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Business Process and Information Technology Alignment: Construct Conceptualization, Empirical Illustration, and Directions for Future Research

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Abstract:

Since strategic alignment first rose to prominence with Henderson and Venkatraman's (1993) seminal paper, research has tended to focus on the extent of fit between IT and business strategy at the firm level. Although useful, a firm-level view of alignment could mask what firms are doing to realize intellectual alignment between business and IT strategy and whether their actions will likely succeed. In this study, we build on an emergent stream of research that considers alignment between IT and business strategy at the process level. Since research tends to view this form of alignment through the lens of IT support for business strategy, this perspective fails to account for how IT can enable the development of new business strategies. Accordingly, we conceptualize alignment between IT and business strategy at the process level using the lens of IT shortfall (a lack of IT support for business activities) and IT slack (having more IT than needed to support current business activities). Using data from matched surveys of IT and business executives at 317 U.S. and E.U. firms, we illustrate the value of this conceptualization and its process measures. Our results show that IT shortfall is negatively correlated with IT business value, while IT slack is positively correlated with IT business value. We further note that the existence of IT shortfall and IT slack depends on differences in firms' chosen business strategy and whether a process is critical or non-critical to that strategy's success.

Keywords: Strategic Alignment, Intellectual Alignment, Process-level Approach, IT Shortfall, IT Slack, Alignment Portfolio, Profile Deviation.

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1 Introduction

Some two decades after Henderson and Venkatraman's (1993) now seminal research paper on various forms of fit or alignment between business strategy, information technology (IT) strategy, business infrastructure and processes, and IT infrastructure and processes, research confirms that alignment between business and IT strategy is a key driver of firm performance even as CIOs identify alignment as a persistent topic of concern (Gerow, Grover, Thatcher & Roth, 2014; Kappelman, McLean, Johnson & Gerhart, 2014)[1]. Prior research has extended our understanding of alignment—its antecedents and consequences—and yet many questions remain. One question in particular involves the level at which one considers alignment (Chan & Reich, 2007; Coltman, Tallon, Sharma & Queiroz, 2015). Prior research has tended to focus on alignment at the firm level. Doing so enables researchers to investigate how shared practices might help IT and business executives to align IT and business goals across the firm. Firm-level analysis also allows one to connect alignment with firm-level performance metrics such as net profit and revenue growth. However, conceptualizing and measuring alignment at the firm level could mask insights that might be visible only at more granular levels of analysis. Just as the literature evolved beyond testing the impacts of IT at the firm level to recognizing that the first-order effects of IT arise at the process level and that these first-order effects combine to form second-order IT impacts at the firm-level (Barua, Kriebel & Mukhopadhyay, 1995), we believe that we can extend and enrich the alignment literature by looking beyond alignment as principally (or strictly) a firm-level construct to envision how one can conceptualize, operationalize, and formally measure alignment at a more granular business process level.

While researchers have taken some steps to conceptualize process-level alignment by adapting what we know about alignment at the firm level (Tallon, 2008, 2012), we first need to define alignment. Researchers use various terms to define the link between IT and business strategy—alignment, cohesion, fit, harmony, linkage (Henderson & Venkatraman, 1993; Reich & Benbasat, 1996; Chan, Huff, Barclay & Copeland, 1997; Kearns & Lederer, 2003; Tallon, 2008; McLaren, Head, Yuan & Chan, 2011)—but all assume, particularly when we identify how alignment is measured, that IT is somehow secondary or subservient to business strategy. Some of the earliest research notes that alignment came about through integrating IT and business plans (Das, Zahra & Warkentin, 1991; King & Teo, 1997; Teo & King, 1997). The business plan was written first and the IT plan followed so that alignment reflected the degree to which IT supported the business strategy. This sequencing of plans reflected a belief—prevalent among non-IT executives—that IT could not lead strategic change. Today, academics and practitioners would argue that, even as IT continues to play an essential supporting role, IT is increasingly able to effect change in business strategy and the activities that give rise to new initiatives (Lederer & Mendelow, 1987; Nohria & Gulati, 1996; Roepke, Agarwal & Ferratt, 2000; Kishore & McLean, 2007; Mohdzain & Ward, 2007; Kang, Park & Yang, 2008; Zhu, Li, Wang & Chen, 2009). However, as we note in Section 2, the way we currently conceptualize and measure alignment does not allow for that possibility. By the same token, the notion of digital IT options whereby organizations hold IT resources in reserve while they wait for a suitable market opportunity or a favorable shift in the environment has never entered the discussion of what it means to be aligned (Benaroch, 2002; Tallon, Kauffman, Lucas, Whinston & Zhu, 2002; Sambamurthy, Bharadwaj & Grover, 2003; Fichman, Keil & Tiwana, 2006). Extant firm-level alignment measures cannot readily distinguish between businesses in which IT does not support the existing business strategy and businesses in which IT does fully support their extant business strategy but who hold their IT resources in reserve. Extant alignment measures would classify organizations as misaligned (especially when evaluating alignment using profile deviation scores), and yet one organization is meeting its IT support needs, while the other is not. Continually using current alignment measures in this instance could yield false and misleading results at any level of analysis, but the degree of distortion could be particularly severe when evaluating alignment in individual processes or across a portfolio of processes that, in its totality, spans the value chain. Distorted alignment measures could also hurt critical IT decision making by perpetuating a false sense of misalignment among CIOs when in fact the opposite holds true.

To enable greater responsiveness to market change, organizations may seek to concentrate IT resources in processes that are critical to the success of their business strategy. Doing so in less critical processes may be considered wasteful. Similarly, a lack of IT resources may be a source of frustration for end users in processes that are peripheral to the business strategy – in human resources, for example – but the firm will survive. The same lack of IT resources in a firm's mission-critical processes (e.g., supply chain

[1] As Gerow, Thatcher, and Grover (2015) explain, the literature continues to use different terms—sometimes interchangeably—to describe different types of alignment contained in Henderson and Venkatraman's (1993) model. For example, intellectual alignment describes a *higher* level of fit between IT strategy, and business strategy (Reich & Benbasat, 1996; Gerow et al., 2015). For ease of expression, we refer to intellectual alignment throughout the paper as either strategic alignment or alignment.

processes in a manufacturing firm with just-in-time inventory processing or with seat pricing in the airline industry) could ruin it. Assessing alignment at the firm level ignores what occurs in each individual process and it does not automatically reveal whether individual processes are aligned. One can achieve this detail only via conceptualizing and measuring alignment at the process level.

Accordingly, in this research, we offer a new conceptualization of alignment at the process level. We extend the work that has been done at the firm level over a 20-year period by highlighting the benefits of introducing a more granular view of alignment across multiple business processes. We adapt measures derived from strategic fit research (specifically, profile deviation measures (Venkatraman, 1989)) to distinguish between cases where process-level misalignment is linked to a lack of IT support for critical activities in a specific process (defined as IT shortfall) and other cases where, even though IT fully supports key processes, excess or slack IT resources (defined as IT slack) that might facilitate changes to business strategy at a later date still exist. We illustrate the merits of this conceptualization and measurement approach using perceptual data from a matched survey of IT and business executives in 317 U.S. and E.U. firms. Our findings reveal the value of looking at alignment in a disaggregated sense at the process level and further confirm the need to update our alignment measures to allow for cases when IT can and is expected to promote and facilitate changes in strategic business direction, enhance individual processes or help implement the overall business strategy.

This paper proceeds as follows. In Section 2, we summarize the alignment literature at both the firm and process levels. In Section 3, we present our process-level conceptualization and the measures used to operationalize it through profile deviation. We illustrate those measures in Section 4 using data from a matched survey of 317 IT and business executives. In Section 5, we examine our results and introduce the idea of an alignment portfolio. Lastly, in Section 6, we describe the broader implications of our research, consider research limitations and future research possibilities, and conclude the paper.

2 Literature Review

In reviewing the IT literature, we confirmed that studies routinely conceptualize and measure alignment at the firm level whereby researchers ascertain the extent of fit between firm-level business and IT strategy. For example, Sabherwal and Chan (2001) classify firms as defenders, analyzers, or prospectors under Miles and Snow's (1978) typology and specify alignment by fitting firm-level IT use to each typology. In contrast, Oh and Pinsonneault (2007) use a typology that defines business strategy as focusing on reducing costs, improving quality, or growing revenue. They identify and link firm-level IT applications to each strategy type to ascertain the level of alignment. Lastly, Tallon, Kraemer, and Gurbaxani (2000) note that alignment, which they operationalize as a single item firm-level measure of IT support for business strategy, increases as firms pursue broader goals for IT. In each of these studies, alignment represents firm-level IT support for firm-level business strategy. We note, however, that the data in these studies show that IT and business strategy can be multidimensional or multi-focused, so any insistence on evaluating alignment exclusively using aggregate firm-level measures could mask potentially new, unique, or revealing insights.

One also needs to recognize that not every alignment study employs a computed or calculated measure of alignment. Of the 170 papers and dissertations that Gerow et al. (2014) identify as comprising the core of the alignment literature, only 71 (41%) include a tangible measure of alignment as evidenced by correlational or other empirical analysis. Of this number, 49 (69%) studies use single measures based on, for example, Likert scales. As such, only 22 (31%) studies have computed an alignment measure using data on IT and business strategy. While Gerow et al. (2014) argue that single measures may yield inflated alignment measures, it is equally likely that single measures are only intended to identify IT shortfall. Such scales are unlikely to uncover firms with IT slack or to disclose the extent of IT slack if it exists.

