

# Acquiring IT Competencies through Focused Technology Acquisitions

*Completed Research Paper*

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## **Abstract**

*In the turbulent information technology (IT) industry, firms need to continuously innovate to maintain or increase their competitiveness. Focused technology acquisitions provide a means to rapidly gain IT competencies and innovations. Research consistently identifies knowledge and culture as critical antecedents to success in these acquisitions. Since such studies are typically observational, these constructs have been considered independently and within limited parametric values. Incorporating an agent-based simulation expanding on the March (1991) exploration-exploitation model, we show that there are marginally decreasing returns on knowledge appropriation, but non-decreasing linear returns on cultural appropriation. Our findings also show that combinations of appropriation strategies yield equivalent performance benefits. Gains are improved by insulating retained employees from any exploitive cultural influences. We confirm prior evidence of the “dual-edged” sword effects of cultural appropriation of acquiring underperforming IT firms.*

**Keywords:** Mergers and acquisitions, Inter-organizational learning, Knowledge, Culture, Simulation and modeling IS, Agent-based models

*Most people forget that in a high-tech acquisition, you really are acquiring only people.*

J. Chambers, CEO of Cisco (Byrne 1998, p.102).

## Introduction

In the turbulent information technology (IT) industry, firms need to continuously innovate to maintain or increase their competitiveness. To cope with rapid advances in information technologies, firms are pressurized to pursue high-speed innovations and adaptations to their IT product and service offerings, and underlying IT skills and competencies. An increasingly common route to innovation followed by both IT product and services firms is through a merger and acquisition (M&A) event. For example, Cisco Systems, a well known exponent of this strategy, gained access to new technologies by acquiring 57 small, specialized technology companies between 1993 and 2001 (Harding et al. 2004). The acquisition of Widevine by Google in December 2010, which adds and enhances Google TV (Dudley 2010) or IBM's acquisition of Netezza Corporation in September 2010 to expand IBM's business analytics initiatives (IBM 2010) are other examples. IT services firms also pursue an acquisition route to acquire new IT skills and competencies. In a recent interview, the CEO of Infosys Technologies, a leading outsourcing vendor, stated "We are looking at acquisitions for strategic reasons - to fill a gap in our service portfolio ... a typical size or the cut-off limit will be 10 per cent of our revenue ..." (Paul et al. 2009). Similarly, Wipro Technologies, another IT service provider, is actively searching for small sized acquisition targets to fill gaps in its service portfolio (Sims 2010).

Research demonstrates that acquisitions expose firms to new ideas and in the long run lead to broader knowledge (Haspeslagh et al. 1991; Leonard 1995; Levitt et al. 1988). Acquisitions are a means for firms to gain technological knowledge, competencies and new products (Graebner 2004), and define a strategy prevalent in the IT industry which avoids the time-consuming and uncertain process of internal innovation (Ranft & Lord 2002). Technology acquisitions serve (or are intended to serve) as strategies to import advanced knowledge, which the acquiring firm does not possess or is unable to master (Puranam et al. 2006; Puranam et al. 2007). In industries that rely on a pipeline of innovation, such as IT, declining or stagnated internal productivity can be successfully offset through acquisitions (Higgins et al. 2006). Targeting specific valuable resources such as technologies, or more specifically knowledge (often proprietary) about the technologies, is an increasingly articulated strategy that drives M&A activities (Ranft et al. 2002). However, as John Chambers' opening quote asserts, it is essential to realize that it is people who are the units of acquisition. As such, people bring not only the *knowledge* gained in the acquired firm (specific to a particular technology, for example), but they also bring the historical-situational context of the pattern of work within which that knowledge was developed and applied – the work *culture* of the acquired firm. Research has consistently indicated that both matter, but which matters most, how do they interact, and under what conditions?

To answer these questions we address a specific type of M&A, termed a *focused technology acquisition*, defined as an acquisition of a relatively smaller, coherently-defined technology-based firm by a larger firm to add technological resources to their own strategic capabilities (Hitt et al. 2001; Puranam et al. 2006; Puranam and Srikanth 2007). The unique element of this strategy is that its value resides within the intellectual capabilities held by the individuals (managerial and technical IT human resources) acquired from the target firm (Bharadwaj 2000; Ranft et al. 2000) and the integration and utilization of those capabilities (Puranam et al. 2007). In focused technology acquisitions, the key resource sought is knowledge of the individuals related to the IT of interest. But there is more to the story.

Research reveals that the risks and failures surrounding acquisitions often dominate the optimism underlying the move (Moeller et al. 2005; Rau et al. 1998; Ravenscraft et al. 1989). Success of focused technology acquisitions appears to be contingent upon the ability "to both exploit their capabilities and technologies in a coordinated way and foster their exploration capacity by preserving their autonomy" (Puranam et al. 2006, p.236). Thus, *acquisition* is a necessary, but not sufficient, condition for improving organizational performance via an influx of knowledge. Acquiring firms also need to *integrate* the acquired knowledge in a way that achieves the usual goal of the acquisition – increasing organizational performance. Success of a focused technology acquisition, a high-level strategic decision, is likely contingent upon the subsequent post-acquisition low-level, operational choices regarding integration (Siggelkow et al. 2009). As it turns out, a critical component of the integration problem in focused

technology acquisitions (as well as other types of acquisitions) is the concept of organizational *culture*. For example, a survey by Bain & Company in 2002 (Harding et al. 2007) identified culture as one of the most important factors influencing post-acquisition success. Therefore, a distinction is made between acquiring the relevant individuals possessing the appropriate *knowledge* and the role organizational *culture* plays in sustaining the contribution of that knowledge over time.

Though the literature on technology acquisitions has repeatedly identified knowledge and culture as two major constructs significantly related to acquisition success, neither the underlying micro processes nor the interaction between them has received sufficient attention as it is quite difficult to isolate the specific impact of these highly entangled, multi-level constructs from complex firm behaviors. Furthermore, the literature reflects (necessarily) mostly observational studies as it is prohibitive to conduct either experimental or quasi-experimental designs on this scale. Consequently, to begin to examine these theoretical gaps and accommodate the empirical limitations, we build an agent-based model of focused technology acquisitions – one firm acquiring another. Our model does not address the acquisition decision itself; rather, our model simply focuses on post-acquisition strategies concerning the two constructs of interest: appropriation of knowledge and culture. For this purpose, we adopt a theoretical perspective wherein knowledge is embedded in the cognitive process of individuals, as is their organizational culture, which embodies the practices of the collective, situated in a particular context and in time, and enforced through various forms of institutionalization.

Given the wide latitude of options afforded by such approaches, we specifically grounded our model on a well-established one – the exploration-exploitation model (March 1991). This addressed the important issues of establishing construct validity and engaging the trajectory of building on prior, sufficiently robust, science (Hawking 2006; Huxley 1965). The constructs of our model map directly into the constructs of the March model. Through a series of computational studies we manipulate the constructs in an exploratory fashion. Specifically, we use the model to reveal the performance consequences of strategic choices of *appropriating knowledge* (operationalized as how many individuals to retain from the acquired firm) and *appropriating culture* (operationalized as how much culture to adopt from the acquired firm) in these acquisitions.

