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Integrating Acquired Capabilities: When Structural Integration Is (Un)necessary

Abstract

Acquirers who buy small technology-based firms for their technological capabilities often discover that postmerger integration can destroy the very innovative capabilities that made the acquired organization attractive in the first place. Viewing structural integration as a mechanism to achieve coordination between acquirer and target organizations helps explain why structural integration may be necessary in technology acquisitions despite the costs of disruption this imposes, as well as the conditions under which it becomes less (or un-) necessary. We show that interdependence motivates structural integration but that preexisting common ground offers acquirers an alternate path to achieving coordination, which may be less disruptive than structural integration.

Keywords

postmerger integration, organization design, coordination

Disciplines

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INTEGRATING ACQUIRED CAPABILITIES:

WHEN STRUCTURAL INTEGRATION IS (UN) NECESSARY

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Acquirers who buy small technology based firms for their technological capabilities often discover that post merger integration can destroy the very innovative capabilities that made the acquired organization attractive in the first place. Viewing structural integration as a mechanism to achieve coordination between acquirer and target organizations helps explain why structural integration may be necessary in technology acquisitions despite the costs of disruption this imposes, as well as the conditions under which it becomes less (or un-) necessary. We show that interdependence motivates structural integration, but pre-existing common ground offers acquirers an alternate path to achieving coordination, which may be less disruptive than structural integration.

In regimes of rapid technological change, many companies adopt external development strategies to renew their capabilities in order to avoid the time consuming and uncertain process of internally accumulating them (Dierrickx & Cool, 1986; Steensma & Fairbank, 1999). Prominent among such strategies is the acquisition of small technology based firms by large established firms (Granstrand & Sjolander, 1990). However, in such technology acquisitions, acquirers often discover that post merger integration can destroy those same innovative capabilities that made the acquired organization attractive in the first place (Birkinshaw, Bresman& Hakanson, 2000; Chaudhuri & Tabrizi, 1999; Graebner, 2004; Puranam, Singh& Zollo, 2003; Ranft & Lord, 2002). Why do acquirers integrate such acquisitions, despite the well-known disruptive effects of post merger integration? Under what circumstances can they avoid integrating them while accessing their innovative capabilities? Answers to these questions are relevant not only in the context of acquisitions, but also for other formats for combining capabilities across organizations (for instance in alliances and joint ventures).

In this paper, we develop a perspective on post merger integration as a means of achieving coordination between acquirer and acquired organizations. This is an instance of the general problem of coordinating across divisions or units within a corporation (Argyres, 1995; Ghoshal & Bartlett, 1990; Gupta & Govindarajan, 1986; Hill, Hitt& Hoskisson, 1992; Tsai, 2001), which has a rich theoretical heritage in the literature on organization design (March & Simon, 1958; Nadler & Tushman, 1997; Simon, 1945; Thompson, 1967; Van de Ven & Delbecq, 1974). In particular, we focus on the potential gains from coordination between acquirer and acquired units created by structural integration – the combination of activities within the same set of organizational boundaries.

Structural integration (distinct from post merger integration in general) refers to the combination of formerly distinct organizational units into the same organizational unit following an acquisition (Haspeslagh & Jemison, 1991; Puranam, Singh and Zollo, 2005; Paruchuri, Nerkar and Hambrick, 2006). As a formal design choice concerning the "grouping" of organizational units, structural integration is a construct that takes on discrete values (Nadler and Tushman, 1997). Discrete decisions about grouping units together within common organizational boundaries, are different from, and precede non-discrete decisions about the use of "linking" mechanisms between organizational units (such as the alignment and standardization of processes and systems, common hierarchical control, cross-unit teams and integrating managers) both temporally and in importance (Galbraith, 1977; Nadler & Tushman, 1998; Thompson, 1967). Scholars who study acquisition implementation describe the choice between complete absorption and preservation of autonomous organizational status as an important initial decision that shapes further fine-grained integration actions (Haspeslagh & Jemison, 1991; Pablo, 1994; Ranft & Lord, 2002; Zollo & Singh, 2004a)