As Table 1 shows, we reviewed 13 of the 22 studies that use computed alignment measures from Gerow et al. (2014) alongside six other studies that they do not include. We note that moderation and profile deviation are the most popular measures in the studies we reviewed (nine studies use one or both measures), while six studies use matching. Our review highlights important results that have helped to shape our knowledge of the literature. For example, Chan et al. (1997) and Sabherwal and Chan (2001) show that firm-level alignment has a positive and significant effect on firm performance. Oh and Pinsonneault (2007) find that firm-level alignment relates to revenues, cost reduction, and profits. Some studies report contradictory results, often based on differences in their strategic orientation, for the link between alignment and performance (Palmer & Markus, 2000; Sabherwal & Chan, 2001; Cragg, King & Hussin, 2002; Byrd, Lewis & Bryan, 2006; Tallon & Pinsonneault, 2011). For example, in studying the retail

sector, Palmer and Markus (2000) failed to find significant differences in key performance measures between firms with matched and unmatched IT and business strategies. Sabherwal and Chan (2001) found a link between alignment and firm performance for prospectors and analyzers but not for defenders. Using a matching-measures approach, Byrd et al. (2006) found no effect of alignment on performance, although they did find a positive link using a moderation approach. Cragg et al. (2002) found an equivalent result and go so far as to say that matching may be misleading. Tallon and Pinsonneault (2011) show that agility fully mediated the absence of a positive and significant effect of alignment on performance. Thus, while studies may show that, in general, alignment has a positive and significant effect on firm performance, the presence of insignificant direct effects for some firms might suggest that the relationship between alignment and firm performance is more nuanced than one might consider from the literature as a whole (Gerow et al., 2014).

One possible way to explain this pattern of results is the existence of mixed or multiple strategies in contemporary organizations. Organizations can pursue a solitary strategic focus such as low costs to the exclusion of all other foci, but data increasingly shows that organizations have multiple business strategies (Dess & Davis, 1984; White, 1986; Tallon, 2007). Tallon (2008) found that alignment has a positive effect on firm performance in customer-intimate and product-leadership firms but detected no such effect in operationally excellent firms. Since the alignment-performance relationship seems to be sensitive to differences in business strategy or strategic orientation and each strategy or orientation requires a different type of IT support (e.g., the IT support that a product leadership strategy needs will likely differ from a customer-intimate or low cost leadership strategy), an organization's ability to achieve alignment at the firm level will likely reflect what is happening with IT at the process level (notably in those processes that lie at the heart of each strategic orientation). The strategy literature shows that different strategic foci require emphasizing different business processes (Miles & Snow, 1978; Porter, 1980, 1985; Kim, Shin, Kim & Lee, 2011). A low-cost operator such as Wal-Mart, Costco, or Ryan Air would unlikely emphasize the same processes as more upscale firms such as Wholefoods or Ethiad. Once we recognize a need to dissect business strategy to look at specific strategic foci, we must begin to consider key process-level activities behind each focus.

Table 1. Review of the Alignment Literature

Reference	Measures	Components of alignment	Summary of key findings
Bergeron, Raymond, & Rivard (2001)	Multiple	The authors base business strategy on the STROBE typology; they based IT strategy on four constructs (strategic use of IT, IT planning and control, IT environmental scanning, and IT acquisition & implementation).	Significant differences emerge from using six perspectives to evaluate alignment and its implications for performance.
Byrd et al. (2006)	Matching; moderation	The authors base business strategy on the STROBE typology; they based IT strategy on the STROEPIS typology.	Strategic alignment moderates the link between IT investment and firm performance.
Cataldo, McQueen, & Hardings (2012)	Moderation	The authors base business strategy on the STROBE typology; they based IT strategy on the STROEPIS typology.	No differences between strategic and process-level alignment; strategic alignment better at explaining IT success.
Chan et al. (1997)	Moderation	The authors base business strategy on the STROBE typology; they based IT strategy on the STROEPIS typology.	Alignment is a significant predictor of IS effectiveness and business performance.
Chan, Sabherwal, & Thatcher (2006)	Profile deviation	The authors base business strategy on the STROBE typology; they based IT strategy on the STROEPIS typology.	The importance of alignment varies by business strategy and industry; past implementation success influences alignment.
Cragg et al. (2002)	Matching; moderation	The authors measured business and IT strategy using nine items relating to new product /service introduction.	Moderation approach is more effective alignment measure. Alignment is positively related to organizational performance.
Hooper, Huff, & Thirkell (2010)	Matching	The authors base business strategy on the STROBE typology; they based IT strategy on the STROEPIS typology.	IS-marketing alignment has a positive impact on business and marketing performance.

Table 1. Review of the Alignment Literature

Reference	Measures	Components of alignment	Summary of key findings
Kang et al. (2008)	Profile deviation	ERP integration (people-based, standardization-based, and centralization-based)	Alignment between ERP and integration modes is positively correlated with performance.
Ling, Zhao, & Wang (2009)	Profile deviation	The authors measured business strategy using Treacy and Wiersema (1995) from which ideal IT use profiles are determined. They compared these ideal IT use profiles with actual IT use in each of five processes.	Alignment between IT and process is associated with higher ambidexterity, which, in turn, lead to higher performance.
McLaren et al. (2011)	Profile deviation	Alignment reflects ideal levels of support for operational efficiency, operational flexibility, planning, internal analysis, and external analysis for defenders, prospectors, and analyzers.	Alignment outcomes based on profile deviation are consistent with data from interviews with case participants. Instances of "overfitting" can arise if more support exists than is needed.
Oh & Pinsonneault (2007)	Matching; moderation	The authors define business strategy as focusing on cost reduction, quality improvement or revenue growth. They inferred IT strategy from the use of 48 core IT systems that they separately mapped to each different business strategy.	Mixed results as to the overall impact of alignment on performance, as measured by costs, sales, and profitability. Nonlinear methods are more likely to detect a link between alignment and performance.
Palmer & Markus (2000)	Matching	The authors identify business strategy as supplier partnering, transaction efficiency or customer detail using the value disciplines typology. They classify IT strategy as supplier, internal or customer focus.	No significant differences in retail-specific performance measures for firms with a match between business and IT strategy and those with mismatched strategies.
Raymond & Bergeron (2008)	Profile deviation	The authors base e-business capabilities on one of four types (e-commerce, e-intelligence, e-communication, and e-collaboration). They base strategic on the classic Miles & Snow (1978) typologies.	Alignment between e-business capabilities and strategic orientation is associated with high productivity, growth, and financial performance (based on 107 manufacturing SMEs).
Sabherwal & Chan (2001)	Profile deviation	The authors base business strategy on a combination of the Miles & Snow (1978) and STROBE typology. IT strategy reflects IT use in four key areas of the business.	Alignment is associated with firm performance for analyzers and prospectors only. No impact among defenders.
Sabherwal & Kirs (1994)	Profile deviation	The authors measured business strategy as a series of critical success factors in a college environment. They base IT strategy on IT capabilities for data management, lab systems, email, and computer-based instruction.	Alignment drives institutional performance and IT success.
Tallon (2008)	Moderation	The authors base business and IS strategy on measures of business activities and IT use in five areas of the value chain: supplier relations, production and operations, product & service enhancement, sales and marketing, and customer relations.	A positive correlation exists between alignment and IT business value at the process level. The primary locus of alignment in the value chain varies based on differences in business strategy.

Table 1. Review of the Alignment Literature

Reference	Measures	Components of alignment	Summary of key findings
Tallon & Pinsonneault (2011)	Moderation	The authors measured both business and IT strategy the process-level.	Process agility fully mediates the link between alignment and firm performance.
Tallon (2012)	Profile deviation	The authors measured business strategy using Treacy and Wiersema (1995) from which ideal IT use profiles are determined. They compared these ideal IT use profiles with actual IT use in each of five processes.	Process-level alignment has a direct impact on IT impact in each focal process but a trickle-down impact on IT business value in adjacent processes in the value chain also exists.
Zahra & Covin (1993)	Moderation	The authors based business strategy measures cost leadership, product mix, product uniqueness, and marketing. IT strategy on automation and innovation, posture, and new product development support.	Business strategy moderates the link between IT strategy and firm performance.

2.1 Emergence of Process-level View

Business processes are "actions that firms engage in to accomplish some business purpose or objective" (Ray, Barney & Muhanna, 2004, p.24) or as routines that organizations use to succeed in the marketplace (Teece, Pisano & Shuen, 1997). As IT become increasingly embedded in business processes—often in ways that make it indecipherable from the business strategy itself (Wheeler, 2002)—IT plays a key role in enabling the routines that are essential to driving strategic goals and firm performance (Ray et al., 2004; Nevo & Wade, 2010). In this way, the IT literature increasingly sees the first-order effects of IT use materializing at the process-level (Barua et al., 1995; Tallon & Kraemer, 2007). Those IT effects may subsequently aggregate to the firm level. For example, CRM may first help to improve customer retention and satisfaction but could later help to generate incremental revenues, market share, and profitability.