In a stage play, characters take on roles that may be interesting, but the story that emerges is based on the dynamics of how these characters interact – focusing on a subset of characters does not reveal the overall narrative. Similarly, our results allow us to tell a richer story detailing not only the roles played by knowledge and culture, but how the *interaction* of these roles is likely to influence the overall performance narrative of focused technology acquisitions. We find that there are unequal benefits between appropriations of knowledge and culture – acquiring more knowledge through individual retention exhibits decreasing rates of return on performance, but appropriating their culture exhibits non-decreasing returns on performance. We also find that a firm can strategically vary appropriation options to yield equivalent gains in performance – levels of knowledge appropriation can be traded-off against levels of cultural appropriation (and vice versa). We show that insulating newly acquired individuals from the strong socialization culture of the firm can substantially increase their value to the firm. Finally, we demonstrate an important consequence of being wrong about an acquisition – if the acquired firm does not have a knowledge advantage, acquisition of their culture can be devastating to the firm's performance. Though acquisitions may only acquire people, the nature of what those people bring, and how the firm, through its *post-acquisition* cultural environment, accommodates what those people bring, determines the likely success or failure of the acquisition. With a possibility of being overly simplistic, we summarize our primary result as follows – when acquiring IT competencies through focused technology acquisitions, knowledge matters, but culture is king.

## **Prior Research on Post-Acquisition Risk**

In focused technology acquisitions, post-acquisition performance depends disproportionately (by definition) on the individuals obtained and their subsequent intellectual contributions to the firm (Ranft et al. 2000). Specifically, an acquirer seeks to integrate the target firm to commercialize the acquired technology and knowledge, while simultaneously striving to maintain some degree of autonomy in the target firm to avoid destruction of its innovation capabilities (Puranam et al. 2006; Puranam and Srikanth 2007). In the presence of this dilemma, effective implementation and integration are essential (Graebner

2004). Thus, a major challenge for acquisition success is maintaining the target firm's knowledge and successfully transferring this knowledge to the acquirer (Felin et al. 2007).

Similarly, a recurring question in acquisitions is the extent to which the culture of the acquired firm can be maintained to maximize the returns on knowledge. For example, Schweizer (2005) concluded that a hybrid post-acquisition strategy of autonomy and integration will allow knowledge transfer *and* cultural integration. The insights driving the choice between integration and autonomy, and how these relate to knowledge and culture are far from complete.

### ***Knowledge as a Risk Factor***

Consider that knowledge is not a free-standing entity, but is embodied and bundled in the cognitive processes of individuals, defining what they know and their routines of interaction (Argote et al. 2000; Dosi et al. 2000). Knowledge held by an individual defines the capability, experience, and skill that underlies acquired individual expertise (Ericsson et al. 2007), which may include knowledge of others' expertise for effective group functioning (Salas et al. 2006).

Knowledge is not a homogeneous good, as it can take on many different forms (Badaracco 1991) such as subjective or objective, concrete or abstract, facts or skills, scientific or historical. Our use of the term is consistent with Argote and Ingram (2000) as *the cognitive process of individuals, defining what they know and their routines and interactions*. Consequently this type of knowledge is held by (and thus "moves with") individual employees and consists of their individual capabilities, experiences, and skills. This definition of knowledge incorporates cognitive aspects of personal knowledge, experience and intuition related to the technological and managerial dimensions of IT knowledge – their perspectives and practices. Key employee *retention* is a commonly reported risk factor in these acquisitions; that is, transfer of ownership does not equate to transfer of knowledge.

Once the firm has been acquired, choices about employee retention define the extent to which knowledge (via individuals) is successfully transferred. Ranft and Lord (2002) propose that integration failure can be rooted in employee loss and disruption of organizational routines, and suggest that the acquirer might be unaware of where valuable knowledge resides within the target firm. Cisco Systems measures the success of individual acquisitions by the ability to retain key employees from the acquired company (Tempest et al. 2000). In general, that employees play a key role in facilitating the transfer of knowledge is well established (Almeida et al. 1999; Groysberg et al. 2008), as is movement of knowledge workers as a means of transfer and dispersion of knowledge assets (Puranam et al. 2007; Song et al. 2003).

### ***Culture as a Risk Factor***

Definitions of culture vary. Although Kroeber and Kluckhohn (1952) reported over 200 definitions of "culture", the situation has improved substantially. Beyond definitional issues, a more important observation is that the manifestation of culture itself varies widely, as White (1949) notes that "culture became differentiated as soon as it appeared" (p. xvii). Cr mer's (1993) definition of corporate culture succinctly captures our perspective, noting that it is "the part of knowledge that is shared by a substantial portion of the employees of the firm, but not by the general population from which they are drawn" (p. 354). This emphasizes the important point that *culture is acquired knowledge*, but knowledge of a different type (Boyd et al. 2005; Carley et al. 1994; Shore 1996). The acquired individuals' *knowledge* (what they endogenously believe to be appropriate) presents the potential for innovation and growth (indeed, the purpose of the acquisition), while the extant *culture* of the acquiring organization (the exogenous pressure to sustain or alter the individuals' beliefs) can enable or inhibit it. We view an individual's knowledge as representing their beliefs in "how to do and view things", and see the organizational culture as representing their beliefs in "how to do and view things here, now."

The formulation of organizational culture is both dynamic and highly influenced by situational factors, many of which are set (intentionally or unintentionally) by the firm itself, articulating the proper ways to behave and attitudes to possess in a temporal context (O'Reilly et al. 1996). Thus, culture is *situated in a particular context and in time, somehow reflecting perspectives of the collective and "enforced" through some form of institutionalization*. For example, the knowledge the acquired employees bring with them may have a preference for a certain type of analytical approach (their belief), but the organizational

culture of their new firm demands (e.g., through established procedure, access to technology, or organizational pressures) a different approach.

Overall, discussions of culture in M&A literature are sympathetic to our perspective. For example, Nahavandi and Malekzadeh (1988) succinctly define culture in M&As as “the beliefs and assumptions shared by members of an organization” (p. 80). Buono and Bowditch (2003) state that M&A integration is a process where two groups attempt to assimilate through adoption of cultural traits. Stahl and Mendenhall (2005) refer to culture as the “normative glue” that “holds an organization together through traditional ways of carrying out organizational responsibilities, unique patterns of beliefs and expectations that emerge over time, and the resultant shared understandings of reality at given points in time” (p. 137). Thus, post-acquisition integration involves the associated socializing processes of culture (Harrison et al. 2006).

Cultural issues have created friction across many acquisitions, including HP’s acquisition of Compaq (Burgelman et al. 2006). Firms have attempted to address this issue directly - Cisco has tried to preserve an acquired firm’s existing infrastructure to retain acquired employees (Goldblatt 1999), and Sun Microsystems measured a target company’s culture (Terranova 2007). Weber and Camerer (2003) note that “while culture may seem like a ‘small thing’ when evaluating mergers, compared to product-market and resource synergies, we think the opposite is true because culture is pervasive”.