Viewing structural integration in terms of the gains from coordination it generates, offers insights about the conditions under which such integration is necessary as well as when it can be avoided. We argue that despite its disruptive consequences, structural integration generates a powerful coordination effect between acquirer and target firms, which is particularly valuable in the presence of significant interdependence between them (Thompson, 1967). Except in the case of holding firm acquisitions, value is created in acquisitions only by linking the acquirer and target's capabilities in some form. However, the extent of linkage required- interdependence- may vary significantly across transactions. Interdependence between acquirer and target organizations determines how value will be created from the acquisition – not how much (Haspeslagh and Jemsion, 1991, pgs139-142). In the context of technology acquisitions, we argue, acquisitions made either for component technologies or for standalone products may create value for the acquirer but the extent of interdependence (and therefore coordination necessary) between the acquirer and target firms is higher in the former than the latter. Thus, if acquirers make optimal choices about structural integration that take into account both its coordination benefits as well as disruption costs, then all else being equal, we expect that the likelihood of structural integration is higher when the acquisition is characterized by the higher level of interdependence associated with buying a component technology rather than a standalone product.

While structural integration is a formal design intervention that achieves coordination, informal coordination can also occur when there is sufficient common ground across interdependent individuals. Common ground – knowledge that is shared and known to be shared- enables successful coordination, as it allows interdependent actors to adjust their actions appropriately to each other (Becker & Murphy, 1992; Chwe, 2001; Schelling, 1960). If substantial common ground exists between acquirer and target firm personnel at the time of the acquisition, it may suffice to coordinate interdependence, making structural integration less necessary and thereby avoiding its disruptive consequences. Thus, the existence of common ground should weaken the tendency towards structurally integrating component technology acquisitions. We find empirical support for these hypothesized relationships between structural integration, interdependence (component technology) and common ground in a sample of 207 technology acquisitions conducted by 49 acquirers in the IT hardware industries.

Prior research on post-merger integration has focused more on its consequences than its causes. Through both large sample studies (Chakrabarti, Hauschildt& Suverkrup, 1994; Gerpott, 1995; Puranam, Singh& Zollo, 2006) as well as in depth cases (Graebner, 2004; Ranft & Lord, 2002), several scholars have investigated the implementation and performance implications of integration practices in acquisitions. However, explicit analysis of the antecedents of integration decisions remains rare, despite the recognition of the critical role that interdependence can play in them. For instance, Haspeslagh and Jemison proposed a normative framework recommending that the extent of integration be based on the extent of strategic interdependence and need for autonomy between acquirer and acquired organization (1991) and Pablo (1994) showed through a policy capture exercise that managers in fact weigh task interdependence significantly in their integration decisions. Yet, there have been few attempts to directly study the relationship between interdependence and integration in acquisitions, or the conditions under which interdependence may be managed without integration.

Our study provides evidence of the positive relationship between interdependence and the likelihood of structural integration, as well as the negative moderating role of common ground in this relationship. In addition to contributing to the study of acquisition management, these results have broader implications for capability renewal strategies through external development. Such strategies call for more than the recognition of valuable new external capabilities that complement internal ones; they require the ability to effectively use them in conjunction (Cohen & Levinthal, 1990; Zahra & George, 2002). This study suggests that the manner in which internal and external capabilities are organizationally linked depends on the nature of interdependence between them, which is likely to have consequences for the extent of disruption that occurs upon linkage. Thus, the attractiveness of external capabilities depends not only on their value in combination with internal capabilities, but also on interdependence.

This study also refines our understanding of the role of shared knowledge in enabling effective linkage between capabilities. Overlapping knowledge bases are known to ease the comprehension of new knowledge as well as its exchange between organizations (Ahuja & Katila, 2001; Cohen & Levinthal, 1990; Mowery, Oxley& Silverman, 1996). Our study emphasizes the importance of common ground as an alternative to the use of formal mechanisms that aid coordination between the activities underlying external and internal capabilities. Thus, building or exploiting common ground can complement external development strategies by helping to avoid formal integration mechanisms and the costs of disruption they impose.