Early stage research into process-level alignment follows a similar path to what occurred with the IT business value literature as it moved from the firm to the process level. The focus during this transition is not on task-technology fit but rather on business activities at the process level (Goodhue & Thompson, 1995). When Chan et al. (1997) first adapted Venkatraman's "strategic orientation of business enterprises" (STROBE) instrument to subdivide strategy into different types (aggressiveness, analysis, internal/external defensiveness, riskiness, futurity, proactiveness, innovativeness), they looked at what firms were doing in such areas as logistics, sales, marketing, operations, and customer relations. However, Chan et al. (1997) focused on strategic orientation across processes rather than on each process. They also considered IT support for each strategy across processes rather than in each individual process. Later, Tallon (2008, 2012) used a set of key business activities and IT support for these activities in each of five generic value-chain processes (supplier relations, production and operations, R&D / product & service enhancement, sales and marketing, and customer relations) as a basis for calculating alignment in each individual process. He found a positive association between IT business value and alignment in each process and noted that the benefits of alignment in each process can spill over into other processes. Since organizations often link processes together to form complex process chains, processes further downstream from the focal area where misalignment first arose can feel the effects of misalignment (Tallon, 2012).

3 Reconceptualizing IT Alignment at the Process Level

Profile deviation, mediation, and moderation are time-honored techniques for estimating alignment from firm-level IT and business-strategy data. Their use in the literature is pervasive as Table 1 shows and largely unquestioned (Chan et al., 1997; Bergeron et al., 2001; Sabherwal & Chan, 2001; Gerow et al., 2014). However, the literature has also remarked that each measure is *flawed* in some way (Bergeron et al., 2001; Gerow et al., 2014). While it is useful when different techniques yield similar results on the same dataset, the reality—as many researchers have noted—is that different approaches can deliver contradictory results (Cragg et al., 2002; Byrd et al., 2006). If we accept these contradictions when evaluating alignment at the firm level, it is only reasonable to expect that these same contradictions could materialize when assessing

alignment at the process level. However, one could also argue that attempts to conceptualize alignment at the process level afford an opportunity to review the tools and techniques that researchers have historically used to measure firm-level alignment and, if appropriate, extend or fine-tune them to better fit the peculiarities of how one might conceptualize strategic alignment at the process level.

The notion of alignment as a measure of *fit* between IT and business strategy remains valid at the process level. The alignment literature has interpreted fit and alignment more broadly to mean IT support for business strategy; one could see IT support as the sine qua non of IT functions in most businesses. As such, misalignment or an absence of alignment connotes a time when a firm does not have enough money to spend on IT or when it has sourced the wrong IT resources, incorrectly deployed its IT resources, or just not used them. If we then think what fit might mean at the process level, one would still want IT to support critical business activities, particularly in processes that a firm deems critical to its business. Yet, this representation of alignment is somewhat myopic for it overlooks instances—even if they are rare—where organizations have more IT resources than they actually need to support their business strategy. If IT executives recognize that digital options allow organizations to react faster to environmental change or to enact changes in their business strategy to take advantage of new marketplace opportunities, they might invest in incremental IT resources or capabilities that they do not currently need to support their current business strategy but that could prove invaluable at some point in the future when moving to a new or significantly revised business strategy (Sambamurthy, 2000; Fichman et al., 2006). Our current IT alignment measures only consider IT support for current business strategies. These measures would say that an organization cannot be *overaligned*: IT either fully supports the business strategy (which produces perfect alignment) or does not fully support the business strategy (which produces misalignment). If the availability or supply of IT resources is greater than what an organization needs to fully support its current strategy (as could happen if organizations invest in digital options), some alignment measures—principally profile deviation—could penalize an oversupply of IT just as much as an undersupply of IT even though the organization is meeting its business strategy's needs. Profile-deviation scores reflect the Euclidean distance between IT and business strategy. One applies absolute or squared terms to all distances with the result that one could erroneously identify fully aligned organizations—even those with slack IT—as misaligned just as much as if IT support was wholly lacking. Despite having slack IT resources, a finding of misalignment could push these firms to add even more IT. As such, our conceptualization of alignment ought to evolve to consider fit not just as IT support for business strategy but whether a firm is making use of *all* IT resources. Misalignment would then arise due to a shortfall of IT relative to current support needs or underuse of IT relative to what IT could achieve.

3.1 IT Shortfall and IT Slack

We continue to conceptualize IT alignment as fit between IT and business strategy, but we extend the notion of fit to reflect two orthogonal components: IT shortfall and IT slack. As such, in each process, alignment can take on one of three possible process-level outcomes: 1) IT fails to fully support the business strategy (IT shortfall), 2) IT fully supports the business strategy in such a way that the supply of IT resources equals the demand for IT resources (perfect alignment), or 3) IT fully supports the business strategy but does so without using the entire body of IT resources available to the firm (IT slack). If we think of business strategy as involving a chain, shop, or network of processes and each process as distinct or separable from other processes, it is conceivable that, across an organization, some processes may exhibit IT shortfall and others may exhibit either IT slack or perfect alignment (Stabell & Fjeldstad, 1998; Tallon, 2012). There is no requirement that alignment be the same in every process (i.e., that all processes exhibit IT shortfall or perfect alignment or IT slack), although it is certainly feasible, for example, that major cuts in IT spending across the entire organization could starve all processes of IT support to such an extent that each process exhibits some degree of IT shortfall. A more likely scenario might be a portfolio of different alignment outcomes across the value chain. IT shortfall is likely to be more injurious to firm performance if an absence of IT support occurs in processes that the firm considers essential to executing its overall business strategy. For example, a firm that views itself as a low-cost provider or operationally excellent in terms of its primary value discipline would likely be hurt more if IT shortfall materializes in operations or production processes since they are essential to its strategy. In comparison, IT shortfall might pose less of a problem for marketing or research and development processes; while these processes are still important on some level, they are not as critical to the firm's business strategy. While the most favorable outcome for any firm is perfect alignment in each process, the real prospect of sudden and unexpected change might prompt IT and business executives to build up IT resources in certain processes in anticipation of being able to absorb those resources if the need arises. It makes more sense to do so—essentially to hold digital IT options—in

processes critical to the firm's overall success, and so we may be more likely to discover IT slack in these processes. Firms may have fewer opportunities to exercise digital options in more peripheral processes given that business and IT executives focus on mission-critical processes and might regard any buildup of IT resources in peripheral processes as unnecessary, risky, and economically wasteful. In this manner, across a range of business processes in an organization, we might expect to find evidence of process-level IT shortfall and IT slack arranged according to the following two hypotheses:

H1: IT shortfall is more likely to occur in processes that are peripheral to an organization's business strategy.

H2: IT slack is more likely to occur in processes that are critical to an organization's business strategy.

3.2 Rethinking the Benefits of IT Alignment

The literature shows, on balance, that organizations with higher alignment at either the process or firm level report significantly higher performance (Chan et al., 1997; Sabherwal & Chan, 2001; Tallon & Pinsonneault, 2011). If we reconceptualize alignment through the lens of shortfall or slack, instances of IT shortfall in a particular business process are likely to hurt performance in that process. For example, if an operationally excellent company is struggling with a supply chain that is only partially automated, failure to use IT to meet all necessary process needs could lead to rising inventory costs, longer delays, and stockouts. These issues could have a detrimental effect on processes further downstream in the value chain or on performance in a more aggregate sense such as reduced revenues or profitability. IT shortfall at the level of a single process can, therefore, have a direct, first order, adverse effect on performance in that same business process. The extent to which IT shortfall contributes to a decline in corporate performance may ultimately depend on whether the process in question is critical to the firm's overall business strategy. One may regard IT shortfall as little more than an inconvenience in processes peripheral to the business strategy. For example, IT shortfall in human resources might simply mean that payroll processing is slower than desired, but that will have little effect on the business as a whole. However, the same degree of IT shortfall in a mission-critical business process such as production and operations could be utterly devastating. By this argument, upon detecting IT shortfall, CIOs may be more likely to focus on corrective action (e.g., increasing IT spending or reallocating IT resources) in core business processes since IT shortfall in those processes is more likely, through second-order effects, to produce a negative effect on overall business performance.

Cases of IT slack pose an interesting challenge. Certainly, organizations spend a great deal of time and money building digital IT options to accommodate potential for future change. For example, an organization might add incremental capacity to its networks in anticipation of a rise in business activity or collect new types of data in the hopes of finding new product or service possibilities. Digital IT options are inherently risky since one will only exercise them if one can resolve uncertainty in favor of the holder. When exercised, IT options can improve market responsiveness, which helps to enable agility and overall firm performance (Sambamurthy et al., 2003; Tallon & Pinsonneault, 2011). If IT slack is concentrated in processes that are critical to the business strategy, process-level performance could be higher in those processes since owning and exercising digital IT options in those processes is more important to the organization's continued success. Indeed, excess IT resources that organizations can deploy across a range of processes may be even more valuable than those resources tailored to just one process alone. The presence of IT slack in a given process means that current process-level needs are already being fully met, and so IT slack could produce higher performance in that process than if IT was only perfectly aligned—a somewhat unusual argument since the current literature argues that an organization cannot be *overaligned*. If IT slack helps to increase process-level performance in this manner, IT executives may want to actively promote *overalignment* in specific processes if concentrating IT resources could, via digital options, help facilitate greater responsiveness to change and so expand performance both in the process and overall at the firm level. However, IT slack in not a panacea and might not be advisable in every process. In more peripheral parts of the value chain, IT slack may create minimal incremental value since exercising digital options in peripheral processes will not fundamentally shift the business's ability to execute the most important parts of its strategy. Indeed, it is possible that IT slack in peripheral or non-core processes could be wasteful to such a degree that IT slack could undermine performance in those processes. Accordingly, we hypothesize:

H3: IT shortfall has a negative effect on process-level performance but particularly in processes that an organization regards as critical to its success.