Both scholars and practitioners agree that knowledge is essential in acquisitions as these. It is also recognized that cultural issues in their various forms are emerging as primary suspects in the frictions encountered in post-acquisition difficulties. As these are co-existing constructs, the task at hand is to craft a model, albeit simple, that begins to tease out the characteristics of each.

## The EEA Model

As we have noted, adopting the constructs of the March model affords both simplicity and construct validity. This approach also enables us to validate the original model and develop a cumulative research tradition (Prietula et al. 2000). The analyses of computational experiments permits us to both compare the results to prior work in the field (calibrating for external validity and replicability) and generate propositions with implications for practice, theory, and subsequent research (Carley 2008; Harrison et al. 2007; Prietula In Press). In our model we focus on post-acquisition *integration strategies* only – the strategic choices that embody how the acquiring firm seeks to obtain the knowledge and manage culture extant in the target firm – and not on the choice to acquire the firm.

### *March’s Original Model*

We explain the March (1991) model in our context as follows. Imagine that there is a *reality* defining the true state of nature revealing what an organization should believe to function optimally in its competitive environment. This true state of nature is characterized as a set of  $m$  beliefs that are simply represented as a vector of  $m$  integers that are either +1 or -1. An organization has a similar set of  $m$  (independent) beliefs about what it should be doing to be successful in its environment. This is called the *organizational code*<sup>i</sup> and is also represented as a vector of  $m$  integers, which can be +1, -1 or 0 (undecided). An organization is also comprised of  $n$  *agents* (employees) and each one of these agents possess its own vector of  $m$  beliefs about what it should be doing to be successful in the environment, which can also be +1, -1 or 0 (undecided). The extent to which the organizational code directly matches reality vector defines the likely long run organizational performance of the firm (assuming environmental stability). Unfortunately, *reality* cannot be directly observed (that would be too easy). Knowing which cultural beliefs to retain and which to discard are consequences of the influence dynamics of the model.

In our model, we re-interpret the organizational code as the current *culture* of the firm – the set of beliefs held by the firm on what it should be doing to be successful in its competitive environment. Consequently, a firm whose culture (organizational code) better matches reality has an advantage over firms whose culture less fits the demands of reality. Accordingly, agents of the firm are pressured to conform to the current culture “as a consequence of socialization into the organization and education into its code of beliefs” (March, 1991, p. 74). This pressure is the *exploitation* parameter ( $p_i$ ) of the March model that

defines the probability that any given belief held by an agent will switch to conform to that of the current *culture* (i.e., organizational code). We reinterpret the exploitation parameter in our context as a firm's effort towards *cultural conformity*. One can imagine that firms vary in their insistence on specific cultural components, and the consequences of having "strong" or "weak" conformity pressures can be significant.

On the other hand, the set of beliefs comprising the current culture also face pressure to adopt the beliefs held by the agents, and this pressure to change the culture is the *exploration* parameter ( $p_2$ ) of the March model. We interpret the exploration parameter as a firm's effort towards *cultural adaptation*. However, not any agent can influence the current culture of the firm; rather, only that subset of agreeing agents whose beliefs *better match reality* can exert pressure on the firm to alter its current culture.

Although the interacting dynamics seem complicated, as the environment is stable and no exogenous factors enter into the model, over time equilibrium is achieved wherein the organizational culture and individuals' beliefs of what the culture should be do converge – the culture of the firm is reflected in the knowledge of its agents.

### **EEA Model Extensions: Appropriating Knowledge and Culture**

Our extension to March's model is essentially as follows. Consider two March-like firms, each of which have run to equilibrium under the same reality (i.e., they share the true state of nature). How does the acquisition of one firm (a smaller firm that is exploration-oriented) by another firm (a larger firm that is exploitation-oriented) impact the subsequent performance of the larger firm, under different strategic choices of appropriating knowledge (individuals) and appropriating culture?

The strategic choice of *appropriation of knowledge* ( $p_k$ ) is expressed as the probability that any given agent from the target (smaller) firm will be retained by the acquiring firm in the acquisition. As the preferred level of *appropriation of knowledge* increases, more of the target firm's employees are added to the acquiring firm's population, bringing with them the knowledge obtained within their former firm. The strategic choice of *appropriation of culture* ( $p_c$ ) is expressed as the probability that any given component of the culture of the target (smaller) firm will be adopted by the acquiring firm's culture. As the preferred level of *appropriation of culture* increases, the acquiring firm's culture will replace more of its own cultural beliefs with the cultural beliefs of the target firm.

We anchor the *exploitation* orientation (high pressure to conform) of the acquiring firm on prior research which emphasizes firms' tendencies to gradually develop tunnel vision and become rigid, narrow and simple (Miller 1993) based both on their propensity to refine existing processes and know-how (Levinthal et al. 1993) and the fundamental inertia to resist change (Levitt et al. 1988). These processes are often self-reinforcing and accelerating, resulting in firms trapped in a suboptimal stage, which is also known as competency trap (Levinthal et al. 1993; Liu 2006). Consequently, acquisitions are seen as a possible way for firms to counter this process of progressive rigidity and simplicity (Vermeulen et al. 2001). As firms with high degree of innovations exhibit higher level of exploration (March 1991), our exploration-exploitation-acquisition (EEA) model of focused technology acquisition will occur between a larger, exploitation oriented acquiring firm and a smaller, exploration oriented target firm.

## **Results of Computational Experiments**

Three separate computational experiments were performed. The experiments consisted of a set of acquisition simulations involving two March-type firms: a larger, acquiring firm (100 agents) with an exploitation bias, and a smaller, target firm (50 agents) with an exploration bias. Each acquisition consisted of three phases: pre-acquisition, acquisition and post-acquisition. During the *pre-acquisition phase*, the two separate firms were run independently until equilibrium was reached by both firms, ensuring that the culture of each firm achieves steady state<sup>ii</sup>. During the *acquisition phase*, the acquiring firm adds some number of randomly selected employees from the target firm as defined by its *appropriation of knowledge* parameter ( $p_k$ ), and changes some components of its culture to match that of target firm as defined by its *appropriation of culture* parameter ( $p_c$ ). In the *post-acquisition phase*, the newly configured acquiring firm is run for another 100 periods guaranteeing convergence to equilibrium (of its culture – the organizational code). The structures, parameters, initial values, and computational

protocol of March's model are retained, allowing us to validate and subsequently extend all constructs contained in the original model (Burton et al. 1995). Accordingly, prior to these experiments we validated our model against the basic findings of the original.<sup>iii</sup> In this model, we elected to focus on the primary constructs of exploration and exploitation, and did not manipulate either personnel turnover or environmental turbulence, as the model's sensitivity to these was not substantial.<sup>iv</sup>

Experiment 1 is the primary experiment, discerning the impact of knowledge and cultural strategic choices on subsequent knowledge levels (performance) of the acquiring firm. Experiment 2 examines the impact of granting autonomy to agents acquired from the smaller firm, testing claims prevalent in the literature that this can sustain the benefits of the acquired knowledge by isolating these employees from the culture of the acquiring firm. Finally, Experiment 3 seeks to validate the primary experiment (Experiment 1) by expanding the landscape of parameter values used for the acquisition simulations.