THE COSTS OF STRUCTURAL INTEGRATION IN TECHNOLOGY ACQUISITIONS

Structural integration results in the location within common organizational boundaries (eg. divisions, departments, units) of related activities originating in the target and acquirer firms. The alternative to structural integration is structural separation, in which activities originating in the target and acquirer firms, while now under common ownership (i.e. in the same firm) may yet remain organizationally distinct. In discussing the costs of structural integration, it is useful to distinguish between the processes by which structural integration is achieved – the set of short-term changes that must be accomplished to create an integrated organization- from the longer-term effects of the final integrated organizational form. While the logistics of the transition itself may be costly in terms of time and effort (Zollo & Singh, 2004b), these short-term effects are not our focus. The costs of structural integration we describe below are the long-term consequences of a realized structurally integrated organizational form, which permanently alters the organizational properties of the acquired organization.

Simply put, structural integration can disrupt the target firm’s innovative capabilities because it ends its autonomous existence. This “loss of autonomy” effect can arise in two different ways. First, there is the possibility of lowered motivation and productivity of inventors in the target firm after being structurally integrated. Arguments from agency theory suggest that structural integration weakens the link between reward and effort, because the number of other agents whose actions influence unit performance increases when units are integrated. Free riding increases whenever formerly distinct organizational units are grouped together, and this precludes the use of sharper incentives (Baker, 2002). Talented employees, particularly those with hard-to-measure skills and efforts are often attracted to smaller organizations because of their ability to offer high-powered incentives (Zenger, 1994). Such employees are likely to become demotivated, and could possibly even leave after their firm has been fully integrated into the acquirer, which would critically undermine the target firm's innovation capacity (Ernst & Vitt, 2000). Lowered intrinsic motivation due to lowered task autonomy following structural integration can lead to similar results (Osterloh & Frey, 2000; Wageman, 1995).

Second, structural integration creates a combined organizational unit; the boundaries of an organization unit imply common authority, work practices and procedures (March & Simon, 1958; Thompson, 1967). However, to become a part of such an integrated unit, the work practices in the target firm must have undergone change, and a superseding of authority and status may have been inevitable. Change can cause disruption, independent of any improvements brought about by a new configuration of organizational attributes (Amburgey, Kelley& Barnett, 1993; Hannan & Freeman, 1984). Such changes can alter valuable organizational routines within the acquired firm, and in doing so can undermine its innovative capabilities (Benner & Tushman, 2003; Leonard-Barton, 1992; Ranft & Lord, 2002). These adverse consequences for motivation and organizational routines can significantly and permanently damage innovation capabilities in acquired firms (Paruchuri, Nerkar& Hambrick, Forthcoming; Puranam et al., 2006).

Given these costs, why do acquirers structurally integrate technology acquisitions, instead of relying on possibly less disruptive linking mechanisms such as cross-unit teams and integrating managers, which preserve the structural autonomy of the acquired organization? We argue that despite the "loss of autonomy" effect and its adverse consequences, structural integration is a powerful means of achieving coordination in the case of significant levels of interdependence between acquirer and target firms. Acquirers therefore structurally integrate acquisitions in the presence of significant interdependence, unless sufficient common ground exists to provide an alternative path to coordination. We develop these arguments in detail in the next sections.

INTERDEPENDENCE AND STRUCTURAL INTEGRATION

Interdependence is a central concept in the theory of organization design, and refers to the property that the value to performing one activity depends on how another activity is performed. It is a core proposition of design theory that the degree of interdependence determines the necessary extent of coordination (Galbraith, 1974; Galbraith, 1977). For instance, Thompson's classic taxonomy of interdependence arrayed pooled, sequential and reciprocal interdependence on a Guttman scale, with situations of reciprocal interdependence expected to generate the highest coordination requirements (Thompson, 1967). Corresponding to increasing levels of interdependence are coordination mechanisms with increasing levels of coordination capacity, such as planning, authority and mutual adjustment (Tushman & Nadler, 1978). Empirical analysis has generally supported the positive association between the extent of interdependence and the coordination capacity of the coordination mechanisms used (Gulati & Singh, 1998; Lawrence & Lorsch, 1967; Van de Ven & Delbecq, 1973, 1974).