H4: IT slack has a positive effect on process-level performance but particularly in processes that an organization regards as critical to its success.

4 Methodology

To demonstrate our proposed reconceptualization of alignment and, in particular, how one might adapt our existing alignment measures to reflect this conceptualization, we used data from matched surveys of senior business and IT executives in the EU and US. Since alignment represents fit between business and IT strategy, we created a strategic planner survey to independently capture data on business strategy from corporate planners or others with responsibility for corporate planning or development and an IT Executive survey to capture data on IT strategy from CIOs or other IT executives. We used CFOs in cases where we could not isolate an executive with overall firm-wide responsibility for strategic planning. Using separate respondents for different items helps to minimize respondent bias while also taking advantage of each respondent's specific area of IT or business expertise (Podsakoff, MacKenzie, Lee & Podsakoff, 2003). In the first of our two data-collection efforts, we created a third survey to gather data on perceived IT impacts at the process level from a senior executive with responsibility for a critical process such as manufacturing, marketing, sales, or service. For our second data-collection effort, we moved the IT impacts survey items to the strategic planner survey to increase our survey response rate by limiting the need for a third respondent. For each phase of our data collection, we mailed surveys separately to each respondent to limit the potential for bias in cases where respondents might otherwise select others with similar views (Podsakoff et al., 2003).

The first data-collection phase involved publicly traded firms in the US and EU (Ireland and the UK). We restricted our sample frame to single segment businesses as a way to avoid multidivisional entities or conglomerates whose business strategies could vary between divisions. We matched the resulting 5,557 single segment firms identified in S&P Compustat with firm-level IT spending data from Computer Intelligence InfoCorp (CII), which yielded a final sample frame of 541 firms. We received matched surveys (three per organization) from 76 firms (a 14% response rate). For the second data-collection phase, we focused on medium-size publicly traded U.S. firms with sales ranging from US$100 million to US$3 billion. We omitted small firms and all of the Fortune 500 because many such firms were part of our earlier data-collection effort. From the 2,826 firms identified in S&P Compustat, we randomly surveyed 1,600 firms from which we received 241 matched surveys (two per firm) (a 15% response rate). Overall, the 317 firms in our sample reflect a 14.8 percent response rate. This rate is consistent with similar efforts in the literature involving matched surveys of senior executives. Average sales for our sample was US$2.1 billion (S.D. $7.3 billion) or $6.4 billion for our first phase of data collection and US$798 million for our second phase. Table 2 shows other descriptive details of our sample, including a breakdown of revenues, industries, and key constructs.

4.1 Survey Measures

Researchers have measured IT and business strategies in various ways in the IT and strategy literature. In the case of business strategy, we asked strategic planners to allocate 100 points across the three categories of Treacy and Wiersema's (1995) strategy typology (operational excellence, customer intimacy, product leadership) with the greatest number of points going to the category that best fit the firm's actual business strategy. In this way, respondents could identify firms with mixed foci in their strategy (e.g., 30-40-30) or those with a more dominant or singular area of strategic orientation (e.g., 10-10-80). The extant alignment literature has used this typology and approach to measuring business strategy in the past (Weill & Broadbent, 1998; Palmer & Markus, 2000; Tallon, 2008).

Table 2. Sample Characteristics (n = 317)

	Frequency	Percent
Revenues		
Less than $100 million (M)	20	6.3
$100M-$250M	80	25.2
$250M-$500M	60	18.9
$500 M - $1 billion (B)	57	18.0
$1B - $2B	47	14.8
More than $2B	53	16.8
Industry categories		
Electronics and computing machinery	82	25.9
Wholesale and retail	55	17.4
Financial services	52	16.4
Software services	31	9.8
Metals and plastics	28	8.8
Pharmaceuticals and health care	18	5.7
Travel and entertainment	13	4.1
Other	38	11.9
Data-collection summary		
Phase 1 (n = 76)	**Key process-level constructs**	
IT executive survey	IT strategy	
Strategic planner survey	Business strategy	
Business executive survey	IT business value	
Phase 2 (n = 241)		
IT executive survey	IT strategy	
Strategic planner survey	Business strategy	
Strategic planner survey	IT business value	

Similarly, research has measured IT strategy in various ways. Since our measures of business strategy highlight actual strategic priorities, we sought to identify how firms actually use IT to support their business activities. Consequently, we asked IT respondents to report the extent to which their firms used IT to support business activities in each of five critical areas of the value chain: supplier relations, production and operations, product and service enhancement, sales and marketing, and customer relations. Overall, these five processes span the entire value chain and represent areas that firms generally see as sources of competitive differentiation and processes that equally absorb in some way the vast bulk of IT resources (Porter, 1985). These processes are sufficiently generic that they apply to manufacturing and services and further map to the primary processes in Michael Porter's classic generic value chain model (Porter, 1985, pp. 37, 46). Each survey item used a seven-point Likert scale anchored on low IT use and high IT use. This approach to evaluating IT strategy as IT use is consistent with how IT researchers have measured IT strategy in the alignment literature in the past (Chan et al., 2006; Chan & Reich, 2007; Tallon, 2008; Tallon & Pinsonneault, 2011).

We assessed the process-level impacts of IT using 25 items that map to the processes identified above (five items per process). Past IT business value research has extensively tested these items and found them to mirror objective measures of IT performance, which potentially assuages concerns that perceptual measures of IT business value are overly susceptible to bias, error, and distortion (Tallon et al., 2000; Tallon & Kraemer, 2007). While the veracity of perceptual items may still be open to question, using knowledgeable high-level business executives can help to signal the potential for valid and accurate responses. For the 25 IT business value items, we asked respondents to evaluate the performance effects of IT on each process-level activity on a seven-point Likert scale anchored on low IT impact and high IT impact. The Appendix lists all survey items for all key constructs.

4.2 Operationalizing Strategic Alignment

As already noted, profile deviation and moderation are among the most popular ways of assessing alignment; matching is less popular but has been widely used. Researchers have criticized moderation (using product terms) for interpretability, notably in terms of providing guidance to practitioners on how to improve their alignment (Hooper et al., 2010). Matching is equally challenging due to its simplicity and because it pushes researchers to assign firms a single IT strategy and a single business strategy (Palmer & Markus, 2000). Matching does not care whether the match is temporary or permanent, weak or strong—it only cares whether IT and business strategy focus on identical goals. The commutative property of product terms means that moderation cannot differentiate between the relative position of IT and business strategy measures. For example, if one assesses each strategy on a seven-point Likert scale, a 2x6 product term is treated for computational purposes in precisely the same way as a 6x2 product term; the product term in this instance (12) ignores the relative positioning of its underlying components, so 2x6, 6x2, 3x4, and 4x3 are viewed as identical for alignment purposes and yet critical data is being overlooked. Profile deviation is much less ambiguous in how it sees deviation as the Euclidean distance from an ideal profile. As previously noted, since profile deviation uses absolute values or square terms to compute a deviation between actual and ideal IT use, we can identify instances of IT shortfall and IT slack by removing the absolute value or square term. Accordingly, in this study, we focus on profile deviation as a primary mechanism for measuring alignment, whether at the firm level or process level.

Profile deviation adopts the fundamental premise that an ideal IT use profile against which one can compare each organization's actual IT use exists. The literature has previously determined ideal profiles in either of two ways. First, researchers have based ideal profiles on IT use in high-performing firms in a response set. This approach guarantees that some firms in the population of interest will align by default (as their IT use is defined as ideal), but this approach is only ideal in a relative sense based on the sample of firms available to the researcher. Second, researchers have identified a theory-based ideal IT use profile for a given business strategy. This approach avoids the problem of defining ideal based on a narrow group of high-performing firms, although it is not a panacea by any means since questions remain about what a theoretical IT use profile looks like and whether researchers can agree on what theory to use. In this study, we opted to use a Delphi approach whereby we solicited input from five IS academics and four IT practitioners/consultants with espoused interest in IT alignment research and practice. Previous research has used this approach to elicit an ideal IT use profile (Tallon, 2008). We gave each judge a brief description of Treacy and Wiersema's (1995) typology with examples of how one might expect businesses such as Walmart, Morgan Stanley, and Apple to self-identify if one asked them to allocate 100 points across the three categories. We then showed each judge a list of five processes (i.e., supplier relations, production and operations, product & service enhancement, sales and marketing support, customer relations) and, process by process, asked them to independently assign values of +1, 0, and -1 to the three strategies according to whether they felt that an organization's use of IT relative to all other organizations would be above average (+1), average (0), or below average (-1). This approach allowed judges to rate each process independently; we then collated the scores from all nine judges. In Table 3, we show the modal scores from this group. We found significant inter-rater reliability among the panel with eight of nine judges agreeing on the location of above average IT use across the different strategies and processes. Seven of nine judges agreed on the placement of average and below average scores. Since the results of this exercise suggest an ideal level of IT use for operational excellence, customer intimacy, and product leadership, we can isolate processes where a firm's actual IT use deviates from their ideal IT use. However, since strategic planners could indicate whether their organization had multiple foci in their strategy, we needed to calculate a weighted ideal profile to reflect the distribution of points noted in the strategic planner's survey, which we accomplished by multiplying each row in Table 3 by the corresponding weights from the survey and then summing up the resulting weighted values in each row to give a single ideal IT use value for each process.

