2004; Malone et al. 1987; Sambamurthy & Zmud 1999; Wang & Seidman 1995; Xue et al. 2008; Yoo et al. 2002
Competence	Resource-Based View, Knowledge- Based View	Ricardian Operational- Efficiency Rents (<i>Exploitation of resources to create and capture value</i>)	Ricardo 1817; Barney 1986, 1991; Demsetz 1973, 1974; Kogut & Zander 1992; Lippman & Rumelt 1982; Penrose 1959; Peteraf 1993	Andreu & Ciborra 1996; Bharadwaj 2000; Carr 2004; Drnevich & Kriauciunas 2011; Gordon et al. 2005; Mata et al. 1995; Powell & Dent-Micallef 1997; Ray, Barney, & Muhanna 2004; Ray, Muhanna, & Barney 2005; Tarafdar & Gordon 2007; Tippins & Sohi 2003; Wade & Hulland 2004
Flexibility	Dynamic Capabilities, Real Options	Schumpeterian Flexibility Rents (<i>Preserve or improve value and position through superior adaptation</i>)	Schumpeter 1934, 1954; Dixit & Pindyck 1994; McGrath 1997; Nelson & Winter 1982; Teece et al. 1997	Bharadwaj et al. 1999; Drnevich & Kriauciunas 2011; Fichman 2004; Sambamurthy et al. 2003; Saraf et al. 2007

[†]Adapted from Makadok (2010, 2011).

Collusion-Based Theories and Information Technology

To earn a profit, the price at which a firm can sell a good or service must exceed the average cost associated with producing and/or providing that good or service. Since industries vary in their average long-term return on equity (ROE), and since long-term superior ROE is not an outcome predicted by perfect competition (which drives prices down to variable costs), theories of imperfect competition are necessary to explain such variations in interindustry long-term profitability. Industry thus matters to profitability; a firm's choice of, and position in, an industry are important factors for performance, as are its abilities to collude, coordinate, and/or cooperate with its rivals to limit the entry of new competitors, block the threat of substitution, and exert power over both its suppliers and customers (Porter 1980, 2008).

The Nature of Collusion-Based Theories of Profit

Collusion-based theories posit that market power (the ability to maintain prices higher than marginal costs over an extended period of time) is necessary for an industry's participants to be able to recover fixed investments and create long-term returns on equity that exceed that of firms in other industries. From the perspective of profit theory, industrial concentration (the extent to which market share is concentrated among a few firms) and barriers to entry (which prevent new firms from competing with incumbents) support explicit or tacit collusion which reduces price rivalry and increases producer surplus (i.e., price minus cost). Such a view evolved from the fundamental *structure-conduct-performance* (S-C-P) paradigm in industrial-organization economics (Bain 1956, 1959; Mason 1939, 1949; Sylos Labini 1956; Modigliani

1958). Collusion-based theories are best known to a management audience, however, from Porter's (1980, 1985) translational "five forces" framework describing threats to market power (*industry rivalry*, *buyer power*, *supplier power*, *threat of new entrants*, and *threat of substitutes*) and its extension into categorizing the creation and capture of value (Brandenburger and Stuart 1996) via the "value net" method (Brandenburger and Nalebuff 1997).

From this very traditional perspective—taught in business schools for most of the 20th century—strategy is seen as the management of a portfolio of capital invested in various profitable businesses. Managerial focus rests on market positioning, tailoring firm strategy to reflect and exploit unique industry characteristics, and establishing and defending a position in product-space close to a sufficiently large body of potential customers but far away from rivals. Key analyses for strategists to perform include the evaluation of industry attractiveness for new capital investments, creation of entry barriers through the prior existence of (or difficulty in creating) physical asset bases, and identification of tactics to exploit product and factor market imperfections. These strategic activities enable a firm to either gain pricing power vis-à-vis the consumer, increasing producer surplus (i.e., price minus cost) at the expense of consumer surplus (i.e., value minus price), or gain bargaining power vis-à-vis suppliers, increasing producer surplus by reducing the costs of key inputs to value creation. Accordingly, the economic profit mechanisms for the firm in this perspective include both Ricardian operational efficiency rents (Ricardo 1817) attributable to power/position over suppliers (e.g., increasing producer surplus through cost minimization) and Bainian monopoly-power rents (Bain 1956; 1959) resulting from sustaining the monopoly price markup (e.g., increasing producer surplus through price optimization) in the face of pressure from competitors and consumers.

Implications of Integrating IT with Collusion-Based Theories

Build and Defend: Protecting Positional Advantages through IT as a Barrier to Entry

Even a purely functional approach to IT investment is certainly sufficient to conclude that IT can enhance the firm's competitive ability to create and capture value through positioning advantages in its industry and/or coordination advantages in its value chain (Porter 1980, 1985, 2008; Porter and Millar 1985). Transcending the functional level, however, yields additional insights into performance. According to collusion-based theories, a primary role of IT investments

at the industry level, for example, is to adjust industry/market entry and exit barriers to sustain an industry structure conducive to positive price-cost margins for all incumbent firms, possibly including those that do not invest. Large-scale capital investments in IT can serve as barriers to entry or exit for an industry: to entry, because of their large initial capital requirements and uncertain prospects for the timing of their recovery (if ever); to exit, because these investments are specialized to the firm's continuing operations and have little salvage value if the firm ceases its operations.

If competing in an industry requires substantial initial investment in IT resources and ongoing investment to maintain complementary capabilities (e.g., for a telecommunications firm that must develop the infrastructure on which to base its product and service offerings), these investments signal commitment on the part of the incumbent to defend its market (making it "tough," in the sense of Bulow et al. 1985). The fear of competing against such a tough firm serves as an incentive-based barrier to entry, discouraging other potential rivals from deciding to compete in the market even though it is technologically and financially possible for them to replicate the incumbent's investments (an example of a "top dog" strategy *a la* Fudenberg and Tirole 1984, since the firms' investment strategies are strategic substitutes). The twin disincentives arising from combining of the sheer size of such a required IT investment (a large negative initial shock to profitability) and the prospect of limited future profitability (a slow and uncertain flow of contribution) when competing against an incumbent firm that has already made such an investment can dissuade prospective competitors from entering an industry. Even if the required capital sums to undertake the investments can be raised by the (presumably small) new entrants, the market share and profitability required to make these investments attractive may not be achievable in the presence of a tough and committed incumbent—and thus these entry-enabling investments cannot be justified on a financial basis, effectively preventing entry.³

Likewise, if an incumbent firm has already sunk a substantial investment into developing industry-necessitated, asset-specific IT investments, this legacy position can serve as an impediment to its exiting an industry, leading to unusual

³ A very interesting asymmetry relevant to investment justification also arises: the entrants must, in the process of raising capital or allocating internal resources to such IT investments, construct a business case for their economic return, whereas the incumbent, having already made these investments and sunk their costs, is under no such burden to justify them. Such an asymmetry, however, does not seem to have dissuaded incumbents from devoting substantial resources to quantifying the benefits of their past investments, even though these costs are already sunk.

pricing dynamics (Sutton 1991). The size and scale of these types of asset-specific infrastructural IT investments lock the firm into its current course to some extent, and thus may prevent the firm from being able to utilize its IT investments for other purposes; the embodiments of these past investments become both firm- and market-specific and thus practically valueless outside of their current deployments. This peculiar process of transforming flexible assets into inflexible ones creates a strategic commitment to fierce defense against prospective new entrants (Croson et al. 1998; Ghemawat 1991), which protects the incumbent firm's position as noted above. Given that incumbents are unable to repurpose their investments or exit the market without a substantial write-off or complete abandonment of the assets, collusion-based theory predicts that they will be stuck in the market and committed to the strategies enabled by their legacy investments. Should these carefully crafted entry barriers fail, these incumbents will suffer from post-entry rivalry—the intensity of which all anticipate to be severe and prolonged given that a fixed market quantity must be divided among more participants, exit is very costly, and a large portion of the incumbent's overall cost structure has already been sunk. Such high-intensity rivalry would seriously undermine the collective profitability of both incumbent and entrants; high average costs (caused by enormous fixed costs) combined with low variable costs (as characterize many telecommunications, digital media, and IT services industries) is a recipe for intense price competition and disastrously low profitability unless the rivals can reach some tacit accommodation on pricing, product differentiation, or market division.

This rivalry within the industry—once entry has occurred—is the central force in Porter's (1980) five forces model. In industries with intense rivalry (usually caused by many small competitors, each with ample capacity, offering undifferentiated products), price competition redistributes surplus (value) from producers (i.e., firms) to consumers and thus lowers firms' returns on sales, assets, and equity (i.e., shifting value capture from producers to consumers). Unless rival firms can explicitly or tacitly collude and coordinate with one another, they cannot capture any of the value they create—not even to recover their fixed costs.

Industrial-organization economics has also long noted that the seemingly most competitive markets can also be the ones in which tacit collusion is easiest to sustain. Because of the large profitability difference between implicitly collusive (monopoly or cartel) pricing and perfectly competitive pricing (at marginal cost), market participants have strong incentives to cooperate with one another—or at least choose some form of differentiated competition in place of direct, head-to-head price competition. The theory of cartel stability (e.g., Abreu

1986; for a summary, see Chapter 5 in Fudenberg and Tirole 1991) indicates that industries can sustain monopoly pricing over time only if single-period deviations (cheating) are not attractive for individual members. The monetary temptation to cheat is determined by the product of three critical factors: (1) the number of such customers that can be switched to the price-cutting firm for a price cut of a given size; (2) the incremental profit gained from switching each of these customers from a rival to the price-cutting firm; and (3) the length of time (measured in number of purchases per customer) such switched customers stay loyal (or at least faithful) to their new supplier.

Enter the IT Dragon: Rethinking Potential Entrants' Effects on Industry Structure

The competition-limiting effects of committal investments on industry structure and profitability also follow the theoretical predictions of Schwartz and Reynolds (1983) and Fudenberg and Tirole (1987), the four of whom upturned industrial-organization economists' thinking about barriers to entry, the value of incumbency, and the theory of anticompetitive behavior and antitrust. Before the appearance of these works, contestability arguments—in which the mere threat of future competition was deemed sufficient to make markets competitive and to eliminate the opportunity for incumbents to make extraordinary returns, even though no entrants actually ever arrived to disrupt incumbents' profitability—were briefly hailed as an “uprising in the theory of industry structure” (Baumol 1982, p. 1). For the proponents of contestability to be correct, argued Schwartz and Reynolds, these prospective entrants would need to possess superpowers—the ability to instantaneously create capacity, change prices, capture customers, make sales, reap profits, sell their capital, and exit (with an option to re-enter later) before incumbents could react. To assert that new entrants could accomplish all this, it was argued, was ridiculous: prices could be changed quickly, quantities more slowly, and capacity more slowly still—all mainstay assumptions of the formal economic modeling of competition in the late 1970s (see Dixit 1980; Salop 1979; Spence 1977).

Fudenberg and Tirole (1987) further formalized this critique with several game-theoretic models of rent-dissipating competition that attempted to weaken the required superpowers assumptions, showing in the process that under no conceivable circumstances did the predictions of contestable markets hold as an equilibrium of any entry and pricing game unless the entrants had some sort of grossly unfair advantage in reaction time and flexibility. Contestability theory softly and silently vanished as an explanation of industry structure

and game-theoretic methods came to the forefront of strategy theory—just in time to dovetail with the arrival of a disruptive method of IT-supported competition documented in the strategic MIS literature.

In an age of multimillion-dollar mainframe computers, the logic of incumbent dominance seemed unassailable. The “entrant superpowers” argument (Fudenberg and Tirole 1987; Schwartz and Reynolds 1983), however, can also be interpreted as a specific prediction about the nature of competition in an e-commerce market structure that did not actually exist when these works were published, but which would become so commonplace in the late 1990s as to become the new standard.

These models clearly identified the critical assumptions about the capabilities of entrants relative to those of incumbents that would make markets newly vulnerable (Clemons et al. 1996). If potential entrants were somehow to acquire these superpowers, the whole industry structure would then change to a contestable one and incumbents would need to take dramatic action or face entry that would destroy them (a process that came to be called “being Amazoned”). No longer would incumbency in digital industries be considered a guaranteed path to profitability; barriers to entry would fall and the average tenure of firms in these industries would shorten. In the absence of these entry barriers, the threat of imminent competition by an entrant would force large players to moderate their use of pricing power (a direct driver of sustained profitability in the collusion framework).

Reacting to the mere *threat* of entry in digital industries would thus lead incumbents to drive their own prices down to average cost, eliminating economic profits and leaving barely adequate returns on capital. Returns on sales, assets, and equity would all fall in industries that could be targeted by such super-entrants, even if these entrants never actually arrived. As noted in Clemons et al. (1996), early strategic information technologies provided many new entrants with exactly these key information advantages, which enabled them to out-compete incumbents with new PC-based IT—even before the advent of internet technologies that took ease of entry to its logical extreme. Given that this now well-established pattern of IT investments in digital industries disproportionately favors entrants over incumbents, the entry-chilling ability of anticipated intense future rivalry has become tepid, which ought to lead scholars to question the appropriateness of relying on traditional collusion-based theories of profit without explicitly considering how competition will play out in digital industries once entry occurs. A research program in digital strategy that seeks to predict firm and industry performance must thus combine analysis of pre-

entry industry structure with explicit models of post-entry competitive conduct.