### **Experiment 1: Determining the Impact of Knowledge and Culture**

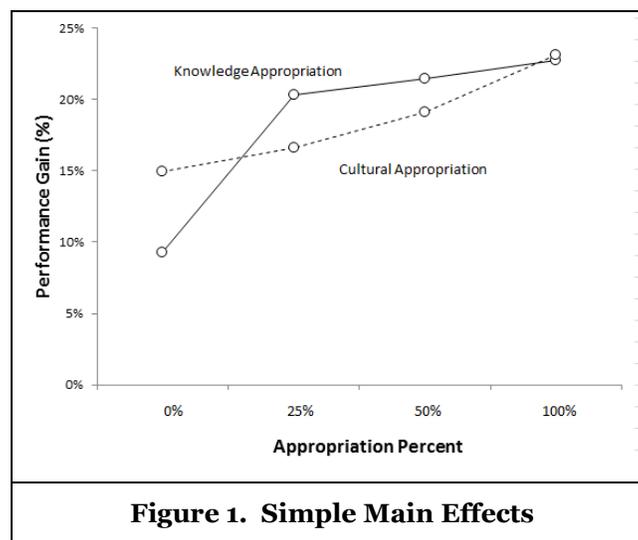
To determine the impact of different strategic choices of knowledge and culture on a firm's performance after an acquisition, we manipulated four levels of *appropriation of knowledge* ( $p_k = 0.0, 0.25, 0.50, 1.00$ ) and crossed these with four levels of *appropriation of culture* ( $p_c = 0.0, 0.25, 0.50, 1.00$ ). For each manipulation pair we ran 400 simulations, for a total set of 6,400 simulations.<sup>v</sup> The dependent variable was *relative performance gain* by the acquiring firm and was defined as difference between how well the knowledge of agents matched reality (i.e., the percent of the dimensions) before and after acquisition.

#### **What the main effects revealed**

The results of the main effects are shown in Figure 1 and their interpretations are summarized as follows:

*Knowledge appropriation helps quickly:* Appropriating "some" knowledge (retaining some employees) has significantly beneficial effects, but there are decreasing returns on acquiring additional knowledge.

*Cultural appropriation helps consistently:* The more culture a firm can appropriate through the acquisition, the better the subsequent performance.



The more individuals retained from the target firm, the more knowledge gain ensued, but there is a distinct non-linearity in those gains, with a decreasing marginal return occurring (Figure 1, solid line). When no knowledge is (employees are) acquired, performance gains can occur simply through the acquisition of culture. Culture matters more at lower levels of knowledge appropriation. The acquiring

firm also extracts a non-linear benefit from adopting more cultural components (i.e., components of the code) from the target firm (Figure 1, dotted line). The statistical results support these observations. There were significant main effects for appropriation of knowledge ( $F(3, 6384) = 259.5, p < .001$ ) and culture ( $F(3, 6384) = 85.4, p < .001$ ) from the target firm (Tukey 1953).<sup>vi</sup>

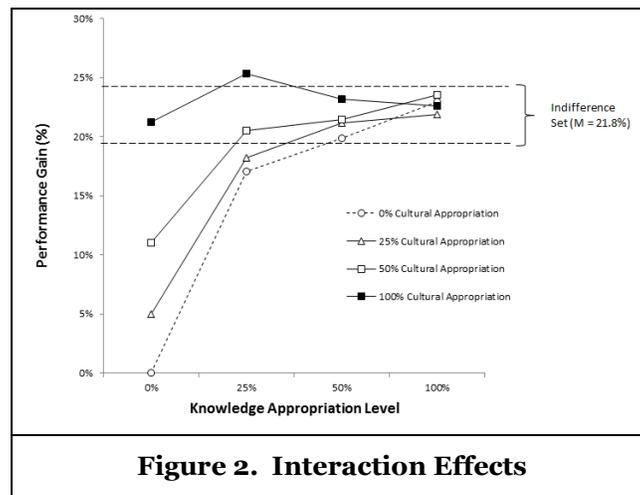
### What the interactions revealed

The results of the interactions between levels of knowledge appropriation and levels of cultural appropriation are shown in Figure 2 and the most important interpretations of those results can be summarized as follows:

*Knowledge and culture are fungible. At low knowledge appropriation levels, performance is improved by increasing cultural appropriation. At low cultural appropriation levels, performance is improved by increasing knowledge appropriation.*

*There are indifference sets of strategic options: Above certain critical thresholds of knowledge appropriation and cultural appropriation, there are a set of strategic choices that yield comparable performance gains.*

The relative gains from culture vary with the proportion of knowledge appropriated from the target firm (and vice versa). This is supported by a significant interaction effect ( $F(9, 6384) = 27.9, p < .001$ ).<sup>vii</sup> Looking across knowledge manipulations, the optimal (for this model) performance gains (25.3%) are achieved by a specific combination of knowledge (25%) and cultural appropriation (100%). However, pragmatically speaking, it is unlikely that a large organization can, without error or consequence, change and retain all of its cultural components. Therefore, the second observation stands out as especially important – the next best performing strategies are defined by a combination of knowledge and cultural appropriation strategies that yield statistically equivalent results, defining a set of options to which an organization should be indifferent (i.e., an indifference set). This set is depicted in Figure 2 by two lines indicating the interior points that indicate the set of eight strategies. On the average, firms selecting from this set would have performance gains of 21.8%.



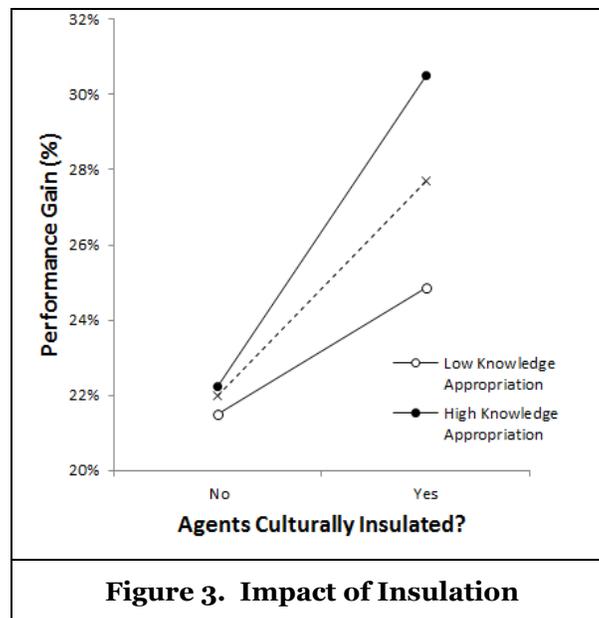
### Experiment 2: When New Employees Retain Their Culture

In Experiment 1 the knowledge level held by the agents of the smaller, acquired firm always exceed that of the larger, acquiring firm. Furthermore, the acquired firms had distinctly different balances of internal pressures to define and maintain their culture than the acquiring firms – the acquired firms were all highly adaptive “exploration” firms (with correspondingly low exploitation values). In Experiment 2 we

made one modification in the post-acquisition context – knowledge held by the agents from the acquired firm was *insulated* against the strong conformity influence of the “exploitation” acquiring firm.