Viewed from an agency theory perspective, an important benefit of structural integration is that despite the greater risk of free-riding, it nevertheless enhances cooperation between the acquired and acquiring organization by aligning interests towards the goals of the integrated unit (see the discussion in Williamson, 1985 about the contrast between high-powered competitive incentives and low powered collaborative incentives; also see Baker, 2002 for a formal analysis). Uniquely from a coordination perspective, the distinctive value of structural integration in technology acquisitions lies in its ability to promote coordination of interdependence across organizations. March and Simon (1958: 28-30) argued that organizing tasks in "self-contained" organizational units, where a unit is "self contained to the extent and degree that the conditions for carrying out its activities are independent of what is done in the other organization units" enables effective coordination (see also Thompson, 1967 and Galbraith 1973). Coordination is the alignment of actions, distinct from cooperation, which is the alignment of interests (Camerer & Knez, 1996, 1997; Grant, 1996; Gulati, Lawrence& Puranam, 2005; Heath & Staudenmayer, 2000). Coordination failures occur when interacting individuals are unable to anticipate each other's actions and adjust their own accordingly.

Traditional perspectives on coordination capacity frame the concept in terms of information processing activities - such as decision-making and communication to allocate the tasks among individuals and enable ongoing adaptation between them as the tasks are executed (Galbraith, 1977; Tushman and Nadler, 1978). While information processing is a macroscopic description of these activities, a closer look reveals that these are ultimately aimed at creating sufficient knowledge among interacting individuals such that they can adequately anticipate each other's actions, and adjust their own accordingly. For instance, interdependent individuals must communicate and decide on how to divide labour as well as how to ensure that the results of their divided individual efforts can be combined effectively again (Grant, 1996; Gulati et al, 2005). Through the information processing activities of communicating and decision making, they can reach a state of agreement on these issues, such that each can then proceed with their respective actions, secure in the knowledge that the others actions will be aligned to their own.

Structural integration typically results in common procedures, common goals, and common authority between acquired and acquiring firm's technical employees, as they are located within common organizational units. While the imposition of these on the acquired organization undoubtedly generates disruption effects, these mechanisms also enhance reciprocal predictability of action as all interacting parties adhere to the same procedures, are aware of a common goal, and are directed by the same source of authority. This enhances their ability to adjust their actions to each other's actions- i.e. coordinate effectively (Galbraith, 1977; March & Simon, 1958; Thompson, 1967). In addition to the impact on the formal systems and procedures of the organization, structural form also shapes over time the emergence of informal organizational processes that aid knowledge transfer, such as the creation of common ground, informal communication channels and group identity (Camerer & Knez, 1996; Ibarra, 1993; Kogut & Zander, 1996; Krackhardt, 1990; Moran & Ghoshal, 1996). These effects may be strengthened if structural integration also results in collocation. We refer collectively to these consequences of structural integration as the "coordination effect" – as cumulatively they serve to enhance coordination between the acquirer and target firm.

We expect that gains from the coordination effect outweigh the costs of the loss of autonomy effect when there are high levels of interdependence between the activities underlying the acquirer's and the target's capabilities. This is because the gains from coordination rise with interdependence (Thompson, 1967), while the costs of the loss of autonomy effect do not directly depend on the extent of interdependence.