Hide and Seek: Information Technology, Price Transparency, and Post-Entry Rivalry

Price transparency in internet markets offers an excellent opportunity to go “back to the future” by integrating the classic insights of the S-C-P paradigm (discussed earlier) with new, previously unenvisioned theories of dynamic competition in digital markets. Internet technologies contributed to substantial changes in rivalry through their effects on reducing search cost and enabling price discovery (Anand and Aron 2003; Brynjolfsson and Smith 2000, 2001; Geoffrion and Krishnan 2003; Hann and Terwiesch 2003). Price transparency on the internet is a frequently researched phenomenon, with several empirical studies showing that prices do not fall to marginal cost even in a seemingly frictionless, perfectly competitive environment. The earliest studies (Brynjolfsson and Smith 2000, 2001) emphasized differentiation at the firm level and consumers’ desire for retailer attributes other than the lowest price. Price-search agents (shopbots) would seem to increase rivalry to its maximum by creating transparent markets, allowing potential customers to find the lowest price by, in effect, paying one small search cost to examine prices at hundreds or thousands of cyber retailers, rather than many larger search costs in searching for brick-and-mortar competitors. Even in the presence of near-zero search costs, however, competitive prices are not guaranteed; Diamond (1971) showed that even a small search cost sufficed to make the monopoly price one equilibrium of a multiple firm pricing game, even in the absence of explicit collusion.

Challenges to Effective Integration of IT and Collusion in Empirical Studies

Challenges to collusion/coordination perspectives have motivated powerful advances in the strategic management field during the past five decades (including development of theories of governance, competence, and flexibility). Such criticisms often involved the static nature of the industry structure perspective (which explicitly ignores the feedback effect of market conduct on future industry structure) as well as its limited applicability to less stable industries and more dynamic environments. These underlying issues pose additional challenges to the effective integration of IT with collusion-based perspectives in empirical research, particularly given the instability and highly dynamic nature of many technology-dominated industries. Given that IT investments may affect post-entry rivalry in an unusual direction

(with investments intended to increase competition sometimes dampening it, and vice versa), the empirical evaluation of such IT investments becomes problematic without an underlying theory of how the technology affects marketplace competition. Understanding the interplay between the technology and the firms' strategies is essential to understanding the dynamics of, and predicting the profitability of firms located in, these perfectly transparent but imperfectly competitive markets.

Governance-Based Theories and Information Technology

Governance-based theories involve the efficient organization of transactions, focusing on the choice between price-mediated market transactions versus authority-based hierarchy structures for coordinating a firm's activities (Williamson 1975, 1979, 1999). Governance perspectives evolved from the work of Coase (1937) and Barnard (1938) and were built upon later by Alchian and Demsetz (1972) and Jensen and Meckling (1976) as well as Williamson (1975, 1979, 1999), whose name is most closely associated with the theory. There are two economic profit mechanisms for the firm in governance perspectives. The first is the familiar Ricardian operational efficiency rents (Ricardo 1817) created by efficient governance of the performance of the firm's operations and activities—increasing producer surplus (price minus cost) through efficiency-based cost minimization to reduce the costs of creating a given level of value. The second is Coaseian transactional efficiency rents from avoiding unnecessary costs (Coase 1937) of coordinating these economic activities.

The Nature of Governance-Based Theories of Profit

A perfect governance structure efficiently partitions activities, separating those that should be performed inside the firm from those that should be performed outside the firm. Accordingly, the two most common governance perspectives from the strategic management literature—transactions costs and agency costs—focus on minimizing particular costs of deviating from an ideal governance structure.⁴ The transactions cost (TCE)

⁴A number of alternate models of IT governance that do not invoke either transactions costs or agency cost theory also exist in the MIS literature (e.g., Weill and Ross, 2004), focusing on implementation of large-scale projects and top-management oversight of major IT investments, policies, and technology choices. Although efficient execution of this type of governance

framework (Williamson 1975, 1979) emphasizes the efficient organization of intra- and interfirm transactions and the avoidance of losses from opportunistic behavior. The agency-cost framework (Eisenhardt 1989; Jacobides and Croson 2001; Jensen and Meckling 1976; Levinthal 1988) emphasizes the costs of aligning (or failing to align) the incentives of the firms' employees and suppliers to act in the best interests of its owners or shareholders. Both governance frameworks facilitate increased producer surplus through efficiency-based cost minimization to reduce the costs of creating value. The agency cost framework also explicitly incorporates the opportunity for the firm's partners to help it increase the level of value created (an effectiveness argument) if incentive-alignment issues can be at least partially resolved.

Implications of Integrating Governance-Based Theories with IT

The past two decades have seen a number of well-grounded theoretical investigations into the role of IT and governance, particularly of the use of IT in the management of supplier networks and monitoring and contract performance. A number of pre-Internet studies examined the role of IT on transactions costs (e.g., Clemons et al. 1993; Gurbaxani and Whang 1991; Malone et al. 1987). These studies were motivated by early, purely theoretical, and largely verbal descriptions of transactions costs (Williamson 1975) and case studies of selected IT investments that epitomized the canonical elements of TCE; the subsequent 30-plus years of theoretical and empirical research in strategic management, as well as the evolution of new IT investment opportunities, have yielded opportunities for substantial refinements of this pioneering work and its conversion into a form appropriate for management practice (e.g., Ross et al. 2006; Weill and Ross 2004).

Nearly all of the early MIS literature emphasized the frictional elements of transactions costs such as search, specification, and contract negotiation (which can be greatly reduced via improved coordination); only Clemons et al. (1993) explicitly addressed the problems of opportunism and transactions risks, which are the primary focus of 21st century strategic management transactions cost research thus far (Lajili and Mahoney 2006). Croson and Jacobides (1997) offered a simple benefit model emphasizing the monitoring role of IT in both the firm and the electronic marketplace when a new e-commerce opportunity allows the firm to expand its scope but forces

is critical to firm performance, we note that this type of governance is essentially functional and project-based rather than *strategic* in the sense of creating or capturing value in a market or value chain.

coordination challenges upon it. Bakos and Brynjolfsson (1997) and Lajili and Mahoney (2006) separately noted that IT changes both the absolute and relative size of key costs that determine governance tradeoffs. Identifying specific IT-attributable ways to mitigate these contractual hazards remains an important open question with implications for strategy as well as MIS research.

A second set of late 20th century models used an agency-cost framework, which fundamentally focuses on trading off the improved allocative efficiency from delegating the tasks to the outside agent (outsourcing) versus the reduced profitability when surplus is captured by the outside agent. Multiple works examined the role of IT on the optimal number of suppliers to contract with, given that these suppliers must be given incentives to perform. Wang and Seidman (1995) observed that the cost of adding suppliers to an EDI network is more than simply “hooking them up,” as they exert negative externalities on each other and must be compensated to participate (an issue examined further in Yoo et al. 2002). Bakos and Brynjolfsson (1993a, 1993b, 1997) emphasized suppliers’ reluctance to make relationship-specific investments because they risk becoming more committed to the relationship than the buyer is (echoing the fundamental transformation from a competitive market to a small-numbers bargaining problem, a seminal result originally noted in Williamson 1975), and thus vulnerable to exploitation. Cowen and Glazer (1996) even noted a potential downside from higher accuracy in performance evaluation, observing that more accurate monitoring removes the incentive for suppliers to excel one iota beyond a targeted cutoff level of performance, which for risk-averse suppliers means reduced effort will be invested.

We also note a substantial literature on the governance of IT (particularly in the outsourcing arena—e.g., Hirschheim and Lacity 2000; Lacity and Hirschheim 1993, 1995). While IT-specific issues about project governance, systems development, and software specifications certainly arise and their resolution affects performance, these issues (and their performance implications) are quite different from the concept of governance *via* IT, a business-strategy level issue.

Challenges to Effective Integration of IT and Governance in Empirical Studies

Governance perspectives have historically been the most-utilized theoretical frameworks in traditional strategy research on firm scope, strategic alliances, managerial incentives, and the management of relationships with suppliers. While a rich empirical tradition tests transactions cost theories (Crocker

and Masten 1988, 1996; Joskow 1985; Klein et al. 2005) and an even richer theoretical tradition models agency-cost theories (Holmstrom and Tirole 1989; Laffont and Martimort 2002), the empirical testing of agency cost theories has been challenged with the problem of operationalizing measures for the performance of governance constructs (David and Hahn 2004; Geyskens et al. 2006), a problem familiar to empirical MIS researchers as well.

Persistent measurement issues, impeding the effective calculation of the marginal impact of IT-improved governance on firm profitability, offer one reason why business-level governance perspectives have not been adopted more widely in the empirical MIS literature. For example, the proper measure of IT’s effect on agency costs depends on an unobservable counterfactual: contrasting the effects of the actual (and observable) choices that the firm made in the presence of IT against the effects of the unobservable choices that it did not make, which would have occurred in the absence of the IT. In the absence of such counterfactual data, an extensive theoretical tradition in modeling agency cost theories has arisen to infer the magnitude of these costs and suggest cost-minimizing contractual solutions (for a truly extensive survey, well beyond that provided by Levinthal (1988) and Eisenhardt (1989), see Laffont and Martimort 2002). Because the theoretically constructed optimal contracts outperform all other feasible alternatives, they can be concluded to be superior to any specific unobserved counterfactual, albeit by an unspecified amount. The lack of a specific counterfactual, combined with the concomitant lack of quantifiability of the difference between the counterfactual and the ideal, leads to a systematic and predictable estimation bias: an inevitable overestimation of the contribution of IT in governance projects actually undertaken. Given that these costly projects were undertaken at all, their initiators must have anticipated high gains, yet the effects of their decisions are measured *ex post* against the performance of a control group composed of mixed high- and low-impact investment opportunities, a classic confound between the selection and treatment effects (Ashenfelter 1978; Heckman 1979; Heckman and Robb 1985). A more evidence-based evaluation policy is sorely needed to correctly attribute and quantify the benefits of these IT initiatives to improve governance and collect the profits associated with its improvement.

Governance benefits are especially hard to isolate from other sources of IT benefit for a second reason as well: the governance role complements other theories of firm profit (as explored in Makadok 2011). IT can support or structure the firm’s relationships with (and potential control over) its buyers and suppliers, for example, serving as the infrastructure for a marketplace and/or exchange mechanism for

sourcing, outsourced manufacturing, and distribution for the firm's products (as is the case with business-to-business exchanges). Such governance decisions explicitly affect market structure, conduct, and performance. Accordingly, IT complements the coordination/collusion argument advanced above.⁵ Furthermore, IT amplifies the firm's abilities to obtain and process information about buyers, suppliers, and competitors (a competence argument, discussed below) creating an information resource which it will use to add value to its capability of choosing among multiple alternatives (a flexibility argument, also discussed below). While these various complementarities between improved governance and other profit drivers are certainly welcomed by firms seeking improved performance, they bedevil empirical researchers seeking to disambiguate their contributions and to pinpoint the magnitude of each.

Governance-based theories of profit, while relatively understudied in the MIS literature, could benefit greatly from improved theory and future data availability. Not only are the benefits from improved governance confounded with its complements, the inherent selection problem caused by the revealed preference of project initiators must be addressed before the treatment effect of IT investment on governance can be isolated (Morgan and Winship 2007). Methodological improvements bringing empirical studies of organizational governance up to the scientific standards of social science as a whole could greatly facilitate the integration of these crucial issues, illuminate the effects of IT investment on governance contributions to firm performance, and give IT investments their true credit due.

Competence-Based Theories and Information Technology

Competence-based perspectives emphasize the resources and capabilities that the firm can draw upon to create and capture value. These resources and capabilities may be variously inherited by the firm from its history, bestowed by chance, or built by conscious managerial action to develop and harvest their fruits. It is the effective utilization of these resources and capabilities at the firm level—as opposed to the structure of the firm's industry, a collusion-based concept—which determines the firm's profitability.

⁵Note that this role of IT also implicitly complements the collusion-based theories by setting the level of competition between suppliers (the opposite of concentration or collusion) at the precise level that mostly benefits the purchasing firm; this level of competition can be set high to encourage low prices, low to encourage investments in quality, or an optimal combination of both (Valluri and Croson 2005).

The Nature of Competence-Based Theories of Profit

The first competence-based theory, the resource-based view (RBV) of the firm (Barney 1986; Lippman and Rumelt 1982; Wernerfelt 1984) became popular in the 1990s (Barney 1991; Peteraf 1993) and has remained a dominant perspective in and beyond the strategy field ever since. The RBV was also contemporaneously extended into the *knowledge-based view* (KBV) (Grant 1996; Kogut and Zander 1992; Spender 1996), in which knowledge was identified as the key inimitable resource that could not be easily replicated through market asset purchases, and to incorporate capabilities, in which the specific, intangible, nontradeable abilities that could survive an ownership transfer were counted as firm resources (as in Barney 1991) and those that could not were treated as capabilities rather than resources (as in Amit and Schoemaker 1993). Williamson (1999) noted that these formal competence-based theories evolved fairly recently, but trace their roots back to Ricardo's (1817) arguments on resource scarcity, Penrose's (1959) theory of firm growth, and Demsetz's (1973, 1974) arguments about the theoretical insufficiency of the S-C-P paradigm (as discussed previously and noted in Makadok 2010, 2011).