For the purposes of our illustration, we can change the way that researchers have traditionally applied profile deviation by removing the need for absolute or square terms in the computation of Euclidean distance. Since alignment is closely tied to the size of the difference between ideal and actual IT use, rather than focus on the absolute or squared distance as is the case with extant measures, we focus instead on the *sign of the difference*. Consequently, when actual IT use is less than ideal IT use in a specific process, the firm faces IT shortfall in that process. However, one may consider a situation where actual IT use is greater than ideal IT use as a proxy for IT slack since the firm is allocating more IT resources to that process than it needs to. We adopt a similar approach to what extent research currently uses by subtracting the signed difference between actual and ideal IT use from one so we can identify the extent of alignment rather than the extent of misalignment. Furthermore, since actual IT use is potentially reflective of industry-level factors such as where

organizations have IT-intensive supplier processes or high-tech solutions for delivery of healthcare, we normalize process-level IT use in each firm using the mean and standard deviation of process-level IT use in its industry. While our data in Table 2 shows that our sample contains a variety of industries, it represents some industries better than others. Hence, to mitigate concerns regarding small sample size, we also normalized process-level IT use data using means and standard deviations for our complete sample. Correlations between these two types of normalized process-level IT use values ranged from 0.97 to 0.98.

Table 3. Ideal IT Use Profiles in Support of Business Process Activities

Business processes	Operational excellence	Customer intimacy	Product leadership
Supplier relations	1	-1	0
Production and operations	1	0	-1
Product and service enhancement	-1	0	1
Sales and marketing support	-1	1	0
Customer relations	-1	1	0

Note: ratings signify the consensus views of nine domain experts. On a process-by-process basis, 1, 0, and -1 ratings denote above average, average, and below average use of IT, respectively, when comparing each value discipline with other value disciplines.

4.3 Validating IT Business Value Measures

To validate our 25 process-level IT business value items, we first undertook a confirmatory factor analysis using PLSGraph (Chin, 1998). All path estimates were significant at $p < 0.001$. We also reviewed our measures for evidence of reliability and validity. Cronbach's alpha and composite reliability exceeded the suggested minimum of 0.8 (Nunnally, 1978) for each process. We considered convergent validity using average variance explained (AVE); in each case, AVE exceeded the suggested minimum of 0.5 (Fornell & Larcker, 1981). We assessed discriminant validity by comparing the correlation between each factor pair with the square root of their respective AVE; in each case, the correlation was less than the square root of the AVE. On this basis, we opted to create composite IT business value scores for each process by taking the simple mean of the five IT business value items under each process. We later created weighted means as a robustness check on our findings: we identified no significant structural differences in our findings.

4.4 Proxy Firm-level Analysis of Strategic Alignment

First, we analyzed our process-level alignment measures by developing firm-level proxy measures of alignment by taking the simple mean of our five process-level measures. We also created a firm-level proxy measure of IT business value by averaging the five process-level measures of IT business value. We performed this analysis in part to ascertain if any continuing validity exists to the claim that alignment might not have a direct impact on performance (Tallon & Pinsonneault, 2011). We found an interesting set of relationships emerging from the correlations in Table 4. For example, we saw a negative correlation between our alignment measure based on signed differences (as a way to represent data on IT shortfall and IT slack) and alignment using absolute/squared differences, which confirms that the literature (perhaps mistakenly) characterizes IT slack as misalignment. The literature depicts what we define as IT slack as misalignment just as much as if the firm had experienced IT shortfall. Quite simply, IT slack is not feasible under our existing approaches to measuring alignment. We also found non-significant correlations between IT business value and measures of alignment created using square or absolute differences. Furthermore, alignment measured using square differences was highly correlated with measures based on absolute differences ($r = 0.96$). When we considered the sign of the difference, we found a significant correlation between IT alignment and IT business value ($r = 0.631$). One may question, therefore, if suggestions in the literature that alignment might not relate directly to firm performance is perhaps linked to the way that one measures alignment. If firms are open to concentrating IT resources in processes that are critical to their business strategy and if researchers currently interpret this openness as misalignment even though IT is adequately meeting the support needs of the business strategy, one may find their ability to link alignment to changes in business performance adversely affected.

Table 4. Correlations between Measures of IT Alignment (Firm-level Proxy Analysis)

	IT alignment (signed diffs.)	IT alignment (abs. diffs.)	IT alignment (sqr. diffs.)	IT business value
IT alignment (signed diffs.)	1.000			
IT alignment (abs. diffs.)	-0.129 *	1.000		
IT alignment (sqr. diffs.)	-0.111 *	0.960 ***	1.000	
IT business value	0.631 ***	-0.021 ns	-0.003 ns	1.000
Note: * p < 0.05, ** p<0.01, *** p < 0.001, ns = non-significant				

4.5 Analysis of Process-level Strategic Alignment

The more important aspect of our analysis pertains to what happens at the process level. We looked at the association between alignment and performance in each process. But, importantly, we also focused on assessing whether firms were experiencing shortfall or slack in their processes and on linking their portfolios of IT shortfall and IT slack to their primary value discipline. Since respondents had to allocate 100 points across the three value disciplines with the highest number of points reflecting their chief value discipline, we used a simple rule to classify each firm as follows: if a value discipline received at least 50 points (over half the allocated points), we classified the firm according to that value discipline (e.g., 50-25-25). In this way, we would classify any unassigned firms as having mixed strategies (e.g., 40-30-20). As Table 5 shows, a discriminant analysis confirmed 98.7 percent (313 of 317) of our company classifications.

Table 5. Discriminant Analysis

Strategic foci	Actual totals	Allocated points %			Predicted totals
		OE	OE	PL	
Operational excellence (OE)	117	60.2	23.2	16.6	116
Customer intimacy (CI)	53	24.2	55.9	19.9	53
Product leadership (PL)	45	22.3	23.7	54.0	45
Mixed strategies (mixed)	102	35.1	34.7	30.2	99
Totals	317	40.7	32.4	26.9	313

Given the large number of firms with mixed strategies (n = 102), we tested a refined classification rule based on whatever strategic foci received the majority of points. A small number of firms (13 of 102) split their points evenly across the three value disciplines (e.g., 33-33-34). In this case, we looked at the business operations of each company in their most recent annual report before deciding what focus to allocate to the company. A discriminant analysis confirmed 93.4 percent of these revised classifications based on the following actual totals: OE = 139; CI = 102; and PL = 76. We conducted all subsequent analysis using both classifications but did not find any significant differences between the results from both. All of our analysis and results in the remainder of the paper reflects the classification details we report in Table 5.

First, we consider the prevalence of IT shortfall and IT slack in each process. Specifically, in Section 3, we hypothesize that IT shortfall is more likely to occur in processes that are peripheral to an organization's business strategy (H1) and that IT slack is more likely to occur in processes that are critical to the organization's business strategy (H2). The question as to what defines a critical process for a specific business strategy is open to debate. In the case of firms with a primary value discipline (illustrated in Table 5 as OE, CI, or PL), we defined processes as critical if our panel of judges in Table 3 saw those processes as having relatively high levels of IT use (seen in Table 3 as 1). We would then identify non-critical business processes in Table 3 as having average (0) or below average (-1) levels of IT use. As such, an operationally excellent firm, for example, might consider supplier relations and production and operations as relatively more important to its success than product/service enhancement, sales and marketing support, or customer relations. In this way, for each value discipline, we could separate critical from non-critical processes and then assess the extent of shortfall or slack in each category. Table 6 shows the results of this descriptive analysis. We used simple T tests to compare the levels of shortfall and slack in critical versus non-critical processes for each value discipline (OE, CI, and PL). Note that we excluded firms with mixed strategies from further analysis.