In technology acquisitions, by definition, the key capabilities of interest are technological – the system of interpersonal and individual routines, knowledge and resources that underlie the capacity to develop technology. The activities underlying the technological capabilities of the target and acquirer are highly interdependent when they cannot be used in combination without significant adjustments made to one or both. This is particularly the case when the target is acquired for a component technology rather than for a standalone product, as the product development teams of the target firm need to manage the interdependence between their own activities and those of the product development teams working on the remaining parts of the system. Acquisitions featuring component technologies are thus likely to be characterized by high levels of interdependence between acquirer and target firms because the acquired technologies are an element of a larger technological system - a property that Winter describes as "system dependence" (1987, pg 173)- so that adaptations to the technology require "significant readjustments to other parts of the system" (Teece 1996).[1] The coordination effect generated by structural integration can be valuable enough in such cases to offset the disruption caused by the loss of autonomy effect. An optimizing decision maker who balances the benefits and costs of structural integration is *more* likely to choose structural integration in this case.

When the target's technology represents a standalone product, however, the interdependence between the product development teams of the target and acquirer is likely to be lower. A standalone system by definition is self-contained, and is not likely to need as much coordination with other systems or sub-systems as a component element would (March and Simon, 1958; Galbraith, 1973) - it is effectively "autonomous" (Teece, 1996). In Thompson's terminology, (1967) the interdependence between itself and other systems and sub-systems will be closer to pooled or sequential interdependence than to reciprocal interdependence. In this case, the coordination effect generated by structural integration is of limited value, as the gains from coordinating interdependence are low. On the other hand, the disruption caused by the loss of autonomy effect will still exist- therefore lowering the net gains from structural integration. An optimizing decision maker who would balance the benefits and costs of structural integration is *less* likely to choose structural integration in this case. We therefore predict:

> **H1**: Structural integration is more likely in technology acquisitions, when the acquisition is motivate by obtaining a component technology (rather than a standalone product).

[1]Note that component technology acquisitions are not the same as vertical acquisitions, because vertical acquisitions can cover a broader range of acquisitions than the acquisition of component technologies. For instance, an acquirer may purchase a downstream distribution and marketing company, which would still be a

COMMON GROUND, INTERDEPENDENCE AND STRUCTURAL INTEGRATION

The notion of common ground has been developed through the work of Herbert Clark and his associates (Clark, 1996) to explain language usage as a coordination game, though it has since been used to study coordination more generally in organizations (Bechky, 2003). Clark defines common ground between two people as "the sum of their mutual, common or joint knowledge, beliefs and suppositions" (Clark, 1996; p93). Common ground enables coordination because it allows people who possess similar stocks of knowledge to accurately anticipate and interpret each other's actions – whether the context be interdependent tasks or the meaning implied by certain words.

The concept of common ground is closely related to the economic concept of common knowledge (Becker and Murphy, 1992; Chwe, 2001). Common knowledge is knowledge that is known iteratively among interacting individuals ("I know that you know that I know that you know…."). For instance in standard principal agent models, the parameters of the contract and production technology are assumed to be common knowledge. Some scholars have however argued that the infinitely iterated series of propositions involving "I know that you know…" is psychologically infeasible, or at the least implausible (Clark, 1996, pg96). Clark's introduction of the concept of common ground was in part a reaction to this infeasibility- by defining common ground in terms of knowledge that is known and known to be known (a reflexive definition) – the concept becomes more cognitively tractable.[2] The reflexive interpretation of common ground as knowledge that is known and known to be known- makes it a closely allied concept to others such as shared understanding, transactional memory (Moreland & Argote, 2003), shared representations

vertical acquisition, but does not involve the acquisition of a component technology. Conversely, a horizontal acquisition may be made for obtaining technology.

(Weick & Roberts, 1993), and focal points (Schelling, 1960). The common thread through these concepts is that they define a form of shared knowledge that enables interacting agents to accurately adjust and align their actions to each others- in other words to coordinate successfully.