Experiencing rapid growth in the past two decades, RBV has steadily eroded the collusion/coordination theories' half-century lead to become the credible alternate perspective of firm profitability taught in business schools and is certainly currently the most popularly debated (and cited) theoretical paradigm among scholars in the Strategy and MIS fields. The applicability of the core theoretical assumptions of RBV have received only relatively modest scrutiny (e.g., Kraaijenbrink et al. 2010; Preim and Butler 2001), however, and thus have evolved only minimally despite hundreds of RBV-based empirical examinations over the past two decades (Armstrong and Shimizu 2007; Barney et al. 2011; Crook et al. 2008; Newbert 2007, 2008). Identifying IT-specific effects on the tenets of the RBV (and vice versa) thus suggests itself as a prime avenue for intellectual integration of the Strategy and MIS fields.

The economic profit mechanism for the firm in competence-based perspectives focuses on the balance between value creation and value capture. The firm must trade off efficiency (i.e., maximizing joint profitability through value creation) through the effective use of resources against the distribution of returns from its efforts, which must be shared between the resources themselves and the firm (i.e., maximizing producer

surplus through value capture).⁶ Therefore, while a resource may help a firm to create substantial economic contribution (value minus cost), the firm's objective in an arms-length, market-mediated transaction is not the maximization of joint benefit but of the amount of value captured, or producer surplus (price minus cost). The RBV emphasizes that maximizing $v-c$ is both mathematically and practically different from maximizing $p-c$, and thus that much of a firm's competitive advantage (a higher $v-c$ than rivals', a definition examined in Postrel 2006) may not translate into above-average unit margins (a higher $p-c$ than rivals'). In particular, if factor markets (e.g., suppliers) for key resources that drive v are not competitive, the firm may dissipate all of its rents (i.e., the value it captures from use of the resource in the market) to acquire and maintain the supply of these scarce and valuable resources (Barney 1986; Teece 1986). This value passes through the firm's hands, but ends up accruing to the resource supplier, leaving the firm with no net gain. Because of its role as a conduit of this value, even a firm with a large competitive advantage may thus be left with no extra profit after paying for its resources, even though these exact resources provided its ability to create extraordinary value compared to its rivals. Interestingly, the reduction in profit from this factor-market problem falls under the competence theory of profit but the gains from common strategic investments (i.e., dedicated suppliers, long-term contracts, vertical integration, standardization) made to avoid these costs clearly fall under the governance theory, suggesting an unexplored theoretical link between the *ex ante* motivators of IT investments and the *ex post* attribution of their contributions to profitability.

Implications of Integrating Competence-Based Theories with IT

Since the popularization of the RBV in the early 1990s (e.g., Barney 1991), scholars in both the Strategy and MIS fields have leveraged competence-based theories to examine the relationships between IT and strategy. Some author teams (e.g., Mata et al. 1995; Powell and Dent-Micallef 1997) made early attempts to bring strategic frameworks into the MIS context or IT into the strategy context, publishing early work in *MIS Quarterly* and *Strategic Management Journal*

examining the concept of IT as a source of sustained competitive advantage. A major role of IT in competence-based theories is to support the creation and capture of value through digitally enhancing a firm's existing resources and capabilities and/or enabling new capabilities (Drnevich and Kriauciunas 2011; Piccoli and Ives 2005; Ray et al. 2004, 2005). The claim that IT does not create differentiation by itself and thus cannot "matter" (Carr 2003, 2004) is consistent with a key underlying assumption of the classic analogy of IT as a magnifying glass: a technology for increasing the magnitude of the impact of existing resources rather than for creating new strategic benefits as a stand-alone resource. For firms seeking a competence advantage from investment in resources, IT is thus often best suited to play the role of a resource multiplier, an enhancer of existing capabilities, or an enabler of new capabilities in conjunction with the existing resource portfolio rather than a stand-alone resource, since most IT, while valuable, is not inimitable or rare (a key criterion noted in Barney 1991).

In such roles, IT that is effectively implemented and integrated with the firm's existing resources and capabilities (and business processes) will improve the firm's performance, whereas investments in "off-the-shelf" IT, unimaginatively utilized, will not. Such an approach is wholly consistent with prior theory development in the RBV on firms' demand for complementarity between resources and capabilities (Hoopes and Madsen 2008; Hoopes et al. 2003; Makadok 2001; Winter 2003). Furthermore, such an "IT as a magnifying glass" view is also consistent with arguments that the profit-contribution potential of external resources (particularly those commonly available to rivals, such as off-the-shelf IT systems) is likely limited to their ability to enrich or reconfigure a firm's preexisting internal resources and capabilities (Branzei and Thornhill 2006; Montealegre 2002; Schroeder et al. 2002). Off-the-shelf technology investments clearly are resources that other firms can observe and imitate, but these investments can magnify the importance of a firm's preexisting unobservable and inimitable internal resources and capabilities, and thereby increase the profits that can be derived (and retained) from investing in such non-IT capabilities.

Challenges to Effective Integration of IT and Competence in Empirical Studies

The competence-based theory of profitability when applied to frame the IT investment–performance relationship comes with its own measurement issues, again tending to overemphasize the apparent contribution of IT to performance. IT investments that complement previously accumulated resources

⁶Our discussion focuses on resources. As capabilities in the Amit and Schoemaker (1993) sense do not trade in an underlying factor market, they do not "get paid" in the same way as resources, and thus do not dissipate rents. We believe that examining the extent to which various forms of IT investment affect the resource/capability balance inside firms, potentially insulating firms from these imperfect factor markets (and thus increasing their retained profitability) is a fertile opportunity for future research.

appear highly profitable, as they unlock value from existing underutilized investments (Nolan and Croson 1995). Furthermore, the RBV theory predicts that the value thus unlocked will not be dissipated, since the IT itself comes from a competitive market and the complemented resources have already been paid for. The combination of sequential investment and value retention leads to a strong empirical impression not only that IT causes the advantage, but that IT investments yield more retained profit than other types.⁷ Finally, although the IT investments *per se* can certainly be imitated, an imitating firm which lacks the underlying resources and capabilities to be magnified will not experience the same “unlocking” gain. This unseen asymmetry will result in the estimation of a weak statistical relationship between IT investment and performance when all firms invest (i.e., due to strategic necessity, as in Clemons and Kimbrough 1986), but the presence or absence of complementary assets cannot be simultaneously observed by empirical scholars examining even firm-level performance data.

We do not find the numerous attempts at integrating IT with competence-based theories (and the author overlap between the two literatures) to be particularly surprising. When explaining (as opposed to predicting) firm performance is the goal, IT and competence theories enjoy high face validity. Furthermore, many of the underlying constructs of interest in MIS research (e.g., IT-based firm resources and capabilities) are similar to strategic management’s competence-oriented focus on resources, capabilities, and knowledge as potential sources of competitive advantage and superior long-term return on equity. From reviews of the MIS literature (e.g., Piccoli and Ives 2005) we also observe that articles grounded in the analysis of IT resources, or focused on the use of IT to create ordinary, noncomplementary capabilities (i.e., functional competence-based perspectives) are a dominant theoretical motivation for MIS research (see Drnevich and McIntyre 2010).

While more than a decade of MIS scholarship (e.g., Andreu and Cibbora 1996; Bharadwaj 2000; Gordon et al. 2005; Ray et al. 2005; Tarafdar and Gordon 2007; Wade and Hulland 2004) has offered rich insights germane to strategy scholars’ understanding of the application of competency-based theories in the IT context, these contributions have not been fully incorporated into the strategic management literature, judging from the sparse citation pattern. Although the strategy literature did not give the IT construct the focal attention

it received in the MIS literature during the same period, strategy scholars often viewed IT as a context for or embodiment of resources or capabilities, but (in contrast to the magnifying-glass approach) not particularly prominent to a firm’s competitive differentiation.

Over the last decade, cross-domain author teams have begun an attempt to elevate the role of IT in the strategy literature. Tippins and Sohi (2003), publishing work in *Strategic Management Journal*, examined organizational learning as the possible missing link in the hard-to-detect relationship between IT competency and firm performance. Another cross-domain author team (Ray, Barney, and Muhanna 2004; Ray, Muhanna, and Barney 2005) has made attempts to explore and exploit the dichotomy between the strategy and MIS domains, publishing work from a single integrated research stream in both *Strategic Management Journal* and *MIS Quarterly*, examining the links between capabilities and business processes, and evaluating IT and performance from RBV perspectives.

Such integrating contributions are particularly important given the interplay between capabilities and the IT investment decision: the firm’s capability of managing specific IT resources (Clemons and Kimbrough 1986; Mata et al. 1995) complements two key capital investment decisions. The first is the firm’s ability to choose a specific value-maximizing level of capital investment in IT (e.g., Brynjolfsson et al. 2002; Yang 1994); the second is to pick the correct IT resources in which to invest (e.g., Makadok 2001). Such capabilities of investment selection and deployment magnify the role of IT investments in determining firm-level competitive differentiation and thus offer a theoretical rationale to explain variation in firm performance (Carr 2004).

Ongoing debate regarding the theoretical clarity, empirical support, and scope of applicability of competence-based theories may also explain some of their observed lack of efficacy in evaluating IT investments or utilization. In particular, debate over their degree of empirical support (Armstrong and Shimizu 2007; Combs et al. 2011; Crook et al. 2008; Newbert 2007) distinguishes the solidity (or lack thereof) of the theoretical underpinnings of competence-based theories from those of market structure and tacit collusion (see Armstrong and Shimizu 2007; Priem and Butler 2001). Such critiques also extend the application of these theories to IT, creating statistical ambiguity at best, and potentially insurmountable theoretical challenges for prescriptive MIS studies at worst. However, we maintain, for the variety of reasons espoused here, that competence-based theory offers unique contributions to both strategy and MIS, and that it should continue to receive refinement and reinforcement in the literature, albeit

⁷If the previous complementary resources were observed by the decision makers but not the researcher, this overestimation of the treatment effect is a classic example of sample selection as a form of omitted variables bias (Heckman 1979; for an approachable overview, see Jargowsky 2004).

with a closer integration of the domains in future empirical research designs. The challenge to MIS research (and to its strategic management counterparts) is thus to identify specific characteristics of IT that allow disambiguation of the effects of these famously underspecified frameworks, in effect, treating IT investments as a natural experiment (Meyer 1995) within the firm. Even a modest amount of such insight, taking advantage of the MIS community's intimate knowledge of IT-enabled competences to identify the contributions of non-IT competences, would greatly benefit the empirical solidity of both fields.

Flexibility-Based Theories and Information Technology

Flexibility-based theories emphasize the firm's ability to quickly respond to change in a way that either improves its efficiency (price minus cost) or effectiveness (value minus price). Flexibility can improve efficiency through enabling the firm to minimize the costs of adapting to a new situation (i.e., increasing producer surplus through reducing the total costs of creating a product or service that delivers a given level of consumer value). Flexibility can improve effectiveness through enabling the firm to seize an opportunity for extraordinary profit (i.e., increasing producer surplus through creating a new or improved product or service, thereby increasing value to the consumer and repricing to capture it). The flexibility perspective originates from Schumpeter's (1934, 1950) classic concept of creative destruction, in which old practices, businesses, and industries are continually replaced by new ones that are more efficient or effective at value creation and capture. Creative destruction is inherently a dynamic process leading to both the entry of new firms and the exit of obsolete ones; firms that neither enter nor exit when uncertainty is added to the environment must still reconfigure themselves for the new competitive landscape.

The Nature of Flexibility-Based Theories of Profit

The profit mechanism in flexibility-based theories combines several diverse streams of literature in strategic management, including evolutionary views, dynamic capabilities, and real options. Evolutionary views (Nelson and Winter 1982) focus on the assembly over time of workable routines, firm structure, and the organization of economic activity, with the final configuration accomplished through experience and trial-and-error rather than *ex ante* optimal design. Dynamic capabilities (Teece et al. 1997) emphasize firm processes for acquiring,

integrating, reconfiguring, and/or releasing resources that produce a "first-order change" (Winter 2003) in the organization to match or create market change (Eisenhardt and Martin 2000). Finally, *real options* is the strategy concept perhaps most directly applicable to the valuation of IT investments under uncertainty (Benaroch and Kauffman 1999). Real options (Amram and Kulatilaka 1999; Bowman and Hurry 1993; Clark and Baldwin 2000; Dixit and Pindyck 1994; Schwartz and Zozaya-Gorostiza 2003) are a characterization of the immanent flexibility in the firm's stock of resources, the financial results of which mimic options contracts. Like financial call options, for example, a real option may give the firm the ability to acquire a rent-generating resource (such as a new technology) if the resource were to become valuable, without needing to commit fully to the resource before its value-creation potential is fully known. Like financial put options, a real option may give the firm the ability to discontinue an unprofitable activity, divest a losing technology investment, or recover money invested in a past technology resource even though its current market value had dropped below its historical cost. Both options substitute for the organization's imperfect ability to predict the future when it must make strategic decisions such as market entry, positioning, or value chain configuration.