Table 6. Alignment in Critical and Non-critical Processes (H1, H2)

	Critical processes	Non-critical processes	Paired T-test
All firms (excl. mixed)			
IT shortfall	-0.63	-0.67	0.373 ns
IT slack	0.62	1.72	9.155 ***
Operational excellence			
IT shortfall	-0.63	-0.72	0.622 ns
IT slack	0.63	1.56	5.738 ***
Customer intimacy			
IT shortfall	-0.44	-0.74	2.107 *
IT slack	0.79	1.78	4.352 ***
Product leadership			
IT shortfall	-0.50	-0.80	1.400 ns
IT slack	0.42	2.06	6.163 ***
Note: * p < 0.05, ** p < 0.01, *** p < 0.001, ns = non-significant			

The results in Table 6 identify several interesting contrasts. First, the amount of IT shortfall in critical business processes was less than that in non-critical business processes although these differences were only statistically significant in the case of customer intimate firms. Hence, we found only partial support for H1 as most firms seem to shun IT shortfall in non-critical processes just as much as in critical processes: this finding applied to all firms regardless of their primary value discipline. We also found, for all firms and for each value discipline, significant differences in IT slack between critical and non-critical processes but in a direction that is totally opposite to what we expected; thus, we did not find support for H2. We reasoned that IT slack is more likely to arise in critical business processes since firms stand to gain more from having additional IT capacity or other forms of digital IT options in more critical areas of the value chain. However, we found that IT slack was more likely to arise in non-critical processes and that a significant amount of IT slack in non-critical areas existed[2]. We probe this point in more detail in Section 5 since it presents an interesting question around why firms seem to have so much IT slack in non-critical processes. We also ask whether it is a problem for firms if these resources remain idle for long periods and whether there is a valid reason for the rise of IT slack in these non-critical areas.

4.6 Alignment and Process-level Performance

To determine whether using revised alignment measures is potentially more useful or informative, we first identified whether alignment was associated with IT business value in each process. Using partial correlations to control for the possible effects of value disciplines on either alignment or IT business value, we then compared how IT business value in a specific process correlated with alignment as traditionally measured using absolute differences and with alignment based on signed differences since the latter distinguishes between IT shortfall and IT slack. We report these partial correlations in Table 7 in which we emphasize intra-process alignment-business value correlations in bold along the main diagonal.

[2] A possible explanation for this result offered by the senior editor speaks to the way in which organizations spread IT spending across key processes. If an organization allocates IT evenly across all processes, IT shortfall may result in critical processes and IT slack in non-critical processes. The organization could allow this situation to remain over time if it perceives the cost of differentiating IT spending to be greater than the perceived losses from IT shortfall. If the focus of IT spending is on individual processes and less on the organization in its totality, IT spending may be more likely to react to the rise of IT shortfall.

Table 7. Partial Correlations between IT Business Value and Alignment at the Process-level

	IT business value				
Strategic alignment	**Supplier relations**	**Production and operations**	**Prod. / service enhancement**	**Sales and marketing**	**Customer relations**
Supplier relations	**0.648 ***** ***0.201*** ***	0.219 *** *0.102 ns*	0.287 *** *-0.060 ns*	0.293 *** *0.123 **	0.274 *** *-0.028 ns*
Production and operations	0.329 *** *0.150 ***	**0.552 ***** ***0.321*** ***	0.336 *** *-0.055 ns*	0.170 ** *-0.009 ns*	0.207 *** *-0.107 ns*
Prod. / service enhancement	0.374 *** *0.087 ns*	0.342 *** *0.191 ***	**0.571 ***** ***-0.098 ns***	0.229 *** *0.113 **	0.313 *** *-0.051 ns*
Sales and marketing	0.347 *** *0.116 **	0.147 ** *0.076 ns*	0.291 *** *0.017 ns*	**0.509 ***** ***0.073 ns***	0.382 *** *-0.064 ns*
Customer relations	0.376 *** *0.165 ***	0.207 *** *0.154 ***	0.354 *** *-0.053 ns*	0.338 *** *0.064 ns*	**0.552 ***** ***0.125 ****

Note: * p < 0.05, ** p < 0.01, *** p < 0.001, ns = non-significant.
Values in italics (the bottom number in each cell of the table) are based on traditional alignment measures using absolute values. Otherwise, IT alignment reflects the signed difference between actual and ideal IT use. Data in bold on the main diagonal constitute a strict test of the relationship between strategic alignment and IT business value in each of the five main processes of the value chain.

The correlations shown on the main diagonal tell an interesting story. When measuring alignment using signed differences between actual and ideal IT use in a way that captures and distinguishes between shortfall and slack, we found positive and significant correlations between alignment and IT business value. When using traditional measures of alignment with absolute differences, we found positive and significant correlations in only three processes. We further note in these three areas (supplier relations, production and operations, customer relations) that correlations found with signed measures of alignment were consistently greater than those found with absolute/unsigned measures. Partial correlations between signed measures of alignment and IT business value also exceeded 0.50 in all five processes. Considering the increase in the correlation coefficients along the main diagonal in Table 7, one might ask if removing absolute values has the effect of inflating or distorting the relationship between alignment and IT business value. Using multiple respondents can mitigate such concerns but we also note that previous research has found perceptual measures of IT business value at the process level to reflect reality more so than researchers might have believed (Tallon & Kraemer, 2007; Gerow et al., 2014). The issue is not necessarily whether a high correlation coefficient means that our proposed measures are better by default than what researchers have used previously but whether our proposed measures are better able to depict what is going on inside firms.

Table 8. Partial Correlations Involving Critical and Non-critical Processes

	IT business value	
IT alignment	**Critical processes**	**Non-critical processes**
Overall alignment		
Critical processes	0.543 ***	0.422 ***
Non-critical processes	0.279 ***	0.295 ***
IT shortfall		
Critical processes	-0.438 ***	-0.384 ***
Non-critical processes	-0.254 ***	-0.214 ***
IT slack		
Critical processes	0.503 ***	0.339 ***
Non-critical processes	0.228 ***	0.279 ***
Note: significance: *** p < 0.001		

A more important assessment involves reviewing correlations between IT business value and IT shortfall and IT slack for both critical and non-critical processes. As Table 8 shows, we found a variety of interesting patterns in our results. First, we found a positive and significant correlation of 0.543 ($p < 0.001$) between IT business value and alignment in critical business processes. We found a smaller but significant correlation of 0.295 ($p < 0.001$) in the case of non-critical business processes. When we separate alignment into

shortfall and slack, we note that IT shortfall was negatively correlated with IT business value in critical business processes (r = -0.438, $p < 0.001$). As such, our results support H3. Our results suggest that, as IT shortfall climbs, organizations are less able to meet their IT support needs and so they are less likely to perceive IT as having a positive impact on process performance. We further note a significant correlation of 0.503 ($p < 0.001$) between IT slack and IT business value for critical processes. The correlation was smaller although positive and significant in the case of non-critical business processes (r = 0.279, $p < 0.001$). As such, our results support H4. These results indicate that IT slack—rather than impeding IT business value—is instead associated with higher IT business value. We saw in Table 6 that IT slack was more evident or prominent in non-critical processes than in critical processes. While we found a positive and significant correlation of 0.279 ($p < 0.001$) between alignment and IT business value in non-critical processes, it appears by virtue of the difference in the correlation and the extent of IT slack in critical and non-critical processes that the returns to IT slack are relatively higher in critical processes than in non-critical processes. In Section 5, we discuss these results and their implications for measuring alignment in the IT literature.

5 Discussion

While the alignment literature has used a variety of approaches to evaluate the fit between IT and business strategy, the IS literature contains the general understanding that misalignment indicates a lack of IT support for a business or, in profile deviation terms, it uses IT at a level below some ideal notion (McLaren et al., 2011; Gerow et al., 2014). In practice, firms are in a constant state of flux, and IT and business strategy rarely perfectly align with each other. While firms may experience times with weak IT support, the literature has also discovered that, in the path to alignment, organizations may also find an excess of IT relative to their actual IT needs (Hirschheim & Sabherwal, 2001; Sabherwal, Hirschheim & Goles, 2001). Indeed, McLaren et al. (2011), in studying profile-based alignment in six business units of five firms, found that a discrepancy in their results disappeared when they excluded business units where actual IT use was higher than ideal IT use (which is consistent with our definition of IT slack). Since their actions departed from using profile deviation in the standard manner, McLaren et al. (2011) argue that "further research is needed before we can advocate adjustments to methods for calculating overall strategic fit using Euclidean distance" (p. 921). In our paper, we revisit the concept of alignment and explore whether theoretical and empirical grounds actually exists for adjusting these Euclidean-based methods. Our results suggest that the presence of IT slack in various processes is more the rule than the exception: 77 percent of our sample held IT slack in at least one of their five processes, and 4 percent held IT slack in all of their processes. The average number of processes containing IT slack across our entire sample was 1.9 processes per firm based on five processes in the generic value chain. If IT slack was the exception rather than the rule, continuing to use our existing profile deviation measures with absolute value or squared terms—at the firm or process level—might not be overly biased or factually wrong, but, if contemporary organizations are making a conscious effort to build up incremental IT resources or to pursue digital options, our extant alignment measures—if left unchecked—could produce spurious results. As a result, IT researchers may fail to detect relationships between alignment and firm performance (a false negative) or underestimate the impacts of alignment if a relationship does exist. For CIOs who consult with IS academics or who rely on the results of their research, alignment studies based on our extant measures could call for investing extra IT resources into processes that already work well simply because those alignment measures view IT slack the same way as IT shortfall. Existing measures do not distinguish between IT shortfall and IT slack. They view both as misalignment and, therefore, equally undesirable in the eyes of firms trying to grow IT returns. Our results suggest that academics and practitioners should continue to see IT shortfall as misalignment and avoid it when possible but promote and encourage IT slack. We build on these points and their implications for alignment theory and practice in Section 5.1.