In contrast to structural integration, which enables coordination primarily through the use of formal mechanisms such as common authority, procedures and goals, common ground can give rise to tacit or informal coordination (Camerer & Knez, 1997).[3] With common ground, actions are aligned not because interacting individuals are mandated to take aligned actions through authority or procedures, but because they share sufficient knowledge to enable each to actively align their actions to each other.[4] In this sense, informal coordination based on common ground can substitute for formal coordination driven by structural integration. Importantly, coordination based on pre-existing common ground is not subject to the disruption effects that accompany structural integration, because no substantial changes to the formal organization are necessary.

In product development settings, for instance, design engineers working on different but interdependent technological sub-systems can coordinate their work by following formal procedures or design standards, or through engaging in formally mandated practices such as participation in cross-project teams. However, if they possess adequate knowledge about each other's sub-systems, then coordination need not depend to the same extent on the formal guidelines, but can proceed tacitly or informally (Chwe, 2001; see also Postrel, 2002 pg 311). Therefore, if the common ground between interdependent individuals contains significant

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[2] Interestingly, Aumann and Brandenburger (1990) showed that "mutual knowledge" which is identical to common ground reflexively defined is an adequate assumption for the economic analysis of coordination games, and the more restrictive definition of common knowledge is not necessary.

[3] Though structural integration may also prove conducive to informal mechanisms of coordination over time, including common ground, as we have noted.

[4] An alternate perspective is that structural integration ensures that the rules and procedure are in common ground. Thus structural integration may ensure that coordination occurs with shallower levels of common ground – the interacting individuals possess shared knowledge of each others likely actions, not the knowledge used to arrive at actions.

levels of shared knowledge about how the interdependent technological sub-systems work, then the need for formal coordination mechanisms such as those associated with structural integration should decrease. Such common ground could exist, for instance when the engineers have been working in the same technological domains prior to the acquisition. Alternately it could be rapidly created after the acquisition, for instance when the interacting parties can rely on blueprints, documentation or artefacts to quickly develop an understanding of each other's activities – i.e. create common ground (Bechky, 2003).

Note that we do not expect that informal coordination based on common ground will perfectly substitute for formal coordination through structural integration. Some coordination problems (such as those captured in games like "battle of the sexes") involve mixed motives, where individuals may have different preferences over the multiple equilibria. Such situations cannot easily be resolved through common ground alone, but require the intervention of authority or other sources of constraint on action (Schelling, 1960; Camerer and Knez, 1997). However, the need for structural integration should decline in the presence of common ground, as it can at least partly substitute for the effects of structural integration by resolving other kinds of coordination problems. Further, reliance on pre-existing common ground does not generate the kind of disruption effects that structural integration does. Therefore an optimizing decision maker is less likely to structurally integrate component technology acquisitions when common ground is available as an alternative means of achieving coordination. Therefore, we predict:

> **H2:** The existence of high levels of common ground between individuals from the acquiring and acquired organizations lowers the likelihood that component technology acquisitions will be structurally integrated.

Figures 1 and 2 present the logic of our arguments graphically. The theoretical model underlying our arguments is essentially a matching model- in which the high levels of interdependence characteristic of component technologies drives the need for coordination, and both structural integration and common ground can contribute to the necessary coordination capacity. This matching between the "need for coordination" and "coordination capacity" is the unobserved core of the model (in the shaded oval in Figure 1). Since structural integration generates disruptive effects (but reliance on common ground does not), it follows that for a given level of interdependence, structural integration is less likely to be invoked if there is pre-existing common ground. This is why we specify a moderating effect for common ground on the relationship between component technology and structural integration.

METHODS

Sample and Data

In keeping with prior literature, we define technology acquisitions as the acquisition of small technology based firms by large established firms to gain access to their technologies (Doz, 1988; Graebner, 2004; Granstrand & Sjolander, 1990; Ranft & Lord, 2002). We chose our sample of acquirers from the information technology hardware industries for two reasons. First, this sector has been frequently profiled in popular publications as being extremely active in technology acquisitions (*Business Week*, September 1999; *Fortune*, November 8, 1999). Second, we were able to obtain access for extensive interviewing at three major firms in this sector—Intel, Cisco Systems, and Hewlett-Packard—which gave us a rich understanding of the context necessary for designing the large sample study. At two of these firms, we were also able to obtain primary data in order to test the reliability and validity of our measures obtained from secondary sources (se below for further details).