Prior research suggests that this is a reasonable manipulation. Schweizer (2005) found that the more specific the acquired knowledge, the more autonomy is granted to the target firm and retained employees. Puranam and Srikanth (2007) discovered that when a target company is completely integrated by adoption of the acquiring firm’s culture and loss of its own identity, it has a negative impact on the new firm’s ability to retain the acquired innovative capabilities. The authors conclude that more autonomy and retention of the majority of the target firm’s culture and identity might support future capabilities to be innovative. Certain forms of autonomy for the target firm following a technology acquisition can be beneficial, especially when attempting to transfer knowledge (Ranft 2006). One way of instilling an aspect of autonomy is to insulate employees from an overarching conformity culture; therefore, our insulation manipulation is the equivalent of testing cultural autonomy.

For Experiment 2, two levels of *appropriation of knowledge* ( $p_k = 0.25$ , Low;  $p_k = 1.00$ , High) were crossed with two levels of *appropriation of culture* ( $p_c = 0.25$ , Low;  $p_c = 1.00$ , High), which were both crossed with two levels of *insulation* (insulated, not insulated). Thus, we not only examined the general impact of autonomy (main effect) but also tested whether the impact of autonomy varied across the two strategic choices of interest. Agents from the acquired firm maintained the low exploitation parameter of their original firm ( $p_i = 0.1$ ), while all other agents in the acquiring firm were subject to the high exploitation parameter of that firm ( $p_i = 0.9$ ). For each manipulation cell we ran 400 replications for a total set of 3,200 simulations.



### What the main effects revealed

The result of the simple main effect of insulating acquired employees from the (more exploitative) conformity culture of the acquiring organization (Figure 3, dotted line) resulted in a significant improvement in gains over the various levels of the other manipulations ( $F(1, 3192) = 83.11, p < .001$ ):

*Maintaining cultural autonomy improves performance. It is advantageous for the acquiring firm to insulate newly acquired employees against exploitative cultural pressures to conform, regardless of the levels of appropriation for either knowledge or culture.*

## What the interactions revealed

There was one interaction with insulation that was significant – the level of knowledge appropriation used by the acquiring firm (Figure 3, solid lines). The finding can be articulated as follows, with the associated effect interpreted bi-directionally:

*The effects of cultural autonomy [knowledge appropriation] are magnified by higher knowledge appropriation levels [cultural autonomy]. Insulating acquired agents against conformity reaps increasing benefits as more agents are acquired (greater knowledge appropriation levels). Conversely, for any given knowledge appropriation level, the benefits can be improved by insulating them against conformity.*

Insulation against the conformity dynamics of the acquiring firm improves gains in performance at both low and high knowledge appropriation levels ( $F(1, 3192) = 17.61, p < .001$ ).

## Experiment 3: Examining the Parameter Landscape of Successful vs. Unsuccessful Acquisitions

To examine the sensitivity and generalizability of the results observed in Experiment 1, a third experiment was performed that expanded the range of values used for knowledge appropriation, cultural appropriation, exploration and exploitation parameters of the sample. This was done to determine the sensitivity of the model to these “classic” March values. A second reason for Experiment 3 was to detect whether knowledge or culture had different effects on successful versus unsuccessful acquisitions (recall that in the first two experiments all acquisitions were “successful” to some degree, as the acquired firm necessarily had a better fitting culture, thus justifying the acquisition). Consider that Stahl and Voigt (2008) found that culture can serve as a “double-edged sword” which may be positively or negatively associated with M&A performance. In addition, Van den Steen (2009) showed that culture clash following an acquisition can have a short term negative impact on firm performance, but may lead to a better fit with the environment on the long run.

We simulated 10,000 samples of acquisitions where the values of the four constructs (knowledge appropriation, cultural appropriation, exploration, exploitation) for each acquisition pairing were randomly selected from a uniform distribution over their relative intervals as follows. For the acquired firm (reflecting its exploration bias), exploration was selected over the interval [0.51, 1.00] and exploitation was selected of the interval [0.01, 0.50]. For the acquiring firm (reflecting its exploitation bias), exploration was selected over the interval [0.01, 0.50] and exploitation was selected of the interval [0.51, 1.00]. Finally, for the acquiring firm, knowledge appropriation and cultural appropriation values were both selected over the same interval [0.0, 1.0].<sup>viii</sup>

## Results: Culture is a dual-edged sword

We performed ordinary-least-squares regression with post-acquisition knowledge (defined as the average percent match with reality of all agents’ knowledge in the acquiring firm) as the dependent variable.<sup>ix</sup> These results (presented in Table 1) provided further empirical validation of the observations noted in our first experiment. All predicted coefficients were significant (at  $p < .01$ ) and consistent with March’s original observations and setup of our model.<sup>x</sup> We compared the results of the complete regression model for the sub-sample of successful acquisitions with the sub-sample of failed acquisitions. The most interesting results can be summarized as follows:

*Failed acquisitions suffer when a firm acquires the wrong culture. Strategic choices of high cultural appropriation are at risk when the acquired firm has, in reality, less appropriate culture (or knowledge) than the acquiring firm. Like a virus on a computer, an inappropriate culture will quickly overtake the firm and result in significant decline in post-acquisition knowledge (and therefore performance).*

*Successful Acquisitions rely on gaining the right knowledge, the right culture, and imposing less conformity: In successful acquisitions, the appropriation of knowledge and culture acquired from a firm that exceeds in knowledge-cultural standing, along with less conformity pressures,*

all had positive and significant effects on post-acquisition knowledge (and therefore performance).

**Table 1. Post-Acquisition Knowledge Regression Results**

Variables	Complete Sample	Successful Acquisitions	Failed Acquisitions
Cultural Adoption ( $p_c$ )	2.321*** (0.663)	4.813*** (0.629)	-4.116*** (1.228)
Knowledge Appropriation ( $p_k$ )	5.878*** (0.720)	6.847*** (0.689)	0.257 (1.081)
Culture x Knowledge ( $p_c \times p_k$ )	-3.557*** (0.594)	-4.117*** (0.562)	-0.427 (1.006)
Exploitation ( $p_1$ )	-14.368*** (0.340)	-12.669*** (0.315)	-1.100* (0.667)
Exploration ( $p_2$ )	10.980*** (0.389)	10.270*** (0.362)	0.756 (0.667)
Acquirer Pre-Acquisition	0.221*** (0.007)	0.347*** (0.008)	0.728*** (0.019)
Target Pre-Acquisition Knowledge	0.616*** (0.011)	0.530*** (0.012)	0.217*** (0.016)
Exploitation x Culture ( $p_1 \times p_c$ )	-4.464*** (1.169)	-3.835*** (1.085)	1.495 (2.402)
Exploitation x Knowledge ( $p_1 \times p_k$ )	0.265 (1.216)	0.316 (1.101)	-1.356 (2.270)
Exploration x Culture ( $p_2 \times p_c$ )	-4.301*** (1.343)	-5.118*** (1.271)	1.587 (2.485)
Exploration x Knowledge ( $p_2 \times p_k$ )	-5.275*** (1.364)	-5.302*** (1.261)	-0.438 (2.187)
Culture <sup>2</sup> ( $p_c^2$ )	-2.158*** (0.629)	-3.316*** (0.597)	1.130 (1.126)
Knowledge <sup>2</sup> ( $p_k^2$ )	-4.104*** (0.676)	-4.805*** (0.639)	-0.360 (1.043)
Constant	22.114*** (0.990)	18.920*** (0.955)	3.020** (1.387)
Observations	10000	7909	2091
<b>R-Squared</b>	<b>0.570</b>	<b>0.645</b>	<b>0.644</b>