5.1 Theoretical and Practical Implications

The theory of alignment holds that organizations are likely to benefit when they optimize the *fit* between their IT and business strategy (Henderson & Venkatraman, 1993). That view is still accurate; the issue is with how one operationalizes it. Profile deviation—given its widespread use and acceptance by academics—is particularly susceptible to bias if one operationalizes fit in Euclidean terms. Absolute value or square terms force all Euclidean distances to be positive with the understanding that all deviations from ideal constitute misalignment and are somehow *bad* or discouraged. Our analysis reveals, however, that, while some gaps or distances between actual and ideal IT use are indeed bad, these relate primarily to IT shortfall (actual < ideal). Our analysis also shows that some gaps or distances (actual > ideal) are *good* to such an extent that one might actively promote IT slack in organizations. We reveal that IT shortfall is

associated with lower IT business value in both critical and non-critical processes and that IT slack is associated with increased IT business value. As such, one might ask whether IT slack is always going to be better and whether CIOs should actively plan to acquire a stock of ready-to-use IT resources in all processes. Research on digital options confirms that options are neither cost free nor risk free, and so any decision to hold extra resources in any process should be a rational decision. It makes sense for firms to develop IT slack in the most critical processes since the opportunity cost of not being able to deploy IT in time can be high. It makes much less sense to pursue IT slack uniformly in each and every process in the value chain if one has little opportunity to ever use these resources in a meaningful way. Instead, firms should likely pursue a portfolio approach to alignment: avoid IT shortfall in all areas since any amount of IT shortfall hurts performance and build up slack IT resources in more mission-critical or strategy-centric processes where slack is likely to have the greatest effect if firms are suddenly presented with a need or opportunity to change business strategy.

5.2 Developing an IT Alignment Portfolio

IS practitioners may find the idea of an alignment portfolio appealing. If, based on the current alignment literature, one sees alignment purely in terms of IT support for a firm's business strategy, CIOs would benefit most by eliminating all instances of IT shortfall, beginning with those processes that they deem critical to their organizations' success. If the measurement of alignment expands to include IT slack, organizations could ask where extra IT resources could be most helpful in the event that the organization is suddenly required to change direction or to expand the scope of its current activities. Of course, as we see in Table 6, IT slack might be less evident in critical processes than in non-critical processes because organizations are more likely to exercise any digital IT options in these processes. Organizations are more likely to adjust their critical business processes when faced with change or the need to revise the scope of their business activities. As such, there is an argument that IT slack will be lower in these processes since there is a greater propensity to absorb any slack IT to support any scale changes within these critical areas of the business. By the same token, firms with IT shortfall in their critical business processes – as seen in Table 8 – lack any slack IT resources with which to quickly adjust to change. Certainly, efforts to address IT shortfall in these areas are likely to lead to improved firm performance but our results also suggest that while removing IT shortfall might be helpful in the short term, the inevitability of change means that this is only a temporary fix and that creating digital IT options in these processes would better serve the longer term interests of the organization. As with any portfolio – financial, IT or otherwise – there may be a need for long term periodic rebalancing based on shifting market conditions and investment availability. It may be politically undesirable for CIOs to allow pockets of IT slack to endure even in non-critical processes if other critical processes continue to experience IT shortfall. Rebalancing an alignment portfolio may mean reassigning IT resources from one process to another. Considering the higher correlation between IT slack and IT business value in critical processes, this may necessitate moving IT resources to critical processes. Some resources are more fungible than others. Today, storage and CPU cycles, for example, can be scaled or repurposed relatively quickly but others resources may be stickier due to high levels of integration with other applications and their dependence on certain IT support personnel. Hence, even if CIOs are aware of the need to rebalance their alignment portfolio, it may take time and considerable effort to achieve this.

The fact that our results reveal IT slack in non-critical processes does not imply that organizations are committing an egregious error or that they are wasting their IT resources. Tallon (2012) shows how the effects of alignment (both positive and negative) cascade from process to process along the value chain. If environmental forces cause firms to tap slack IT resources in critical business processes, any stepped-up level of business activity in a critical process will likely impact adjoining processes where the level of activity must also increase. Hence, it makes sense for non-critical processes to have some level of IT slack since these non-critical processes still tightly link to critical processes and could otherwise turn into bottlenecks if IT slack is unavailable. Accordingly, firms should not overlook IT slack. One could also infer, perhaps, that expanding the availability of IT resources to all processes—critical and non-critical—is good. Systems theory states that the overall system benefits of higher IT spending leads to increased agility even if some portion of this spending is in uncertain areas that might not help the firm in the short term (Google's many futuristic projects outside its search engine are one such example). In this way, IT is not like other functional areas that might experience some degree of slack from time to time. IT is a utility that promotes and accelerates value creation in other functions; creating IT slack may, therefore, allow these other functions to create value in a non-linear fashion.

5.3 Measuring Alignment by Other Means

Because we illustrate IT shortfall and IT slack only with profile deviation, one might ask: what about other ways of measuring alignment such as moderation and matching? Is there a way to adjust these other measures to consider the gap or relative distance between IT and business strategy even though the Euclidean distance is not part of these methods? Matching is a blunt measure since it focuses only on whether IT and business strategy have identical foci. As such, it would be difficult but not impossible to incorporate IT shortfall or IT slack into this binary (matched or non-matched) measure. Researchers implement moderation as a product score between measures of IT strategy and business strategy. Researchers have questioned the meaning of moderation scores in the past. If one measures IT and business strategy as *x* and *y,* respectively, *xy* and *yx* are interchangeable, and the fact that $x > y$, $x = y$, or $x < y$ is irrelevant. What matters is the product of *x* and *y*. Just as we divided alignment into IT shortfall and IT slack, one can retain product terms and further classify those product terms according to the distance between *x* and *y*, which would permit researchers to develop and test two types of moderation scores in their analyses. For example, one could treat *xy* product terms where $x > y$ independently from *xy* product terms where $x < y$.

5.4 Contribution of the Research

This paper contributes to the alignment literature in three ways. First, we build on an emergent stream in the alignment literature that looks at alignment at the process level. Much of what we know about alignment comes from studies that consider alignment as a firm-level construct that involves a solitary measure of IT strategy and a solitary measure of business strategy. By proposing a more granular view of alignment at the process level, we can consider the degree to which IT supports individual activities under the guise of critical and non-critical processes. In much the same way that the IT business value literature has transitioned from the firm to the process level in light of the argument that the first-order effects of IT materialize at the process level, the alignment literature may also benefit from looking at the challenges and benefits of aligning IT at the process level even though the multiplicity of processes could prove challenging.

Second, we question the need to continue assessing alignment as the absolute or squared distance between actual and ideal IT use. As we report in Section 2, profile deviation continues to be one of the most popular ways of measuring alignment, but its use causes one to view all deviations from ideal IT use (regardless of how ideal IT use is specified) as misalignment. This treatment may have been acceptable at a time when firms saw IT primarily as a support tool for business strategy. However, firms increasingly see IT as enabling or driving business innovation. To account for this transition, we illustrate how using signed differences between ideal and actual IT use can detect IT shortfall (where IT cannot fully support the business strategy) and IT slack (where IT meets all current business needs with an excess supply of IT resources). These ideas extend our understanding of alignment while correcting for some inaccuracies in how previous research has applied profile deviation measures.

Third, we reinforce the received view in the IT literature that alignment is associated with greater performance. By measuring IT shortfall and IT slack in each process and grouping processes according to whether they were critical or non-critical, we could empirically demonstrate that IT shortfall (IT slack) is negatively correlated (positively) with IT business value. Ignoring the conceptual differences between IT shortfall and IT slack could potentially bias, distort, or confuse the link between alignment and performance. Revising our measures of profile deviation is an important first step toward recognizing that situations where firms have opted to acquire digital IT options is, contrary to current alignment measures, not a source of misalignment in the same sense as IT shortfall. IT slack is more enabling than restrictive.

5.5 Limitations and Future Research

Despite contributing to theory and practice, our research contains several limitations that could lead one to question the robustness and generalizability of our results. While we surveyed multiple C-level individuals in each organization as a way to minimize respondent bias, we cannot guarantee that the opinions of one individual regarding business strategy represent that individual's firm as a whole. Business cycles could cause a drop in the level of business activity and, thus, lead to a reduction in ideal IT use. When we represent IT slack as digital options in cases where actual IT use is greater than ideal IT use, we do so assuming that firms have made a logical decision to adopt digital options. A declining business cycle could artificially create the semblance of IT slack where the firm cannot scale back its actual IT use in a rapid manner. While we did not find any evidence in our data of a declining business cycle (we compared firm performance before

and after the year of data collection), it is still possible that, when we see IT slack as a valuable business option, others could see it as a burden. In probing the effects of alignment—IT shortfall and IT slack—in each process, we used executives' perceptions of IT business value. While past research has found that perceptions are not as susceptible to error, bias, and distortion as once believed, it would still have been advantageous to probe the effects of alignment against quantifiable or objective process-level performance outcomes. There may also be an issue of resource munificence in our results if, for example, the highest performing firms were also those who could afford to create digital options (Tallon et al., 2002; Coltman, Devinney & Midgley, 2011). One could reasonably argue that high-performing organizations benefit from reinvesting profits by enabling them to acquire incremental resource slack and, thus, reinforcing their future success. In contrast, financially struggling firms may scale back their IT spending to such an extent that pockets of IT shortfall emerge. As our analysis shows, these pockets of IT shortfall could trigger a decline in performance that leads to further cuts in IT spending and so on over time. However, because our study is a cross-sectional study, we lack the ability to probe how alignment reacts to changes in IT spending. Future research could benefit by exploring how organizations react to discovering IT shortfall in critical processes and the steps they take to address it. It would also be useful for future research to explore in more detail the link between alignment and digital options. The true value of IT slack to an organization is not just the aggregate value of IT slack in each process if the organization can easily move slack resources between processes. Process-specific IT slack is less valuable than process-independent IT slack if an organization can share IT among processes. Future research could also open up the idea of process-level IT slack to discover the implications of different combinations of hardware, software, labor, and service resources. What we describe as IT slack is likely to be a complex web of different types of IT resources in practice, so it will likely be important to subject IT slack to further detailed investigation. Equally, IT shortfall could be linked to different combinations of hardware, software, and other resources.