Acquiring firms were selected from SIC codes of manufacturing industries connected to information technology (computing and communications). Our criteria for selecting large established acquirers required them to have been listed continuously in COMPUSTAT between 1988-1998 and to have more than 1,000 employees at every point of time in the study period. The choice of the time window was driven by the availability of good public information on acquisitions. Continued existence during the study-window operationalized our definition of established firms.[ii] The use of 1000 employees as the cut-off point for large acquirers is consistent with prior research (Pavitt, Robson& Townsend, 1987, 1989). We used the U.S. Small Business Administration definition of small businesses (< 500 employees), and identified acquisitions of such small firms made by the acquirers through SDC Platinum's M&A Database. Finally, we relied on media coverage at the time of the acquisition to isolate acquisitions in which technology was reported as a key motivating factor for the transaction (Ahuja & Katila, 2001). Though the acquirers were all from the IT hardware industries, the target could have been from other industries as well. A total of 217 acquisitions by 49 acquirers met these criteria. Data availability reduced this to 207 acquisitions for 49 acquirers.

Structural integration: To record the structural form of each acquisition, we examined the CORPTECH database in the years after the acquisition. CORPTECH conducts an annual survey of technology firms and units within firms that maintain independent P&L accounts, or distinct status as operating entities. The continued appearance of the target firm in the CORPTECH database after the acquisition was interpreted to mean that structural integration had not been carried out (Structural Integration=0). If the firm disappeared from CORPTECH the year after the acquisition, we interpreted this to mean that structural integration had occurred (Structural Integration=1), so that it was no longer traceable as a distinct organizational entity nor maintained separate P&L accounts.

To corroborate this measure with other evidence on structural integration, we took two additional steps. First, we examined press releases and articles (obtained through Dow Jones Interactive and Lexis-Nexis) in a time window spanning one month before and after the date of announcement to obtain information on the proposed organizational status of the target firm after acquisition. Such announcements often contain a statement about whether the target firm would function as a distinct operational unit after the acquisition (e.g., would function as a “wholly owned subsidiary” or a “separate unit”) or would be merged into one of the business units of the acquiring firms (Paruchuri et al 2006). If an explicit mention was made of retaining the target firm as a distinct entity, we recorded this as instance of structural autonomy, else as structural integration. For 217 acquisitions, we had disagreement between the measure obtained from CORPTECH and the measure obtained from coding press releases in only 22 cases, indicating 90% agreement. Second, in addition to the above check using secondary data, we also used primary data for a sub-sample of transactions to help us assess the validity of our measurement of post-acquisition product introduction and structural integration. We had obtained primary data on these measures for all transactions conducted by two of the most prolific acquirers in our sample, which together account for about a fifth of the data (41 acquisitions). We asked our respondents to answer a single question for each target in this sub-sample of 41 acquisitions conducted by their respective firms: one year after the acquisition, was it possible to identify any distinct organizational units in the acquirer as having come from the target firm? We coded “no” responses as instances of structural integration. We found 87% agreement between our archival measure of structural integration and the answers of our respondents, lending confidence in the validity of our coding.

Taken together, the data on structural form obtained from CORPTECH and press announcements also suggests that the structural integration decision announced at the time of the acquisition is indeed the steady state post-acquisition organizational structure, and is achieved within a year of acquisition (as reflected in the disappearance or continued appearance of the acquired firm in CORPTECH in the year following acquisition). We report analyses with the measure obtained from CORPTECH. The results are qualitatively unaltered with either measure.