In the flexibility perspective, the economic profit mechanism is Schumpeterian flexibility rents (Schumpeter 1934, 1950). For example, during periods of disequilibrium, opportunities arise that a fast and flexible firm can exploit for superior profitability (the call option story), whereas a slow and rigid firm suffers from the new violation of its assumptions of how to organize. Conversely, during difficult conditions (e.g., high environmental uncertainty, severe economic downturn), a flexible firm can reconfigure itself by reversing previous investments (the put option story), salvaging some value from obsolete resources without incurring significant adjustment costs.

Implications of Integrating Flexibility-Based Theories with IT

IT and Flexibility as Complements to Information, Knowledge, and Decision-Making

Flexibility can serve as a value-creating complement to a firm's knowledge resources and decision-making capabilities. In a Schumpeterian setting, new opportunities and threats continually appear. IT gives a flexible firm the opportunity to exploit these opportunities (e.g., enabling access to markets across the world, or upgrading to a state-of-the-art platform that enables better provisioning of products and services—an

effectiveness gain) or to reconfigure itself to avoid the strategic jeopardy (Nolan 1995; Nolan and McFarlan 2005) caused by a rival's unexpected action that threatens the firm's existence. Without the complementary knowledge of which opportunities are attractive (and which should be avoided), however, this expanded set of options does not create any economic benefit. The practical value of this flexibility depends critically on the information that supports its use.

This strongly conditional value of flexibility, in the sense of having a broader scope of choices (i.e., more opportunities for value creation) and/or a lower cost of reconfiguring the organization when a different strategy is desired (i.e., more opportunities for value capture), may seem puzzling. Flexibility would seem to be an economic benefit—whether or not enabled by IT (as conceptualized in Sambamurthy et al. 2003 and operationalized in Ross et al. 2006). Having a broader scope of choices, however, does not automatically lead to superior decision-making performance in the absence of information (for recent cognitive psychology-based expositions of this effect, see Schwartz 2003; Iyengar 2010). Information on the relative desirability of alternatives is necessary to unlock the value of this broader choice set and a well-structured and effective decision process (perhaps enabled by a decision support system, an IT-embodied complement to flexible business operations) is required to realize this value.

In decision analysis, a decision maker needs information not only on the anticipated results of the choice contemplated, but also on the relationship between the payoff from the choice undertaken and the unchosen alternatives (Lawrence 1999; Raiffa 1970) to make the correct decision. The knowledge resource (and/or the enhanced decision-making capability that incorporates it) from a decision-support system thus serves to complement the organization's flexibility, which is the capability to choose different actions in response to new information. This complementarity increases the marginal benefit of each resource, leading to superadditive values (Athey 1996; Milgrom and Roberts 1995); having more information makes having a given amount of flexibility more valuable, and vice versa. IT-generated flexibility thus integrates two non-IT components whose values are complementary, leading to a higher payoff than separate investments in flexibility and information. While this superadditivity is very welcome to managers simultaneously investing in both initiatives, it leads to a difficult empirical challenge of separating the effects of investments in flexibility-supporting IT and decision-supporting IT. When examining the joint effects of simultaneous investments in these complements, however, an outside researcher's inability to attribute separate individual contributions to information and flexibility investments does not mean that either type's value is zero and can be ignored.

Flex Your Brain: Combining Flexibility-Enabling IT and Decision Support Systems

The strong potential for complementarity between flexibility-enabling systems and decision-support systems offers another, vastly underdeveloped, area for IT to create profitability in a firm whose operations are largely digital. IT can provide firms with the strategic flexibility to respond to opportunities in the environment by enabling the firm to realign in response to an environmental change, quickly innovating and reconfiguring its core activities to apply to new opportunities (Sambamurthy et al. 2003; Ross et al. 2006). If, for example, a firm's capabilities are instantiated in software, the option to rapidly modify it means that the flexibility-DSS nexus contributes to actual profitability (an opportunity also recently foreshadowed in the business press by Mills and Ottino 2012). This new option value from the flexibility-DSS combination arises in addition to the traditional DSS contribution of information that triggers a response to a new environmental opportunity or threat, or the traditional operational value of the flexible IT that supports the day-to-day operations of a flexible company.

As an alternative to viewing the information resource (e.g., DSS) as a complement to flexibility, one could view flexibility as the complement to an existing information resource. Without flexibility, even the most accurate information resource would be of no use, as the organization's actions would be predetermined and could not vary based on the new information, a classic case where information has exactly zero value (see Lawrence 1999, pp. 70-72), in marked contrast to the inseparability argument above wherein information had a positive but indeterminate value.

This mutual complementarity unlocked by sequential investments in flexibility-enabling systems and DSS (or vice versa), clearly holds implications for the correct valuation over time of both types of systems. In the absence of an appreciation of this complementarity among sequential investments, the first resource to be accumulated will appear *ex post* to be valueless (even though it was prioritized) and the second resource to be accumulated will appear (1) disproportionately attractive to invest in *ex ante*; (2) seemingly randomly profitable when compared to other firms making similar investments; and (3) limited by legacy factors from achieving its full potential—all of which are certainly common-enough outcomes of studies of IT investment performance. MIS and strategy scholars must be especially careful to avoid the trap of precision over accuracy (Clemons 1991; Clemons and Weber 1990) in this sequential-investment situation: although the value of earlier investments in information cannot be decoupled from that of the later investments in flexibility,

researchers should resist the temptation to put their estimate of either value at a convenient level of zero.

In this context, the combination of knowledge and flexibility is echoing the effects of dynamic capabilities proposed in Winter (2003), which act on other existing competences to layer, align, and manage the firm's abilities to adapt to change in the marketplace (Galunic and Rodan 1998). While flexibility is a substitute for perfect information about the future (which, if possessed, would obviate the need for flexibility), it becomes a complement for, and increases the marginal value of, imperfect information about the present.

Challenges to Effective Integration of IT and Flexibility in Empirical Studies

Making a statistical connection between flexibility and profit is especially difficult because flexibility is a prospective asset (to be used in the future) whereas profit is analyzed in retrospect; furthermore, real option value (or changes therein) does not show up as a line item on any accounting statement. Observing that a flexible firm, in retrospect, was abnormally profitable offers little insight into how it managed its options to become so; it may have converted its superior flexibility into Schumpeterian rents through the product market in any combination of three very different ways—creating more value than other firms, capturing a larger proportion of it, or avoiding costs that its competitors must bear—all look identical in hindsight. The causal profit connection between superior value creation and capture in flexibility-based perspectives is thus that flexible firms can more quickly and effectively allocate resources and capabilities to respond to new opportunities (or threats) on an ongoing basis, which can create a stream of temporary competitive advantages over their less-flexible rivals. A firm with a flexibility-derived “head start” can experience short-term superior profitability until rival firms respond fully to the opportunity or adjust effectively to the costs of the threat (Makadok 2010, 2011; Teece et al. 1997). Over time, even though none of the specific, individual head start advantages need be durable, the ability to create a continuous stream of these temporary competitive advantages through flexibility (as with innovation, e.g., Christensen and Rosenbloom 1995; Foster 1986) can facilitate sustained long-term superior profitability.

There has been a relatively asymmetric development of the underlying theory in this perspective of profitability (with real options receiving most of the new analytical modeling since 1981). The empirical documentation of the value of these real options embedded in IT investments, however, is particularly problematic, for two reasons: (1) owner-contingent intrinsic

values and (2) time values that cannot be determined in retrospect due to a unique information problem.

IT that enables spontaneous reconfiguration allows its holder to capture and exploit an unforeseen opportunity. The private value of a real IT-embedded call option is thus strongly contingent on its holder's resource configuration and alternatives (as opposed to a financial option, where the option has a well-defined common intrinsic value at expiration to anyone who holds it).⁸ Discussing the intrinsic value of such options without their firm-embedded contexts is meaningless. Furthermore, even if a good estimate of private intrinsic value were determinable, equating the increase in value of one firm as a result of a given option's exercise to the value of the same option to another firm is misleading at best, as the complementary assets of the option are not identical (or even observed) in the two contexts. The very real threat of omitted variables bias, although foreseeable, nonetheless contributes to a lack of generalizability of intrinsic values across firms from identical IT resource investments.

Unfortunately, estimating time value is not any easier. The very existence of real options frequently remains undocumented and unobservable until exercised, whereas the bulk of their value (the analog of time value in financial options) exists at their inception and is often gradually dissipated before exercise (Amram and Kulatilaka 1999; for the MIS perspective on such wasting assets, see Clemons and Gu 2003). While the costs of maintaining a wasting asset are well-documented, however, their benefits may not be. The financial value of real put options, in particular, completely disappears when viewed using historical financial statements; upon exercise, they allow the status quo to be maintained without loss, which appears in financial records to be a *lack* of change in profitability. Although these investments seem to have exactly zero payoff, their economic value comes from their role as insurance against potentially catastrophic loss, and their apparent lack of power to improve firm performance is due not to their lack of value but a failure to observe the correct counterfactual (the catastrophe that was averted). This key measurement failure is an interesting example of the “trap of the wrong base case” in IT investment decision making (Clemons 1991; Clemons and Weber 1990) where the absence of information required to evaluate the IT investment (the consequences of the averted catastrophe) is directly due to the successful exercise of the option embedded in it, which caused

⁸Financial option contracts have underlying securities on whose prices their value is based (and in which form the consequences of their exercise are delivered). By analogy, options to change strategy must have a corresponding underlying strategy; since this strategy has firm-specific values, the option will as well.

Table 2. New Opportunities in Strategy/MIS Research

Theory Perspective	New Opportunities in Strategy/MIS Research
Collusion/Coordination	<ul style="list-style-type: none"> Advantages of new entrants Effects of shopbot-enabled price transparency on collusion Methods of virtual differentiation of seeming commodities
Governance	<ul style="list-style-type: none"> Supplier management using cross-ownership and credible commitment Alignment of incentives to overcome opportunism
Competence	<ul style="list-style-type: none"> Valuation of IT-enabled competences Identification of capabilities for IT management as a source of competitive advantage
Flexibility	<ul style="list-style-type: none"> Information as substitute and complement to flexibility Value of avoiding future fixed costs

the catastrophe to be averted and thus unobservable.⁹ The importance of the unobserved, unchosen, and unsuffered alternatives generates a data issue of unobserved counterfactuals that, on the whole, tend to understate the value of IT-based flexibility, in contrast to the overstatement bias in measuring the value of IT-based governance and competence.

Summary Discussion of Contributions and Conclusions

In this work we offer a diligent attempt to improve the theoretical clarity of the relationship between IT and business-level strategy. We have constructed our synthesis based on the four theories of profit framework (Makadok 2010, 2011) that underpin firm performance in business-level strategy and discussed some canonical roles of IT in determining (and, in most cases, improving) profitability under each of these four perspectives. We then ventured beyond the existing separate IT and strategy literatures to discuss the implications of integrating research in strategic information systems (which evolved in parallel to the mainstream strategy theories, with limited or delayed cross-pollination), with strategic perspectives on each of four theories of profit and their underlying causal mechanisms.

A large number of opportunities beckon for future research into the business-level strategy effects of IT investment, deployment, project evaluation, and innovations. If each literature were to adopt a common framework that integrates

these two fields, which have been working largely in parallel for decades, research in each could advance both. As we argued earlier in the paper, each of the four theories of profit shows clear lacunae in at least one IT-related issue; through pursuit of each of these identified opportunities, it is within the power of MIS scholars to make contributions to the strategic management literature and for strategy scholars to make contributions to the MIS literature. Cooperation in the exploration and exploitation of this key relationship is urgently indicated, and we hope that this paper will help to inspire and motivate such work. Actionable inroads into measurement issues and valuation methodologies will only be made by combining knowledge of strong methodologies with specific knowledge of IT to identify appropriate instruments, disambiguate conflated effects, and avoid the various forms of omitted variables bias discussed above. In Table 2 we offer an overview of some of the integrative opportunities for future research collaboration between MIS and Strategy scholars.