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Robust standard errors in parentheses

Consequently, the value of appropriating culture varies with the quality of the culture appropriated. Referring to Table 1, in Successful Acquisitions, the largest coefficients are associated with the cultural dynamics of the acquiring firms, demonstrating that less conformity and more cultural adaption (within its restricted parameter values) are associated with better cultural matches to reality (and better performance). Also associated are appropriating knowledge and culture from the acquired firm. Note, however, that in Failed Acquisitions, the sign for the Appropriation of Culture is reversed – appropriating

more culture leads to poorer cultural matches (and poorer performance). Culture, consequently, is a *dual-edged sword* in its ability to yield either benefits or losses in these (simulated) types of acquisitions.<sup>xi</sup>

## Discussion

Through computational experiments based on the March model of exploration-exploitation, we examined two important constructs that impact the success of acquiring IT competencies through focused technology acquisitions: knowledge (beliefs by the individuals acquired) and culture (beliefs held by the organization within which those individuals were situated). Prior research indicated that retention of employees and thus, retention of individual knowledge, was important (Birkinshaw 1999; Ranft and Lord 2000; Ranft and Lord 2002). However, the precise relationship between retention with post-acquisition performance conditions was unclear, as many confounding factors in such observational studies made comparison difficult across retention levels.

### *Implications of Appropriation of Knowledge*

Our findings regarding the *appropriation of knowledge* suggest that relatively lower appropriation of knowledge (via lower employee retention rates) can yield the greatest relative gain post-acquisition in performance. We also find that marginal returns to knowledge appropriation are nonlinear and decreasing. These results concur with previous literature that argues as IT companies acquire smaller firms, the majority of knowledge which the acquiring firm aims for might reside in specialized areas of the target firm, such as the technical personnel in the Research & Development (R&D) area or the product, client and market knowledge residing in the customer facing sales force (Birkinshaw 1999). Consequently, other areas might not yield specific technological knowledge that is important to the acquiring firm (Ranft et al. 2002). On the other hand, increased level of knowledge appropriation might, at its extreme, increase cost of operations and integration, but not necessarily lead to an increase in knowledge that is transferable to performance. Contrary to previous research that asserts lower knowledge appropriation undermines capability development in the acquiring firm (Meyer et al. 2003), we observe that lower numbers of retained employees introduce divergent views even while being subjected to stronger pressures to assimilate to acquiring firm's culture, leading to higher long term knowledge development.

These findings regarding the appropriation of knowledge imply that firms may consider adopting a selective employee retention strategy. IT professionals possessing technical knowledge are associated with higher rates of turnover when compared to professionals possessing IT managerial knowledge (Ang et al. 2004). The demand for these professionals is higher because of greater time and effort required to cultivate these competencies. IT technical knowledge is also more specialized or tacit in nature. Thus, acquiring firms may concentrate their energies on appropriating this type of IT knowledge. Our findings also reconcile with prior IS literature which suggests that the integration of highly complex IT skills and competencies within large collaborative environments is fraught with decreasing marginal returns. These findings also resonate with prior qualitative studies which find personnel retention critical in the post-acquisition transfer of specialized knowledge regarding IT applications and tools (Niederman et al. 2009).

### *Implications of Appropriation of Culture*

The question of *cultural appropriation* has often been raised as an antecedent to the success of M&As in general and technology acquisitions in particular (Stahl et al. 2008; Weber et al. 2003). Nevertheless, conflicting views on the effects of integration with acquiring firm's culture versus disintegration of the acquired culture have resulted in the question of how different "levels" of cultural appropriation impact post-acquisition performance remaining unanswered. Our results suggest that there exist non-decreasing, linear rates of return from appropriation of culture, if the knowledge differential in the acquisition is appropriate (i.e., the acquired firm's knowledge is greater than the acquiring firm's knowledge). Further, such benefits are supported if the motivations for such acquisitions are indeed the consequence of exploitation oriented cultural inertia (Vermeulen et al. 2001) or a result of being stuck in a competency trap due to rigid mental models and lack of spontaneous and experimental behavior (Levitt et al. 1988). These findings imply that differing underlying integration processes and pressures result in unequal returns to appropriation of knowledge and appropriation of culture. This may suggest strategic choices of

resource constraint driven appropriation of low levels of knowledge and returns maximization driven appropriation of high levels of culture.

Regarding cultural appropriation, our findings also demonstrated the value of *insulating* the newly acquired employees from the exploitation-biased organizational culture of the acquiring firm (prior Figure 3). This modeled a “hybrid post-acquisition approach” (Schweizer 2005) wherein certain areas of the target firm might be “shielded” from the high socialization dynamics of the acquiring firm and as such remain autonomous, addressing the coordination-autonomy dilemma discussed in prior literature (Puranam et al. 2006). When acquired employees are insulated from the high socialization dynamics of the acquiring firm, there are performance gains across both extremes of knowledge and cultural appropriation strategies. However, creating simple forms of *structural* autonomy of the target firm may not suffice. Acquiring firms may need to adopt forms of autonomy that enable one-way flow of influence, much like the process of osmosis. These forms would reduce the strong influence of the acquiring firm’s culture on the target firm, while maintaining the influence of the target firm on the acquiring firm’s culture. This may facilitate the insulation of retained employees and lead to higher level of critical knowledge gain, as case studies of bio-tech firms have shown (Schweizer 2005).

Our findings speak towards literature on IS integration that identifies culture as a critical success factor in integrating the IT/IS departments of firms (Niederman et al. 2009). Adopting culture, practices and beliefs facilitates common language, values and principles across all IT personnel (Tanriverdi et al. 2010). Much of this literature considers culture within a broader framework and thus our findings enable a more fine-grained examination of this prior work. The implications of our findings gain further credence when considering prior IS research that finds increased employee turnover an acquisition within the IT industry (Fontaine 2010). While this increase is contingent upon factors such as the nature of the acquisition (hostile or friendly) and the reputation of the acquirer, it suggests the risks of strategy with a singular focus on employee retention. Appropriation of culture provides a plausible mechanism by which the higher mobility of IT human resources can be averted. This also resonates with and has implications towards prior IS research that finds that organizational context and workplace characteristics matter to IT professionals (Ahuja et al. 2007).