This research provides a first pass at one way of isolating digital options, although we cannot say how, when, or if these options are exercised. Longitudinal studies (e.g., Sabherwal et al., 2001) could offer insights into this dynamic view of alignment. Industry-level research (e.g., Palmer & Markus, 2000; Dorociak, 2007; Broadbent & Weill, 1993) might allow researchers to examine whether IT shortfall and IT slack appear in similar processes and similar volumes for firms that are their direct competitors. Controlling for industry-level effects would allow researchers to see if IT slack, for example, allowed firms to realize a process-led competitive advantage among firms operating in the same industry.

6 Conclusion

Despite significant strides by IT researchers in understanding the form and function of alignment over a three decade period, alignment continues to be included among the most critical issues facing CIOs worldwide (Kappelman et al., 2014). While IT practitioners can readily identify the often insurmountable challenges associated with achieving and maintaining alignment, researchers have struggled with ways of measuring alignment with any degree of accuracy and consensus. Measurement is both difficult and error prone, while the fact that alignment is a function of the fit between IT and business strategy—two equally *thorny* constructs—makes measuring alignment that much more complex. Yet, over time, IS researchers have managed to develop measures that principally involve matching, moderation (or product terms), and profile deviation. Different measurement approaches have produced different results, but behind almost all these measurement approaches is an implicit assumption that fit equates to IT support for the business strategy. The alignment literature has its genesis in a time when firms saw IT as a support tool; IT was subservient to business strategy in the sense that managers viewed it in tactical rather than strategic terms. The reality today is different. Managers widely accept IT as having strategic potential and as having the possibility of shaping or enabling business strategy. Our current alignment measures cannot clearly distinguish between whether IT is a support tool or a strategic enabler; the default has been to favor the former rather than the latter or to combine both. Using profile deviation—one of the most popular ways to measure alignment—is especially relevant in this regard since its use of absolute or squared Euclidean distances between actual and ideal IT use treats all such deviations as misalignment. Some deviations (e.g., IT shortfall) constitute misalignment if actual IT use is less than what an organization needs to support its business strategy. We question whether cases where actual IT use is more than what an organization needs to support its business strategy—IT slack—are also misalignment. While there may be some exceptions, we contend that it is not misalignment. IT slack means that an organization has ample resources to support the business with some resources left over. On one level, one could see IT slack as wasteful but, on another, as an option that organizations can exercise when a shift in business strategy calls for additional IT support.

Changing how we measure profile deviation to allow it to account for IT shortfall and IT slack is simple and yet essential to triggering a more meaningful debate as to how organizations can better use IT.

Importantly, we found that IT shortfall was negatively correlated with IT business value whereas IT slack was positively correlated with IT business value. The effects of IT slack were higher in critical processes than in non-critical processes even though, in absolute terms, these critical processes appeared to have less IT slack. Hence, IT executives could think about alignment not just as a type of fit between IT and business strategy at the process level but as a portfolio of different values that they need to manage or rebalance over time as conditions change. If researchers continue to use existing alignment measures without adjusting for IT slack (77% of our sample exhibit some form of IT slack in at least one process), they would misconstrue IT slack as IT shortfall despite the fact that IT slack means that the organization already meets its IT support. Researchers have hinted in the past that, while it may be unusual to see situations where actual IT use exceeds ideal IT use, it may be time to take a more in-depth look at how we calculate alignment since these cases could dramatically alter our research results if we measure alignment properly (McLaren et al., 2011). What will convince researchers that it is time to rethink our alignment measures is further evidence that alignment is much more than IT shortfall and that IT slack is also a way for firms to consider the fit between IT and business strategy. We encourage further debate on this topic in anticipation of increased interest in the strategic nature of IT and ongoing pressures facing IT and non-IT executives to reduce the gap—real or imagined—between IT and business strategy.

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Appendix

SURVEY INSTRUMENT #1
IT EXECUTIVES

Business Strategy and Value Disciplines (Treacy & Wiersema, 1995)

What is your firm's primary strategy/operating focus? Please allocate 100% across the following foci.

Strategy/Operating Focus		Percent
Operational excellence (e.g., emphasize efficiency and reliability, low cost, end-to-end supply chain optimization)	% =	
Customer Intimacy (e.g., emphasize flexibility and responsiveness, customer service, market-place management)	% =	
Product/service leadership (e.g., emphasize creativity, product development, time to market, market communications)	% =	
	Total	100

IT Support for Critical Business Activities

To what extent is IT used to support critical business activities in each of the following processes?

	Low IT Use						High IT Use
Supplier Relations	1	2	3	4	5	6	7
Production and Operations	1	2	3	4	5	6	7
Product and Service Enhancement	1	2	3	4	5	6	7
Marketing and Sales	1	2	3	4	5	6	7
Customer Relations	1	2	3	4	5	6	7

SURVEY INSTRUMENT #2
BUSINESS EXECUTIVES / CFO

Business Strategy

Business strategy is reflected in the execution of business activities throughout the firm. For each of the business processes below, please consider the critical business activities on the right, and identify the extent to which these activities have been implemented or enacted by your firm.

Activities Implemented: Not Implemented						Fully Implemented	Business Processes	Critical Business Activities
1	2	3	4	5	6	7	Supplier Relations	Forge closer links with suppliers; monitor quality; monitor delivery times; gain leverage over suppliers; negotiate pricing.
1	2	3	4	5	6	7	Production and Operations	Improve throughput, boost labor productivity, improve flexibility and equipment utilization; streamline operations.
1	2	3	4	5	6	7	Product and Service Enhancement	Embed IT in products; increase pace of development / R&D; monitor design cost; improve quality; support innovation.
1	2	3	4	5	6	7	Sales and Marketing Support	Spot market trends; anticipate customer needs; build market share; improve forecast accuracy; evaluate pricing options.
1	2	3	4	5	6	7	Customer Relations	Respond to customer needs; provide after-sales service and support; improve distribution; create customer loyalty.

SURVEY INSTRUMENT #3
BUSINESS EXECUTIVES

(Separate survey in first data collection; items added to survey #2 in second data collection.)

IT Business Value

How much impact has IT had on your firm's performance in each of the following areas? Please limit your appraisal to value already realized rather than value expected in the future.

Supplier Relations

Low IT Impact						High IT Impact	
1	2	3	4	5	6	7	Help your corporation gain leverage over its suppliers.
1	2	3	4	5	6	7	Reduce variance in supplier lead times.
1	2	3	4	5	6	7	Help develop close relationships with suppliers.
1	2	3	4	5	6	7	Improve monitoring of the quality of products and services from suppliers.
1	2	3	4	5	6	7	Enable electronic transactions with suppliers.

Production and Operations

Low IT Impact						High IT Impact	
1	2	3	4	5	6	7	Improve production throughput or service volumes.
1	2	3	4	5	6	7	Improve operating flexibility.
1	2	3	4	5	6	7	Enhance utilization of machinery and equipment.
1	2	3	4	5	6	7	Improve the productivity of labor.
1	2	3	4	5	6	7	Streamline business processes.

Product and Service Enhancement

Low IT Impact						High IT Impact	
1	2	3	4	5	6	7	Enhance the value of products and services by embedding IT in them.
1	2	3	4	5	6	7	Decrease the cost of designing new products and services.
1	2	3	4	5	6	7	Reduce the time-to-market for new products and services.
1	2	3	4	5	6	7	Enhance product and service quality.
1	2	3	4	5	6	7	Support product / service innovation.

Marketing and Sales

Low IT Impact						High IT Impact	
1	2	3	4	5	6	7	Help track market response to pricing strategies.
1	2	3	4	5	6	7	Increase your ability to anticipate customer needs.
1	2	3	4	5	6	7	Enable sales people to increase sales per customer.
1	2	3	4	5	6	7	Improve accuracy of sales forecasts.
1	2	3	4	5	6	7	Enable identification of market trends.

Customer Relations

Low IT Impact						High IT Impact	
1	2	3	4	5	6	7	Enhance your ability to provide after-sales service and support.
1	2	3	4	5	6	7	Improve product / service distribution.
1	2	3	4	5	6	7	Enhance flexibility and responsiveness to customer needs.
1	2	3	4	5	6	7	Enhance your ability to attract and retain customers.
1	2	3	4	5	6	7	Enable you to support customers during the sales process.

About the Authors

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