Discussion and Speculation: Out on a Limb

In this spirit of cooperation between the strategy and MIS domains to more fully develop digital business strategy, we will now attempt to identify several high-potential areas of future research that employ this integrating framework. Doing so is a challenging task when applied to the MIS field. Similar attempts at prognostication by other scholars over previous decades have experienced mixed success in identifying the major underlying technological trends in MIS (e.g., PCs replacing mainframes, networking, the Internet, e-commerce, etc.) that create discontinuity in MIS research. Given the inherently dynamic nature of IT innovations, these predictions repeatedly suffer from black swans (Taleb 2007): events on which their originators placed zero probability. Prognosticators in the 1990s who initially completely missed the overwhelming dominance of the Internet on theory and

⁹The "Y2K" problem offers one excellent example of everybody taking precautions for an expected event, then nothing happening, with people then complaining that too much concern and expense had been expressed about the issue

practice in the MIS field, for example, are in good company (Bakos and Kemerer 1992; Gates et al. 1995; Nolan and Croson 1995). We hope to use our newfound identification and explication of the contributions of IT to (digital) business-level strategy and profitability to answer the following questions:

- (1) Looking forward, what are the characteristics of the next generation of questions, issues, and problems?
- (2) What are the un- or under-explored theoretical interdependencies between digital business and competitive strategy?

We now offer five such avenues: our objective is not to be right *per se*, but to be creatively wrong (or at least provocative) in a constructive manner that drives exploration and development of new integrated theories of digital business strategy.

Limb #1: Implications of Internet Data Caps for Unmetered Bandwidth Business Models

Pioneer Stewart Brand (1987, p.202), expanding on his earlier work (1985, p. 49) noted a now 25-year unresolved conflict on the pricing of information:

Information wants to be free. Information also wants to be expensive. Information wants to be free because it has become so cheap to distribute, copy, and recombine—too cheap to meter. It wants to be expensive because it can be immeasurably valuable to the recipient. That tension will not go away. It leads to endless wrenching debate about price, copyright, “intellectual property,” the moral rightness of casual distribution, because each round of new devices makes the tension worse, not better.

As of 2011, 56 percent of U.S. fixed broadband subscribers faced limits or caps on how much data they can download per month (Jenkins 2011), and Verizon joined AT&T and T-Mobile in their move to metering wireless data access, leaving Sprint as the only major service provider in the United States offering unlimited wireless data access for a fixed price (Tibken 2011). AT&T further increased their data prices in 2012 (Bensinger 2012), a move that was matched and exceeded by Verizon in the summer of 2012 when they retooled their wireless business model around mobile data services (Troianovski and Gryta 2012). These observations appear to indicate a trend in which, in the not so distant future, 100 percent of wired and wireless subscribers will eventually face

such caps to internet data transfer (Catan and Schatz 2012; Jenkins 2011) and increased, utility-like, metered fees for data services (Troianovski and Gryta 2012). Information may “want to be free” and the marginal cost of delivering data may be miniscule, but both owners of data-delivery infrastructures (who control the pricing schemes) and government agencies (who supply, license, and regulate the wireless spectrum) (Jenkins 2012), unsurprisingly want to collect prices substantially higher than their marginal costs. Whether the infrastructure providers have the market power (generated by small numbers of competitors and a fixed-cost-heavy structure that commits them to vicious price competition if necessary) to sustain this pricing power over the long run remains to be seen—and if not, whether it will be known-but-unregulated substitutes (e.g., Wi-Fi) (Jenkins 2012) or new entrants with as-yet unforeseen technologies that will unseat these incumbents. This change will present significant competitive challenges to the value-creation and value-capture models of many companies with multibillion-dollar valuations (e.g., Facebook, Google, Netflix, Hulu, Dropbox and other cloud-computing apps, smart phone/tablet providers Apple, and Samsung). It will also threaten the value of strategic acquisitions made by companies in other primary areas (e.g., eBay’s—and now Microsoft’s—Skype, Google’s YouTube, Apple’s iTunes and TV ventures), which are fundamentally based on assumptions of unmetered bandwidth. By the summer of 2012, such concerns by these firms even led the U.S. Department of Justice to begin conducting antitrust investigations of the major bandwidth providers (Catan and Schatz 2012).

What are the implications of the future realities of data access caps for these firms? While major wireless service providers argue that two gigabytes of data usage per month (e.g., enough to download only one 30-minute television episode in HD) (Hyman 2011) is more than adequate for 98 percent of their customers (Tibken 2011), these claims are both fluid—already revised by AT&T (Bensinger 2012; Plank 2012) and Verizon (Troianovski and Gryta 2012)—and highly dependent on underlying consumer demand and unpredictable future media and application usage. Data-storage manufacturers likely held similar feelings only a little over a decade ago about the excessiveness of their two-gigabyte hard drives—a size which currently appears quite modest even for computer RAM or portable USB flash-memory storage, and is incomprehensible as a hard drive capacity. Given such past and current observations of technological change, firm behavior, and consumer demand, we believe that a better integration of strategic management theory and IT knowledge can tell us about what will (and won’t) happen to the future structure, conduct, and performance (not to mention the strategic interactions among players) in these complex and complementary value chains.

Limb #2: IT-Enabled Price Transparency Leading to Newly Uncompetitive Markets

Earlier, in the section on collusion-based theories, we discussed using IT to support barriers to entry. In that section, we noted three key factors supporting stable and profitable markets: (1) the number of customers switching after a price cut, (2) the incremental profit of serving these new customers, and (3) the length of time that they stay loyal. Given that IT has effects on all three of these factors, we expect a complex and nonmonotonic relationship between IT and competitiveness (and thus future profitability). Ironically, the (IT-enabled) price transparency provided by shopbots may reduce a market's overall competitiveness, dampening rivalry rather than intensifying it (opposite of commonly accepted arguments and expectations). Shopbots, in addition to informing customers, can also be used by competitors to get instantaneous feedback on their rivals' prices—supporting quick reactions to changes in rivals' pricing policies and potentially limiting the effectiveness of price competition among close rivals.

One potential explanation for such conflicting observations may be cartel-stability arguments, as price-matching policies have been long-known to have potentially anticompetitive outcomes (Corts 1996; Edlin 1997; Logan and Lutter 1989; Salop 1986) even in non-digital industries. The ability to see competitors' price moves and react to them instantly acts as an implicit price-matching policy, provided that it is a capability conspicuous enough that all rivals understand it to be pervasive in the industry—a clear case of an IT-based capability *reducing* the overall strength of rivalry in an industry.¹⁰ Such rapid response also supports Schwartz & Reynolds' (1983) flexibility-based argument that firms can change prices very quickly in the short run, yet the combination of this competence in getting quick feedback and the flexibility to act on it also makes the pricing structure of the industry collusive rather than competitive, a rare convergence of *three* IT-based profit drivers (competence, flexibility, and collusion).

The existence and popularity of shopbots thus has ambiguous predictions on the intensity of price competition in an online market. If most customers use shopbots, a small price change in a transparent environment will move a large number of customers to the price-reducing firm (increasing the number of customers switching after a price cut, which is factor (1) above). Given this effect, even a small price change is enough to move a large number of customers (increasing the

overall profitability of the customer base, which is factor (2) above), implying that even small price cuts become attractive. If a large fraction of competitors also perform price monitoring, however, these small price cuts can be quickly detected and matched by rivals (decreasing the length of time that the newly-acquired customers stay loyal, factor (3) above), which eliminates much of the gain, and thus the incentive to make price cuts in the first place. If only a small fraction of *customers* use shopbots, but a large fraction of *rivals* use the technology to monitor competitors' actions, the net effect can easily be a movement toward collusion rather than competition, even though the industry appears to be highly price competitive.

Such anomalies and confounding observations warrant further exploration in future research by scholars in both the strategy and MIS domains. In this convergent area of research, such hypotheses are prime targets for testing by both lab- and field-based data.

Limb #3: Piggybacking, Isolating Mechanisms, and Judo

IT-enabled "price piggybacking" (Clemons and Weber 1990; Stuchfield and Weber 1992), in which prices are matched opportunistically without commitment to providing substantial inventory quantity (in goods markets) or liquidity depth (in securities markets), predates shopbots. Business model piggybacking, in which a large number of extremely similar rivals quickly imitate an early entrant in hopes of getting a small portion of a large market (e.g., Groupon and dozens of virtually identical group-discount buying services in 2011; Raice and Woo 2011) seems to support the idea that IT can be employed to overcome barriers to imitative entry rather than creating or enhancing them (as we argued earlier). An analysis of the role of IT in creating (or overcoming) isolating mechanisms that slow, deter, or prevent this imitability (Rumelt 1984) would be a marvelous integrative research opportunity.

Specific information about incumbents can be extraordinarily valuable to flexible prospective entrants. At the extreme level, Hirschleifer (1971) obliquely noted that publicly traded incumbents provide a subtle source of financing for new entrants; the private knowledge that a rival would be damaged by your entry, combined with an efficient capital market and the possibility of short sales of the incumbents' shares pre-entry, should generate enough capital to start a "spoiler" business (Hansen and Lott, 1995). The value of such "judo strategies" (Gelman and Salop 1983; Yoffie and Kwak 2001, 2002a, 2002b), which use an incumbent's strength against it,

¹⁰We should note that the threat to match a lower price is automatically credible, as without such price-matching the higher-priced firm would receive 0 percent market share, putting an upper bound of 0 on profit.

is magnified by information—leading to an obvious role of IT in strategic planning even before a firm actually comes into existence through entry into its first market. Advances in our understanding of the role of IT in the tactics of these new firms will greatly bolster the emerging field of entrepreneurial strategy.

Limb #4: Augmented and Virtual Worlds and Strategic Decision Making

Smartphone's GPS location-based services and social networks (short of major changes in data privacy laws) provide firms with vast amounts of data on their customers' locations, behaviors, and interactions. Such data, while a rich source of information for targeted-marketing purposes, also provides firms with the ability to track customers' activities in real-time to develop and provide augmented reality services to the consumer (Boehret 2011). Dynamic couponing (offering price discounts to physically nearby shoppers) seems to be the dominant application thus far (Raice and Woo 2011). Presumably, there are other real-time actions which can be informed (and their results improved) by this information; its reliable availability will thus become a capability that supports innovative and profitable business strategies and complements the flexibility inherent in the technology platform. The potential value of such dynamic information services is also likely a factor in the numerous changes and revisions in privacy policies at companies such as Google, Facebook, and Apple.

Further, such integrated lifestyle and locational behavioral data provide the essential DNA-style building blocks for complex intelligent-agent based virtual-world simulations, which could allow firms to create evidence-based synthetic realities of entire markets, industries, national economies, and other complex multi-agent systems (e.g., Chaturvedi et al. 2011) facilitating more accurate strategic planning, forecasting, modeling of consumer behavior, government regulatory responses, and other decisions. Such an approach is in direct contrast to current theoretical simulations, whose structures are predetermined even though their parameters are calibrated using real-world data. Model-agnostic techniques, based on real-time data, capture hidden or emergent relationships (even though they are unknown or poorly understood) much as an auction enables price discovery even for a good whose worth the seller does not know (Ashenfelter 1989). Although such simulation models are critiqued in the academic literature for their conspicuous omission of a theoretical model of the underlying process (Chaturvedi et al. 2011), they are particularly attractive for business application. Simulation models implicitly incorporate information that

decision makers do not realize that they possess, an example of causal ambiguity (Lippman and Rumelt 1982) at even the single-firm level. We expect that, eventually, these models' predictive usefulness will more than compensate for their lack of explanatory power. Their capability to conduct "what-if" analyses, however, allowing inexpensive tests of proposed policy, product, and pricing changes, is as yet unproven, offering another rich area for interesting and potentially lucrative integrative research between MIS and strategy.

Limb #5: Long-Term Increased Regulation and Taxation of Online Sales Channels

In mid-2011, the state of California decided that Amazon.com, based in the state of Washington, needed to charge (and collect on California's behalf) sales tax on its shipments to California (Bustillo and Woo 2011). While the ability to enable customers to avoid sales tax is not a cost advantage *per se* over brick-and-mortar rivals, it does create an unusual sort of competitive advantage that does not fit into the usual *value minus cost* frameworks (Blecherman 1999; Postrel 2009; Tirole 1985; Walker 2003, 2007). Customers in California currently perceive that Amazon possesses a cost advantage over California rivals because the price customers pay to Amazon for their goods is not automatically augmented by the price they usually pay California for the privilege of purchasing something while in California. This unbundling is a function of IT and e-commerce as a technological channel, not something specific to Amazon as a firm. It is thus neither a resource nor a capability to Amazon, but apparently still generates profits—a digital gap in our understanding of the relationship between competence and profitability. That the revenues from such taxes are fervently desired by state tax authorities and that nonmarket strategies that urge their collection will be aggressively pursued by brick-and-mortar rivals is hardly even debatable. The role of IT in collecting such taxes—or, of course, supporting creative and quasi-legal methods of potentially avoiding them—will soon become a key issue in the design of retailing strategies in such tax-intensive states.

Convergence of the MIS and Strategy Fields?