### ***Implications of Interaction of Knowledge and Culture***

Our findings also provided important insight into the performance *consequences of co-occurring strategies*. Acquisitions incorporating both knowledge and cultural appropriation strategies often simultaneously occur to certain degree. For example, one might consider that as more employees are retained, the more these individuals might remain within prior structures and teams, thus supporting a sufficient level of autonomy, prior beliefs and culture. Previously, culture has been found to interact with human resources and their knowledge (Schweizer 2005; Xiao et al. 2009). Our results demonstrate that the impact of cultural appropriation varies according to the knowledge appropriation strategy and vice versa. As appropriation of knowledge is increased, the marginal contribution of appropriating culture on post-acquisition performance decreases. On the other hand, the highest performance gain due to cultural adoption can be found with a small level of target employee retention.

We know from prior research that integration of new knowledge requires complex changes to knowledge interfaces and relationship networks within and outside organizations (Cohen et al. 1990; Grant 1996). The costs of assimilating increasing amounts of knowledge may exceed the benefits of acquiring it. In the short run, cultural appropriation may increase the effectiveness of knowledge appropriation by reducing organizational, relational and cultural challenges and costs to the process of knowledge integration. In the long run, cultural appropriation may refocus the organization's attention on forgotten or prior neglected values and behaviors that enhance the benefits of the newly appropriated knowledge. In focused technology acquisitions, the adoption of cultural components such as work patterns and ways of interacting may not only stimulate future knowledge creation and technological innovation, but also increase the immediate benefits of low levels of knowledge appropriation. Cultural adoption may provide familiar and conducive work settings for retained employees, thereby lessening disruption of their routines (Paruchuri et al. 2006). Improvements in extant culture through adoption of new components and learning gains by original employees result in positive dynamic interaction of knowledge and culture.

Finally, our findings indicated that the interaction effects between knowledge and cultural appropriation reveal that for every focused technology acquisition, there exist a range of strategic options between cultural adoption and employee retention (knowledge) that yield equivalent gains in post-acquisition performance (prior Figure 2). The exact choice of the combination of knowledge and culture may depend upon other organizational considerations (e.g., incentive structures). However it is interesting to observe that given the comparison between successful and unsuccessful acquisitions, only the strategy of cultural appropriation yields highly variant positive or negative impacts on post-acquisition performance; employee retention on the other hand results in relatively lower, but positive impacts in both scenarios (prior Table 1). This offers support for Stahl and Voigt's (2008, p.171) suggestions that "cultural differences matter in M&A, but they seem to present a double-edged sword or mixed blessing. Thus cultural differences may be positively or negatively associated with M&A performance ..."

Prior research in IS has alluded to a potential interaction effect between knowledge and culture in the context of acquisitions. Most recently, Tanriverdi and Uysal (2010) assert that acquiring organizations need to take two decisions; 'which employees to retain' and 'whose practices to use'. They consider retention of IT personnel and adoption of practices as part of one of five dimensions of cross-business IT integration capability. However, they empirically link overall cross-business IT integration capability to M&A performance. Thus, the value created by cross-business IT integration is potentially influenced by the interaction of the knowledge and culture prevalent within the IT function. Our findings shed light upon the nuances of this theory and provide deeper insights to this framework.

The majority of studies on acquisitions in the IS area have concentrated upon the technical aspects of post-merger IT integration strategies (Wijnhoven et al. 2006). Our findings imply that the appropriation of knowledge and culture can provide complementary strategies that may enhance the success of IT integration. Knowledge and culture may have individual or joint effects on the effectiveness of various IT integration strategies. Overall, our findings enrich the nascent stream of IS research on M&A. While most of this work concentrates upon IT integration as the construct of interest, there is increasing research, besides this work, that considers M&A performance as the dependent variable. Our findings have implications for this IS research stream as well as the much larger research stream on technology acquisitions in the strategic management literature. Our findings also provide insights into why seemingly similar acquisitions – for example the acquisition of Jumpcut by Yahoo! versus the acquisition of YouTube by Google, have radically different outcomes. Finally, the revealed interaction effects have implications towards research on the extended enterprise. There may exist similar indifference sets of knowledge and cultural appropriation which yield equivalent returns in performance in the context of alliances, outsourcing, extended supply chain and other forms of organizational networks involving inter-organizational transfer, integration, and utilization of knowledge and competencies.

### ***Limitations and Future Research***

In summary, prior literature has discussed two main post-acquisition integration strategies in the context of technology acquisitions, the appropriation of knowledge through retention of employees and appropriation of culture, but our work is the first to consider and investigate the individual and joint relationships among levels of these two integration strategies and post-acquisition performance. Our model reconciles differences in prior literature regarding the similarities and dissimilarities in returns to knowledge and cultural appropriation. This methodological contribution confirms the applicability of the March framework to multi-organizational phenomena. The theoretical contributions also extend into managerial implications based on this foundation. The paper indicates that managers of acquiring firms need to consider specific levels of appropriation of knowledge and culture and that the level of each factor has an impact on the effectiveness of the other. This work strengthens the assertion that the adoption of acquired culture should be a critical tactic in a post-acquisition strategy; however managers should be aware of the risks attached to cultural appropriation following the acquisition.

However, as common in all research, this paper has limitations. It is important to remember that we do not claim that appropriation of knowledge and culture are the only factors determining the success or failure of focused technology acquisitions. Numerous variables have been identified that influence the success or failure of technology acquisitions in general (e.g., Hitt et al. 2001; Puranam et al. 2009; Ranft et al. 2002): knowledge and culture are but two of the most prominent. It is well known that computational simulations (as are all models) are a simplified representation of a real-world setting and

such simplifications have their drawbacks, but their benefits can be substantial (Sterman 2002). One has to consider the risk of oversimplifying a very complex process of post-acquisition integration (e.g., considering only two acquisition strategies which are solely reflected in retention of target employees or acceptance of a certain level of the target firm's organizational code) as well as idealizing imperfect processes (e.g. post-acquisition performance gain only measured as delta of pre- and post-acquisition knowledge that matches reality). We have aimed to mitigate these limitations by extending an established and highly regarded computational model of organizational learning (March 1991) into the EEA model and by grounding our extensions and findings in empirical research.

Looking forward, we envision that future research could take our findings and discern the limits of their contextual validity in practice, perhaps identifying moderating variables to augment the model. Researchers have qualitatively and empirically examined the moderating effect of IT investments on merger integration (Tafti 2011). Our model lends itself to a nuanced examination of the effects of specific types of IT on post-acquisition integration. Our findings regarding the importance of culture and its inertia are relevant to the recent work on mimicry as an exploitation strategy, weaving friction and uncertainty into practice change (Csaszar et al. 2010). Future academic endeavors could search deeper into the causal mechanisms underlying the double-edged effect of cultural integration attempts – few papers have so far considered that culture can have a positive as well as negative effect on post-acquisition performance (e.g., Reus et al. 2009; Stahl et al. 2008). Our model confirmed these empirical findings, but research is still in need to develop an in-depth understanding of how and why culture can have significant impacts in both directions. Finally, it remains to be determined that our findings do not extend beyond those of our “focused technology” acquisitions. What was interesting about these types of acquisitions was a) the likely distribution of their relative values of exploration and exploitation (acquiring firm: exploitation-biased; acquired firm: exploration-biased), and b) their likely distribution of knowledge and culture resulting from these biases under the same competitive environment (the acquiring firm would have less knowledge than the acquired firm). The prevalence of any type of acquisition in the population that has these distributional properties probably extends beyond our initial restriction to information technology.