In conclusion, we predict convergence between the (strategic) information systems and (strategic) management fields. Over the past 30 years, the MIS literature has frequently played the role of the laboratory (or practicum) to strategic management's science lecture: empirical investigations (sometimes

firm-specific) in support of general theoretical principles expounded (sometimes vaguely) in top strategic management outlets. Both the MIS and strategic management fields have benefited from this symbiotic relationship. Our lecture-to-lab (and the need for lab-to-lecture) claim certainly does not deny that original theory is constantly developed in the MIS field—in some cases, predating the main discussion in the strategic management literature by decades. The focus, however, is different: whereas the strategy literature focuses on the general concept of capabilities that support key value drivers, the MIS literature documents value and cost drivers associated with the technology, specifying the new capabilities that it supports. Such a focus makes a specific technology (or its implementation within a company), the unit of analysis rather than the underlying theory. Indeed, top MIS journals have traditionally favored, or even insisted upon, MIS-specific content rather than emphasizing generalizable business theory. Given the rapid rate of change in information systems relative to that of overall business practices, however, we hypothesize that this enforced differentiation relationship must turn in the other direction: the gap between the strategic MIS discipline and the mainstream strategy discipline must narrow, bringing the fields ever closer together on a relative basis. Whether this predicted convergence implies that MIS will primarily become more generalizable—or the strategic management field more specific, concrete, and implementation-oriented—on an absolute basis is as yet undetermined. We hope that grounded empirical studies, respected in both fields, will build upon the theoretical concepts we explore here and support the future convergence of the two complementary fields of MIS and strategic management.

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References

- Abreu, D. 1988. "On the Theory of Infinitely Repeated Games with Discounting," *Econometrica* (56:2), pp. 383-396.
- Alchian, A., and Demsetz, H. 1972. "Production, Information Costs, and Economic Organization," *The American Economic Review* (62:5), pp. 777-795.
- Amit, R., and Schoemaker, P. 1993. "Strategic Assets and Organizational Rent," *Strategic Management Journal* (14:1), pp. 33-46.
- Amram, M., and Kulatilaka, N. 1999. *Real Options: Managing Strategic Investment in an Uncertain World*, Cambridge, MA: Harvard Business School Press.
- Anand, K. S., and Aron, R. 2003. "Group Buying on the Web: A Comparison of Price-Discovery Mechanisms," *Management Science* (49:11), pp. 1546-1562.
- Andreu, R., and Ciborra, C. 1996. "Organizational Learning and Core Capabilities Development: The Role of IT," *The Journal of Strategic Information Systems* (5:2), pp. 111-127.
- Armstrong, C. E., and Shimizu, K. 2007. "A Review of Approaches to Empirical Research on the Resource-Based View of the Firm," *Journal of Management* (33:6), pp. 959-986.
- Ashenfelter, O. 1978. "Estimating the Effect of Training Programs on Earnings," *The Review of Economics and Statistics* (60:1), pp. 47-57.
- Ashenfelter, O. 1989. "How Auctions Work for Wine and Art," *Journal of Economic Perspectives* (3:3), pp. 23-36.
- Athey, S. C. 1996. "Characterizing Properties of Stochastic Objective Functions," Working Paper 96-1, Department of Economics, Massachusetts Institute of Technology.
- Bain, J. S. 1956. *Barriers to New Competition*, Cambridge, MA: Harvard University Press.
- Bain, J. S. 1959. *Industrial Organization*, New York: Wiley.
- Bakos, J. Y., and Brynjolfsson, E. 1993a. "From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships," *Journal of Organizational Computing* (3:3), pp. 301-328.
- Bakos, J. Y., and Brynjolfsson, E. 1993b. "Information Technology, Incentives, and the Optimal Number of Suppliers," *Journal of Management Information Systems* (10:2), pp. 37-53.
- Bakos, J. Y., and Brynjolfsson, E. 1997. "Organizational Partnership and the Virtual Corporation," in *Information Technology and Industrial Competitiveness: How Information Technology Shapes Competition*, C. Kemerer (ed.), Boston: Kluwer Academic Publishers, Chapter 4.
- Bakos, J. Y., and Kemerer, C. F. 1992. "Recent Applications of Economic Theory in Information Technology Research," *Decision Support Systems* (8:5), pp. 365-386.
- Bakos, J. Y., and Treacy, M. E. 1986. "Information Technology and Corporate Strategy: A Research Perspective," *MIS Quarterly* (10:2), pp. 107-119.

- Barnard, C. 1938. *The Functions of the Executive*, Cambridge, MA: Harvard University Press.
- Barney, J. 1986. "Strategic Factor Markets: Expectations, Luck, and Business Strategy," *Management Science* (32:10), pp. 1231-1241.
- Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99-120.
- Barney, J., Ketchen, Jr., D. J., and Wright, M. 2011. "The Future of Resource-Based Theory: Revitalization or Decline?," *Journal of Management* (37:5), pp. 1299-1315.
- Barua, A., Kriebel, C., and Mukhopadhyay, T. 1995. "Information Technologies and Business Value: An Analytic and Empirical Investigation," *Information Systems Research* (6:1), pp. 3-23.
- Barua, A., and Lee, B. 1997. "The Information Technology Productivity Paradox Revisited: A Theoretical and Empirical Investigation in the Manufacturing Sector," *International Journal of Flexible Manufacturing Systems* (9:2), pp. 145-166.
- Baumol, W. J. 1982. "Contestable Markets: An Uprising in the Theory of Industry Structure," *American Economic Review* (72:1), pp. 1-15.
- Benaroch, M., and Kauffman, R. 1999. "A Case for Using Real Options Pricing Analysis to Evaluate Information Technology Project Investments," *Information Systems Research* (10:1), pp. 70-86.
- Bensinger, G. 2012. "AT&T Raises Pricing for Cell Data," *The Wall Street Journal*, January 19, p. B10.
- Bharadwaj, A. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169-196.
- Bharadwaj, A. S., Bharadwaj, S. G., and Konsynski, B. R. 1999. "Information Technology Effects on Firm Performance as Measured by Tobin's Q," *Management Science* (45:7), pp. 1008-1024.
- Bharadwaj, A. S., El Sawy, O., Pavlou, P., and Venkatraman, N. 2009. "Call for Papers MISQ Special Issue on "Digital Business Strategy: Toward a Next Generation of Insights," *MIS Quarterly* (33:1), pp. 204-208.
- Blecherman, B. 1999. "The Cathedral Versus the Bazaar (With Apologies to Eric S. Raymond): An Economic and Strategic Look at Open-Source Software," March 11 (http://www.ite.poly.edu/chapel_printable.htm, retrieved July 1, 2011).
- Boehret, K. 2011. "Why Smartphones Can See More Than We Can," *The Wall Street Journal*, May 4, p. D3.
- Bowman, E., and Hurry, D. 1993. "Strategy Through the Option Lens: An Integrated View of Resource Investments and the Incremental-Choice Process," *Academy of Management Review* (18:4), pp. 760-782.
- Brand, S. 1985. "Keep Designing: How the Information Economy Is Being Created and Shaped by the Hacker Ethic," *Whole Earth Review*, May, pp. 44-55.
- Brand, S. 1987. *The Media Lab: Inventing the Future at MIT*, New York: Viking Penguin.
- Brandenburger, A., and Nalebuff, B. 1997. *Co-opetition*, New York: Crown Business.
- Brandenburger, A., and Stuart, H. W. 1996. "Value-Based Business Strategy," *Journal of Economics and Management Strategy* (5:1), pp. 5-24.
- Branzei, O., and Thornhill, S. 2006. "From Ordinary Resources to Extraordinary Performance: Environmental Moderators of Competitive Advantage," *Strategic Organization* (4:1), pp. 11-41.
- Brynjolfsson, E. 1993. "The Productivity Paradox of Information Technology," *Communications of the ACM* (36:12), December, pp. 66-77.
- Brynjolfsson, E., and Hitt, L. 1998. "Beyond the Productivity Paradox," *Communications of the ACM* (41:8), August, pp. 49-55.
- Brynjolfsson, E., Hitt, L., and Yang, S. 2002. "Intangible Assets: Computers and Organizational Capital," *Brookings Papers on Economic Activity: Macroeconomics* (1), pp. 137-181.
- Brynjolfsson, E., and Smith, M. 2000. "Frictionless Commerce? A Comparison of Internet and Conventional Retailers," *Management Science* (46:4), April, pp. 563-585.
- Brynjolfsson, E., and Smith, M. 2001. "The Great Equalizer? Consumer Choice Behavior at Internet Shopbots," Sloan Working Paper No. 4208-01, Massachusetts Institute of Technology.
- Bulow, J., Geanakoplos, J., and Klemperer, P. 1985. "Multimarket Oligopoly: Strategic Substitutes and Complements," *Journal of Political Economy* (93:3), pp. 488-511.
- Bustillo, M., and Woo, S. 2011. "Retailers Push Amazon on Taxes: Wal-Mart, Target and Others Look to Close Loophole for Online Sellers Amid State-Budget Crises," *The Wall Street Journal* (Eastern Edition), March 17, p. B1.
- Carr, N. 2003. "IT Doesn't Matter," *Harvard Business Review*, May, pp. 41-49.
- Carr, N. 2004. *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage*, Cambridge, MA: Harvard Business School Press.
- Catan, T., and Schatz, A. 2012. "U.S. Probes Cable for Limits on Net Video," *The Wall Street Journal*, June 13, p. A1.
- Chaturvedi, A., Dolk, D., and Drnevich, P. 2011. "Design Principles for Virtual Worlds," *MIS Quarterly* (35:3), pp. 673-684.
- Christensen, C. M., and Rosenbloom, R. S. 1995. "Explaining the Attacker's Advantage: Technological Paradigms, Organization Dynamics, and the Value Network," *Research Policy* (24:2), pp. 233-257.
- Clark, K. B., and Baldwin, C. Y. 2000. *Design Rules. Vol. 1: The Power of Modularity*, Cambridge, MA: MIT Press.
- Clemons, E. K. 1991. "Evaluation of Strategic Investments in Information Technology," *Communications of the ACM* (34:1), pp. 22-36.
- Clemons, E. K., Croson, D. C., and Weber, B. W. 1996. "Market Dominance as a Precursor of a Firm's Failure: Emerging Technologies and the Competitive Advantage of New Entrants," *Journal of Management Information Systems* (13:2), pp. 59-75.
- Clemons, E. K., and Gu, B. 2003. "Justifying Contingent IT Investments: Balancing Need for Speed of Action with Certainty before Action," *Journal of Management Information Systems* (20:2), pp. 36-47.
- Clemons, E. K., and Kimbrough, S. O. 1986. "Information Systems, Telecommunications, and Their Effects on Industrial Organization," in *Proceedings of the 7th International Conference on Information Systems*, San Diego, CA, pp. 99-108.

- Clemons, E. K., Reddi, S. P., and Row, M. C. 1993. "The Impact of Information Technology on the Organization of Economic Activity: The 'Move to the Middle' Hypothesis," *Journal of Management Information Systems* (10:2), pp. 9-35.
- Clemons, E. K., and Weber, B. W. 1990. "Strategic Information Technology Investments: Guidelines for Decision-Making," *Journal of Management Information Systems* (7:2), pp. 9-28.
- Coase, R. H. 1937. "The Nature of the Firm," *Economica* (4:16), pp. 386-405.
- Combs, J. G., Ketchen, Jr., D. J., Crook, T. R., and Roth, P. L. 2011. "Assessing Cumulative Evidence Within 'Macro' Research: Why Meta-Analysis Should be Preferred Over Vote Counting," *Journal of Management Studies* (48:1), pp. 178-197.
- Copeland, D. G., and McKenney, J. L. 1988. "Airlines Reservations Systems: Lessons from History," *MIS Quarterly* (12:3), pp. 353-370.
- Corts, K. S. 1996. "On the Competitive Effects of Price-Matching Policies," *International Journal of Industrial Organization* (15:3), pp. 283-299.
- Cowen, T., and Glazer, A. 1996. "More Monitoring Can Induce Less Effort," *Journal of Economic Behavior and Organization* (30:1), pp. 113-124.
- Crocker, K. J., and Masten, S. E. 1988. "Mitigating Contractual Hazards: Unilateral Options and Contract Length," *RAND Journal of Economics* (19:3), pp. 327-343.
- Crocker, K. J., and Masten, S. E. 1996. "Regulation and Administered Contracts Revisited: Lessons from Transaction-Cost Economics for Public Utility Regulation," *Journal of Regulatory Economics* (9:1), pp. 5-39.
- Crook, T. R., Ketchen, Jr., D. J., Combs, J. G., and Todd, S. Y. 2008. "Strategic Resources and Performance: A Meta-Analysis," *Strategic Management Journal* (29:11), pp. 1141-1154.
- Croson, D. C., Fox, J. F., and Ashurkov V. 1998. "Flexible Entry Strategies for Emerging Telecom Markets," *Technological Forecasting and Social Change* (57:1-2), pp. 35-52.
- Croson, D. C., and Jacobides, M. G. 1997. "Agency Relationships and Monitoring in Electronic Commerce," *International Journal of Electronic Commerce* (1:3), pp. 65-82.
- Daft, R. 1983. "Learning the Craft of Organizational Research," *The Academy of Management Review* (8:4), pp. 539-546.
- David, R. J., and Hahn, S. 2004. "A Systematic Assessment of the Empirical Support for Transaction Cost Economics," *Strategic Management Journal* (25:1), pp. 39-58.
- Demsetz, H. 1973. "Industry Structure, Market Rivalry, and Public Policy," *Journal of Law and Economics* (16:1), pp. 1-9.
- Demsetz, H. 1974. "Where is the New Industrial State?," *Economic Inquiry* (12:1), pp. 1-12.
- Diamond, P. 1971. "A Model of Price Adjustment," *Journal of Economic Theory* (3:2), pp. 156-168.
- Dixit, A. K. 1980. "The Role of Investment in Entry Deterrence," *Economic Journal* (90:357), pp. 95-106.
- Dixit, A. K., and Pindyck, R. S. 1994. *Investment under Uncertainty*, Princeton, NJ: Princeton University Press.
- Drnevich, P., and Kriauciunas, A. P. 2011. "Clarifying the Conditions and Limits of the Contributions of Ordinary and Dynamic Capabilities to Relative Firm Performance," *Strategic Management Journal* (32:3), pp. 254-279.
- Drnevich, P., and McIntyre, D. 2010. "Information Technology and Strategy: Two Camps, Four Perspectives, One Elusive Goal," *International Journal of Strategic Information Technology and Applications* (1:2), pp. 1-18.
- Drucker, P. 1954. *The Practice of Management*, New York: Harper & Row.
- Drucker, P. 1966. *The Effective Executive*, New York: Harper & Row.
- Edlin, A. 1997. "Do Guaranteed-Low-Price Policies Guarantee High Prices, and Can Antitrust Rise to the Challenge?," *Harvard Law Review* (111:2), pp. 528-575.
- Eisenhardt, K. 1989. "Agency Theory: An Assessment and Review," *Academy of Management Review* (14:1), pp. 57-74.
- Eisenhardt, K., and Martin, J. 2000. "Dynamic Capabilities: What Are They?," *Strategic Management Journal* (21:10), pp. 1105-1121.
- Feeny, D. F., and Willcocks, L. P. 1998. "Core IS Capabilities for Exploiting Information Technology," *Sloan Management Review* (39:3), pp. 9-21.
- Fichman, R. G. 2004. "Real Options and IT Platform Adoption: Implications for Theory and Practice," *Information Systems Research* (15:2), pp. 132-154.
- Foster, R. 1985. "Timing Technological Transitions," *Technology in Society* (7:2-3), pp. 127-141.
- Fractalanci, C., and Galal, H. 1998. "Information Technology and Worker Composition: Determinants of Productivity in the Life Insurance Industry," *MIS Quarterly* (22:2), pp. 227-241.
- Fudenberg, D., and Tirole, J., 1987. "Understanding Rent Dissipation: On the Use of Game Theory in Industrial Organization," *American Economic Review* (77:2), pp. 176-83.
- Fudenberg, D., and Tirole, J. 1991. *Game Theory*, London: The MIT Press, Chapter 5.
- Galunic, D. C., and Rodan, S. 1998. "Resource Recombinations in the Firm: Knowledge Structures and the Potential for Schumpeterian Innovation," *Strategic Management Journal* (19:12), pp. 1193-1201.
- Gates, W., Myhrvold, N., and Rinearson, P. 1995. *The Road Ahead*, New York: Viking.
- Gelman, J., and Salop, S. 1983. "Judo Economics: Capacity Limitation and Coupon Competition," *Bell Journal of Economics* (14:2), pp. 315-325.
- Geoffrion, A. M., and Krishnan, R. 2003. "E-Business and Management Science: Mutual Impacts (Part 1 of 2)," *Management Science* (49:10), pp. 1275-1286.
- Geyskens, I., Steenkamp, J. B., and Kumar, N. 2006. "Make, Buy, or Ally: A Transaction Cost Theory Meta-Analysis," *Academy of Management Journal* (49:3), pp. 519-543.
- Ghemawat, P. 1991. "Market Incumbency and Technological Inertia," *Marketing Science* (10:2), pp. 161-171.
- Gordon, J. R. M., Lee, P. M., and Lucas, Jr., H. C. 2005. "A Resource-Based View of Competitive Advantage at the Port of Singapore," *Journal of Strategic Information Systems* (14:1), pp. 69-86.
- Grant, R. 1996. "Toward a Knowledge-Based Theory of the Firm," *Strategic Management Journal* (17), pp. 109-122.
- Gurbaxani, V., and S. Whang, 1991. "The Impact of Information Systems on Organizations and Markets," *Communications of the ACM* (34:1), pp. 59-73.

- Hann, I., and Terwiesch, C. 2003. "Measuring the Frictional Costs of Online Transactions: The Case of a Name-Your-Own-Price Channel," *Management Science* (49:11), pp. 1563-1579.
- Hansen, R., and Lott, J. 1995. "Profiting from Induced Changes in Competitor's Market Values: The Case of Entry and Entry Deterrence," *The Journal of Industrial Economics* (43:3), pp. 261-276.
- Heckman J. J. 1979. "Sample Selection Bias as a Specification Error," *Econometrica* (47:1), pp. 153-161.
- Heckman J. J., and Robb, R. 1985. "Alternative Methods for Evaluating the Impact of Interventions: An Overview," *Journal of Econometrics* (30:1-2), pp. 239-267.
- Henderson, J. C., and Venkatraman, N. 1993. "Strategic Alignment: Leveraging Information Technology for Transforming Organizations," *IBM Systems Journal* (32:1), pp. 4-16.
- Hirschheim, R., and Lacity, M. C. 2000. "The Myths and Realities of Information Technology Insourcing," *Communications of the ACM* (43:2), pp. 99-107.
- Hirshleifer, J. 1971. "The Private and Social Value of Information and the Reward to Inventive Activity," *American Economic Review* (61:4), pp. 561-574.
- Holmström, B. R., and Tirole, J. 1989. "The Theory of the Firm," Chapter 2 in *Handbook of Industrial Organization*, Vol. 1, R. Schmalensee and R. D. Willig (eds.), Amsterdam: North-Holland, pp. 63-133.
- Hoopes, D., and Madsen T. 2008. "A Capability-Based View of Competitive Heterogeneity," *Industrial and Corporate Change* (17:3), pp. 393-427.
- Hoopes, D., Madsen T. L., and Walker G. 2003. "Why Is There a Resource-Based View? Toward a Theory of Competitive Heterogeneity," *Strategic Management Journal* (24), pp. 889-902.
- Hyman, D. 2011. "Why Bandwidth Pricing Is Anti-Competitive," *The Wall Street Journal*, July 8, p. A15.
- Iyengar, S. 2010. *The Art of Choosing*, New York: Twelve Press.
- Jacobides, M. J., and Croson, D. C. 2001. "Information Policy: Shaping the Value of Agency Relationships," *Academy of Management Review* (26:2), pp. 202-223.
- Jargowsky, P. A. 2004. "The Ecological Fallacy," in *The Encyclopedia of Social Measurement*, Vol. 1, K. Kempf-Leonard (ed.), Amsterdam: Elsevier, pp. 715-722.
- Jenkins, H. W. 2011. "Internet Data Caps Cometh," *The Wall Street Journal*, May 11, p. A15.
- Jenkins, H. W. 2012. "The Wireless Equivalent of Fracking," *The Wall Street Journal*, February 1, p. A13.
- Jensen, M. C., and Meckling, W. H. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* (3:4), pp. 305-360.
- Joskow, P. 1985. "Vertical Integration and Long-Term Contracts: The Case of Coal-Burning Electric Generating Plants," *Journal of Law, Economics and Organization* (1:1), pp. 33-80.
- Karake, Z. A. 1992. "An Empirical Investigation of Information Technology Structure, Control and Corporate Governance," *Journal of Strategic Information Systems* (1:5), pp. 258-265.
- Kern, T., Kreijger, J., and Willcocks, L. 2002. "Exploring ASP as Sourcing Strategy: Theoretical Perspectives, Propositions for Practice," *Journal of Strategic Information Systems* (11:2), pp. 153-177.
- Klein, P., Mahoney, J. T., and Nickerson, J. A. 2005. "Williamson's Transaction Costs Economics: Theoretical Contributions and Empirical Evidence," Working Paper, University of Missouri.
- Kogut, B., and Zander, U. 1992. "Knowledge of the Firm, Combinative Capabilities and the Replication of Technology," *Organization Science* (3:3), pp. 383-397.
- Kohli, R., and Devaraj, S. 2003. "Measuring Information Technology Payoff: A Meta-Analysis of Structural Variables in Firm-Level Empirical Research," *Information Systems Research* (14:2), pp. 127-145.
- Kraaijenbrink, J., Spender, J. C., and Groen, A. J. 2010. "The Resource-Based View: A Review and Assessment of Its Critiques," *Journal of Management* (36:1), pp. 349-372.
- Lacity, M., and Hirschheim, R. 1993. "Implementing Information System Outsourcing: Key Issues and Experiences of an Early Adopter," *Journal of General Management* (19:2), pp. 17-31.
- Lacity, M., and Hirschheim, R. 1995. *Beyond the Information Systems Outsourcing Bandwagon: The Insourcing Response*, New York: J. Wiley & Sons.
- Laffont, J. J., and Martimort, D. 2002. *The Theory of Incentives: The Principal-Agent Model*, Princeton, NJ: Princeton University Press.
- Lajili, K., and Mahoney, J. 2006. "Revisiting Agency and Transactions-Costs Theory Predictions on Vertical Financial Ownership and Contracting: Electronic Integration as an Organizational Form Choice," *Managerial and Decision Economics* (27:7), pp. 573-586.
- Lawrence, D. 1999. *The Economic Value of Information*, Berlin: Springer-Verlag.
- Lee, B., and Barua, A. 1999. "An Integrated Assessment of Productivity and Efficiency Impacts of Information Technology Investments: Old Data, New Analysis, and Evidence," *Journal of Productivity Analysis* (12:1), pp. 21-43.
- Lee, J. N., Miranda, S. M., and Kim, Y. M. 2004. "IT Outsourcing Strategies: Universalistic, Contingency, and Configurational Explanations of Success," *Information Systems Research* (15:2), pp. 110-131.
- Levinthal, D. A. 1988. "A Survey of Agency Models of Organizations," *Journal of Economic Behavior and Organization* (9:2), pp. 153-185.
- Lippman, S. A., and Rumelt, R. P. 1982. "Uncertain Imitability: An Analysis of Interfirm Differences in Efficiency under Competition," *The Bell Journal of Economics* (13:2), pp. 418-438.
- Logan, J. W., and Lutter R. W. 1989. "Guaranteed Lowest Prices: Do They Facilitate Collusion?," *Economics Letters* (31:2), pp. 189-92.
- Loveman, G. 1994. *An Assessment of the Productivity Impact of Information Technologies*, New York: Oxford University Press.
- Makadok, R. 2001. "Towards a Synthesis of the Resource-Based and Dynamic-Capability Views of Rent Creation," *Strategic Management Journal* (22:5), pp. 387-401.
- Makadok, R. 2010. "The Interaction Effect of Rivalry Restraint and Competitive Advantage on Profit: Why the Whole Is Less Than the Sum of the Parts," *Management Science* (56:2), pp. 356-372.