## **Conclusion**

The fast-paced nature of technology changes in the IT industry leads to high knowledge depreciation and the need to develop new information technologies, competencies and associated knowledge (e.g. Agarwal et al. 2002; Makri et al. 2010; Mithas et al. 2008). Since technical IT competencies are acquired largely through learning by doing (Ang et al. 2002), development of new IT competencies by IT vendors is subject to time compression diseconomies and requires substantial efforts and resources including training, mentoring and team-based work across multiple projects (Ang et al. 1998; Levina et al. 2003; Slaughter 2009; Slaughter et al. 1996). Focused technology acquisitions provide a more rapid gain of technological knowhow for IT vendors, but are subject to the consequences of strategic choices involving knowledge and cultural appropriation. We used a novel extension to March's original model, but retained the form and constructs, thus maintaining the intent and integrity of the original model. Our model confirmed prior empirical findings which independently investigated the effects of appropriating knowledge and culture at “static” levels, and extended those findings indicating that post-acquisition performance is not linearly related to appropriation of knowledge but rather exhibits decreasing returns (concavity). Our model also demonstrated previously undocumented interaction effects between knowledge and culture revealing regions of choices that generate equivalent performance, and to which there should be strategic indifference. Our results showed that the gains from these choices are more substantial when the target firm is insulated from the socializing dynamics of the acquiring firm, but still retains the ability to influence the acquiring firm – simple autonomy structures are unlikely to impact an acquiring firm. We found that the appropriation of culture can have either highly positive or negative impacts on the acquiring firm. Organizations engaging in such an acquisition should conduct a rigorous audit of not only the target firm's knowledge, but also the target firm's culture, and assess its own culture, prior to the process of integration. How do they differ? How should appropriated knowledge be managed? How should appropriated culture be managed? There are choices and there are consequences of those choices. This is because when gaining IT competencies through acquisitions, knowledge certainly matters, but culture is king.

<sup>i</sup> Organizational code (as in “code of behavior”) in actual firms may or may not be explicitly documented, but are explicated and endorsed in some form, enforced with some extant social pressure and consist of common terminologies, beliefs of fact, and procedures facilitating coordination and communication (e.g., Cremer, 1993; Guetzkow, 1997). Although expressed abstractly, one can imagine that a component really belief might be “invest heavily in cloud computing” where the corresponding organizational code or agent knowledge would be +1 (agree), -1 (disagree), or 0 (undecided).

<sup>ii</sup> Acquiring, target and post-acquisition firm’s reached initial equilibrium in average of 11.09 (s.d. = 2.03), 64.82 (s.d. = 6.44) and 4.17 (s.d. = 0.80) runs respectively.

<sup>iii</sup> At end of the pre-acquisition phase, the knowledge of target and acquiring firms (reflecting differing levels of  $p_1$  and  $p_2$  in the original model) was statistically different ( $t = -25.64$ ;  $p < .01$ ;  $d = .51$ ). Expectedly, the target firm possessed higher knowledge than the acquiring firm. An exploration strategy led to slow initial learning, but higher long-term knowledge and an exploitation strategy led to short-term gains, but lower long-term knowledge. These results remained unchanged for two firms of equal size. Addition of environmental turbulence and personnel turnover produced effects consistent with March’s observations. Non-parametric Mann-Whitney U test, more resistant to non-normal distributions and possessing greater power than a  $t$  test (Conover & Iman, 1981), was also conclusive and indicated that knowledge of the acquiring and target firms is not equal.

<sup>iv</sup> March also defined personnel turnover ( $p_3$ ) and environmental turbulence ( $p_4$ ). Consistent with March’s findings, in the EEA model, environmental turbulence in the absence of personnel turnover ( $p_4 = 0.02$ ,  $p_3 = 0.00$ ) leads to long-term degenerative and inadaptable organizational knowledge; the addition of personnel turnover ( $p_4 = 0.02$ ,  $p_3 = 0.02$ ) avoids this scenario. Since only interim values of knowledge are impacted by  $p_3$  and  $p_4$ , their presence ( $p_3 = 0.02$ ,  $p_4 = 0.02$ ) or absence ( $p_3 = 0.00$ ,  $p_4 = 0.00$ ) did not alter our results which report equilibrium values of knowledge. To abbreviate this paper and avoid any confounding effects, we eliminated their manipulation in Experiments 1 and 2 and set both to zero.

<sup>v</sup> A-priori power analysis determined number of runs per experimental condition. To achieve power of .80 (medium sized effect  $f = .25$ ,  $\alpha = .01$ ) the test required a sample of 354 for the interaction effect, which was rounded up to 400. Post-hoc analysis confirmed that power values of .97, .87 and .99 were achieved for the tests of the main effects, interaction effect and 2x2x2 design respectively (Faul et al., 2007). All statistical analyses were conducted using Statistica 8, Stata 11 and G\*Power 3. Minimum significance levels were set at .05 for Experiments 1 and 2 and at .10 for Experiment 3 (due to its exploratory nature).

<sup>vi</sup> Post-hoc analysis using Tukey HSD method (Tukey, 1953) provided supporting evidence that for appropriation of knowledge, there are significant gains between 0% and 25% acquisition levels ( $p < .001$ ), but not between 25% and 50% ( $p = .16$ , ns) or between 50% and 100% ( $p = .06$ , ns), with 100% being the only significant gain over 25% ( $p < .001$ ). The post-hoc analysis also provides evidence of significant percentage gains between all levels: 0% to 25% ( $p < .001$ ), 25% to 50% ( $p < .001$ ) and 50% to 100% ( $p < .001$ ) for appropriation of culture.

<sup>vii</sup> Post-hoc analysis using the Tukey HSD test (Tukey, 1953) supported the interpretation of equivalent performance gains for the identified Indifference Set.

<sup>viii</sup> To provide complete replication and confirmatory analysis, personnel turnover and environmental turbulence were similarly assigned random values over the interval [0.00, 0.04].

<sup>ix</sup> Replication of analysis with *relative knowledge gain* as dependent variable produced similar results. Here, the observed coefficient of  $p_k$  was nearly three times the coefficient of  $p_e$ . Nested regression and forward stepwise regression also validated our results. The results of these additional analyses are omitted for the sake of brevity.

<sup>x</sup> We controlled for heteroskedasticity using Huber/White standard errors (Huber 1967; White 1982). Interaction terms were mean-centered to reduce multicollinearity (Aiken and West 1991).

<sup>xi</sup> Probit regressions on *relative knowledge gain* with both subsamples (omitted for brevity) also showed a dual-edged effect. Superior cultural beliefs had a significant ( $p < .01$ ) effect on positive knowledge gain whereas appropriation of inferior cultural beliefs resulted in ( $p < .01$ ) negative knowledge gains (loss).

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