- Makadok, R. 2011. "The Four Theories of Profit and Their Joint Effects," *Journal of Management* (37:5), pp. 1316-1334.
- Malone, T. W., Yates, J., and Benjamin, R. I. 1987. "Electronic Markets and Electronic Hierarchies: Effects of New Information Technologies on Market Structures and Corporate Strategies," *Communications of the ACM* (30:6), pp. 484-497.
- Mason, E. S. 1939. "Price and Production Policies of Large-Scale Enterprise," *American Economic Review* (29:1), pp. 61-74.
- Mason, E. S. 1949. "The Current State of the Monopoly Problem in the United States," *Harvard Law Review* (62:8), pp. 1265-1286.
- Mata, F., Fuerst, W., and Barney, J. 1995. "Information Technology and Sustained Competitive Advantage: A Resource-Based Analysis," *MIS Quarterly* (19:4), pp. 487-505.
- McGrath, R. G. 1997. "A Real Options Logic for Initiating Technology Positioning Investments," *Academy of Management Review* (22:4), pp. 974-996.
- Melville, N., Kraemer, K., and Gurbaxani, V. 2004. "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value," *MIS Quarterly* (28:2), pp. 283-322.
- Meyer, B. 1995. "Natural and Quasi-Experiments in Economics," *Journal of Business and Economic Statistics* (13:2), pp. 151-161.
- Milgrom, P., and Roberts, J. 1995. "Complementarities and Fit Strategy, Structure, and Organizational Change in Manufacturing," *Journal of Accounting and Economics* (19:2-3), pp. 179-208.
- Miller, D. 2003. "An Asymmetry-Based View of Advantage: Towards an Attainable Sustainability," *Strategic Management Journal* (24:10), pp. 961-976.
- Mills, M., and Ottino, J. 2012. "The Coming Tech-led Boom," *The Wall Street Journal*, January 30, p. A15.
- Modigliani, F. 1958. "New Developments on the Oligopoly Front," *Journal of Political Economy* (66:3), pp. 215-232.
- Montealegre, R. 2002. "A Process Model of Capability Development: Lessons from the Electronic Commerce Strategy at Bolsa de Valores de Guayaquil," *Organization Science* (13:5), pp. 514-531.
- Mooney, J., Gurbaxani, V., and Kraemer, K. 1996. "A Process Oriented Framework for Assessing the Business Value of Information Technology," *DATABASE for Advances in Information System* (27:2), pp. 68-81.
- Morgan, L., and Winship C. 2007. *Counterfactuals and Casual Inference: Methods and Principles for Social Research*, New York: Cambridge University Press.
- Nelson, R. R., and Winter, S. G. 1982. *An Evolutionary Theory of Economic Change*, Cambridge, MA: Harvard University Press.
- Newbert, S. L. 2007. "Empirical Research on the Resource-Based View of the Firm: An Assessment and Suggestions for Future Research," *Strategic Management Journal* (28:2), pp. 121-146.
- Newbert, S. L. 2008. "Value, Rareness, Competitive Advantage, and Performance: A Conceptual-level Empirical Investigation of the Resource-Based View of the Firm," *Strategic Management Journal* (29:7), pp. 745-768.
- Nolan, R. L. 1995. "Reengineering: Competitive Advantage and Strategic Jeopardy," Harvard Business School Case No. 9-196-019.
- Nolan, R. L., and Croson, D. . 1995. *Creative Destruction: A Six-Stage Process for Transforming the Organization*, Cambridge, MA: Harvard Business School Press.
- Nolan, R. L., and McFarlan, F. W. 2005. "Information Technology and the Board of Directors," *Harvard Business Review* (83:10), pp. 96-106.
- Orlikowski, W., and Gash, D. 1994. "Technological Frames: Making Sense of Information Technology in Organizations," *ACM Transactions on Information Systems* (12:2), pp. 174-207.
- Pavlou, P. A., and El Sawy, O. 2006. "From IT Leveraging Competence to Competitive Advantage in Turbulent Environments: The Case of New Product Development," *Information Systems Research* (17:3), pp. 198-227.
- Penrose, E. T. 1959. *The Theory of the Growth of the Firm* (3rd ed.), Oxford, UK: Oxford University Press.
- Peteraf, M. A. 1993. "The Cornerstones of Competitive Advantage: A Resource-Based View," *Strategic Management Journal* (14:3), pp. 179-191.
- Piccoli, G., and Ives, B. 2005. "IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature," *MIS Quarterly* (29:4), pp. 747-776.
- Plank, W. 2012. "Confessions of an iPhone Data Hog," *The Wall Street Journal*, January 27.
- Porter, M. 1980. *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, New York: Free Press.
- Porter, M. 1985. *Competitive Advantage: Creating and Sustaining Superior Performance*, New York: Free Press.
- Porter, M. 2008. "The Five Competitive Forces That Shape Strategy," *Harvard Business Review* (86:1), pp. 137-145.
- Porter, M., and Millar, V. 1985. "How Information Gives You a Competitive Advantage," *Harvard Business Review* (63:4), pp. 149-160.
- Postrel, S. 2006. "Competitive Advantage and the Surplus Landscape: A Synthesis," Working Paper; Cox School of Business, Southern Methodist University.
- Postrel, S. 2009. "Multitasking Teams with Variable Complementarity: Challenges for Capability Management," *Academy of Management Review* (34:2), pp. 273-296.
- Powell, T., and Dent-Micallef, A. 1997. "Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources," *Strategic Management Journal* (18:5), pp. 375-405.
- Priem, R., and Butler, J. 2001. "Is the Resource-Based View a Useful Perspective for Strategic Management Research?," *Academy of Management Review* (26:1), pp. 22-40.
- Raice, S., and Woo, S. 2011. "Groupon's Boston Problem: Copycats," *The Wall Street Journal*, July 8.
- Raiffa, H. 1970. *Decision Analysis: Introductory Lectures on Choices Under Uncertainty*, Reading, MA: Addison-Wesley.
- Ray, G., Barney, J., and Muhanna, W. 2004. "Capabilities, Business Process, and Competitive Advantage: Choosing the Dependent Variable in Empirical Tests of the Resource-Based View," *Strategic Management Journal* (25:1), pp. 23-37.
- Ray, G., Muhanna, W., and Barney, J. 2005. "Information Technology and Performance of the Customer Service Process: A Resource-Based Analysis," *MIS Quarterly* (29:4), pp. 625-652.

- Ricardo, D. 1817. *On the Principles of Political Economy and Taxation*, London: John Murray.
- Ross, J. W., Beath, C. M., and Goodhue, D. L. 1996. "Develop Long-Term Competitiveness through IT Assets," *Sloan Management Review* (38:1), pp. 31-42.
- Ross, J., Weill, P., and Robertson, D. 2006. *Enterprise Architecture as Strategy: Creating a Foundation for Business*, Boston: Harvard Business School Press.
- Rumelt, R. P. 1986. "Toward a Strategic Theory of the Firm," in *Competitive Strategic Management*, R. Lamb (ed.), Englewood Cliffs, NJ: Prentice Hall, pp. 556-570.
- Salop, S. C. 1979. "Monopolistic Competition with Outside Goods," *The Bell Journal of Economics* (10:1), pp. 141-156.
- Salop, S. C. 1986. "Practices that (Credibly) Facilitate Oligopoly Co-ordination," in *New Developments in the Analysis of Market Structure*, J. E. Stiglitz and G. F. Mathewson (eds.), Cambridge, MA: The MIT Press, pp. 265-294.
- Sambamurthy, V., Bharadwaj, A., and Grover, V. 2003. "Shaping Agility through Digital Options: Reconceptualizing the Role of IT in Contemporary Firms," *MIS Quarterly* (27:2), pp. 237-263.
- Sambamurthy, V., and Zmud, R. W. 1999. "Arrangements for Information Technology Governance: A Theory of Multiple Contingencies," *MIS Quarterly* (23:2), pp. 261-290.
- Saraf, N., Langdon, C. S., and Gosain, S. 2007. "IS Application Capabilities and Relational Value in Interfirm Partnerships," *Information Systems Research* (18:3), pp. 320-339.
- Schroeder, R., Bates, K., and Junttila, M. 2002. "A Resource-Based View of Manufacturing Strategy and the Relationship to Manufacturing Performance," *Strategic Management Journal* (23:2), pp. 105-117.
- Schumpeter, J. A. 1934. *The Theory of Economic Development*, Cambridge, MA: Harvard University Press.
- Schumpeter, J. A. 1954. *History of Economic Analysis*, New York: Oxford University Press.
- Schwartz, B. 2003. *The Paradox of Choice: Why More is Less*, New York: Harper/Collins.
- Schwartz, E. S., and Zozaya-Gorostiza C. 2003. "Investment under Uncertainty in Information Technology: Acquisition and Development Projects," *Management Science* (49:1), pp. 57-70.
- Schwartz, M., and Reynolds, R. J. 1983. "Contestable Markets: An Uprising in the Theory of Economic Structure: Comment," *American Economic Review* (73:3), pp. 488-490.
- Smith, M., and Brynjolfsson, E. 2001. "Customer Decision Making at an Internet Shopbot: Brand Still Matters," *Journal of Industrial Economics* (49:4), pp. 541-558.
- Spence, A. M. 1977. "Entry, Capacity, Investment and Oligopolistic Pricing," *Bell Journal of Economics* (8:2), pp. 534-44.
- Sponder, J. C. 1996. "Making Knowledge the Basis of a Dynamic Theory of the Firm," *Strategic Management Journal* (17:Winter Special Issue), pp. 45-62.
- Stuchfield, N., and Weber, B. W. 1992. "Modeling the Profitability of Customer Relationships: Development and Impact of Barclays de Zoete Wedd's BEATRICE," *Journal of Management Information Systems* (9:2), pp. 53-76.
- Sutton, J. 1991. *Sunk Costs and Market Structure*, London: MIT Press.
- Sylos Labini, P. 1956. *Oligopolio e progresso tecnico* (Oligopoly and Technical Progress), Milan: Giuffrè.
- Symeonidis, G. 2003. "Comparing Cournot and Bertrand Equilibria in a Differentiated Duopoly with Product R&D," *International Journal of Industrial Organization* (21:1), pp. 39-55.
- Taleb, N. 2007. *The Black Swan: The Impact of the Highly Improbable*, New York: Random House.
- Tarafdar, M., and Gordon, S. R. 2007. "Understanding the Influence of Information Systems Competencies on Process Innovation: A Resource-Based View," *Journal of Strategic Information Systems* (16:4), pp. 353-392.
- Teece, D. 1986. "Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy," *Research Policy* (15:6), pp. 285-305.
- Teece, D., Pisano, G., and Shuen, A. 1997. "Dynamic Capabilities and Strategic Management," *Strategic Management Journal* (18:7), pp. 509-533.
- Thatcher, M. E., and Pingry, D. E. 2004. "An Economic Model of Product Quality and IT Value," *Information Systems Research* (15:3), pp. 268-286.
- Thomadsen, R., and Rhee, K. E. 2007. "Costly Collusion in Differentiated Industries," *Marketing Science* (26:5), pp. 660-665.
- Tibken, H. W. 2011. "Verizon Alters Data Pricing: Carrier to Scrap Unlimited Plans for Smartphones and Set Monthly Limits," *The Wall Street Journal*, July 6.
- Tippins, M., and Sohi, R. 2003. "IT Competency and Firm Performance: Is Organizational Learning a Missing Link?," *Strategic Management Journal* (24:8), pp. 745-761.
- Tirole, J. 1988. *The Theory of Industrial Organization*, Cambridge, MA: MIT Press.
- Troianovski, A., and Gryta, T. 2012. "Verizon Wireless Unveils Shared-Data Plans," *The Wall Street Journal*, June 13, p. B1.
- Valluri, A., and Croson, D. C. 2005. "Agent Learning in Supplier Selection Models," *Decision Support Systems* (39:2), pp. 219-240.
- Vitale, M. R. 1986. "The Growing Risks of Information Systems Success," *MIS Quarterly* (10:4), pp. 327-334.
- Wade, M., and Hulland, J. 2004. "Review: The Resource-Based View and Information Systems Research: Review, Extension, and Suggestions for Future Research," *MIS Quarterly* (28:1), pp. 107-142.
- Walker, G. 2003. *Modern Competitive Strategy* (1st ed.), Boston: McGraw-Hill/Irwin.
- Walker, G. 2007. *Modern Competitive Strategy* (2nd ed.), Boston: McGraw-Hill/Irwin.
- Wang, E., and Seidman, A. 1995. "Electronic Data Interchange: Competitive Externalities and Strategic Implementation Policies," *Management Science* (41:3), pp. 401-418.
- Weill, P., and Ross, J. 2004. "IT Governance on One Page," Center for Information Systems Research Working Paper 349, Massachusetts Institute of Technology.
- Weitzel, T., Beimborn, D., and Koenig, W. 2006. "A Unified Economic Model of Standard Diffusion: The Impact of Standardization Cost, Network Effects, and Network Topology," *MIS Quarterly* (30:Special Issue on Standard Making), pp. 489-514.
- Wernerfelt, B. 1984. "The Resource Based View of the Firm," *Strategic Management Journal* (5:2), pp. 171-180.
- Williamson, O. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*, New York: Free Press.

- Williamson, O. 1979. "Transaction-Cost Economics: The Governance of Contractual Relations," *Journal of Law and Economics* (22:2), pp.233-261
- Williamson, O. 1991. "Strategizing, Economizing, and Economic Organization," *Strategic Management Journal* (12:Winter Special Issue), pp. 75-94.
- Williamson, O. E. 1999, "Strategy Research: Governance and Competence Perspectives," *Strategic Management Journal* (20:12), pp. 1087-1108.
- Winter, S. 2003. "Understanding Dynamic Capabilities," *Strategic Management Journal* (24:10), pp. 991-996.
- Xue, Y., Liang, H., and Boulton, W. R. 2008. "Information Technology Governance in Information Technology Investment Decision Processes: The Impact of Investment Characteristics, External Environment, and Internal Context," *MIS Quarterly* (32:1), pp. 67-96.
- Yang, S. 1994. "The Relationship between IT Investment and Market Value of Firms," Master's Thesis, Sloan School of Management, Massachusetts Institute of Technology.
- Yoffie, D., and Kwak, M. 2001. *Judo Strategy: Turning Your Competitors' Strength to Your Advantage*, Cambridge, MA: Harvard Business School Press.
- Yoffie, D., and Kwak, M. 2002a. "Mastering Balance: How to Meet and Beat a Stronger Opponent," *California Management Review* (44:2), pp. 8-24
- Yoffie, D., and Kwak, M. 2002b. "Judo Strategy: 10 Techniques for Beating a Stronger Opponent," *Business Strategy Review* (13:1), pp. 20-30.
- Yoo, W. S., Suh, K. S., and Lee, M. B. 2002. "Exploring the Factors Enhancing Member Participation in Virtual Communities," *Journal of Global Information Management* (10:3), pp. 55-71.
- Zott, C. 2003. "Dynamic Capabilities and the Emergence of Intra-industry Differential Firm Performance: Insights from a Simulation Study," *Strategic Management Journal* (24:2), pp. 97-125.

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