Component Technology: To assess whether the acquired technology was for a standalone product or a component technology, we relied on expert coding of the text of press releases and articles about the acquisition that appeared in the media in a time window spanning one month before and after the date of announcement. Three expert coders were selected from among senior graduate students in the computer science department at a major US research university. The selected coders had substantial experience in software and hardware systems development prior to enrolling in the graduate program. Two experts coded the entire sample, while a third coded only the discrepancies so that the majority value could be used. For each acquisition, the expert coders searched a wide variety of business press and trade publication articles to gain knowledge about the target and acquirer's technologies and how they related to each other. After having assembled a set of articles on a particular acquisition, the material was made available to each coder so that each could independently assess whether the target was acquired for a component technology or a standalone product. Their assessments were used to construct a dummy variable COMPONENT which was set=1 if the technology was "to be used as a technological component of a larger product system" or as a standalone technology (COMPONENT=0) if "to be used for creating a standalone product." There was 92% agreement between coders ($p<0.01$). The disputed cases were resolved through the third coder.[5]

Common Ground: We operationalize the existence of common ground- shared knowledge about technological capabilities – through the existence of pre-acquisition patenting activity by both targets and acquirers in the same technology classes. A patent is the

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[5] While undoubtedly related to the notion of modularity (Sanchez and Mahoney, 1996; Baldwin and Clark, 2000; Hoetker, 2006) we hesitate to identify the standalone vs. component technology dichotomy squarely with modular vs. integral technologies, simply because former does not capture a critical aspect of modularity-interface specification. Thus in principle at least (though unlikely in practice) our component technologies might have had fully specified interfaces, making them modular. Put differently, while our standalone technologies are very likely always modular, our component technologies may or may not be. However, this can only introduce a conservative bias in our approach to assessing interdependence that should make it harder to find the effect we predicted.

grant of a property right to an inventor for an invention. The patents assigned to a firm represent the knowledge that a firm is acknowledged as having created (Jaffe, Trajtenberg& Henderson, 1993). In this sense, the patents filed by the acquiring and acquired firms *prior* to acquisition are a measure of the knowledge stock of these firms. The USPTO classifies all patenting activity in the US into about 450 broad classes, with thousands of sub classes. These sub-classes indicate qualitatively distinguishable domains of technological knowledge, and scholars have used them to track changes in the scope of inventive effort (Ahuja & Lampert, 2001) as well as construct measures of proximity in the technology space.

If the target firm has filed patents in the same technology sub-class as the acquirer in the three years prior to the acquisition (to ensure a measure of current knowledge stocks; see Ahuja and Lampert, 2001), we take this as evidence that at the time of the acquisition, there existed common ground between the technical personnel of the acquirer and acquired firms. This is because both acquirer and acquirer possess similar basic technological knowledge necessary to patent in that class, and the act of patenting (which is in the public record) ensures that both parties know that such shared knowledge exists. We constructed a measure "CG" (common ground) that was the number of technology sub-classes in common between acquirer and target normalized by total number of sub-classes that target firm patented in. This continuous measure ranged from 0 to 1. We also constructed several alternate measures such as a) the number of technology classes in common between acquirer and target firm/ Total number of technology classes that the target firm patents in b) the number of acquirer firm patents in the same technology sub classes as target firm and c) the number of target firm patents in the same technology classes as the acquirer's patents. The results are qualitatively identical with any of these measures.

Control variables.

We controlled for several acquirer, target and relational characteristics that could possibly influence interdependence, common ground and structural integration decisions.

Target size and age: We obtained the number of employees in the target firm (Target Employees), and its age at the time of acquisition (Target Age) from CORPTECH and SDC Platinum. Age and size of target firms may influence their attributes (such as whether they patent or not, whether they develop component or standalone technologies), and also how they are treated (in terms of organizational autonomy) by acquirers (Pablo, 1994; Seth, 1990).

Target quality: The amount paid per employee in the acquisition in millions of dollars (Dollars per Employee) was obtained from SDC Platinum and from press releases (VALEMP). We also controlled for the stock (number) of patents filed by the target firm prior to the acquisition (PREPAT), as this might indicate the quality of the acquired firm's technological respurces. Controlling for quality is essential as it mitigates against the confounding signal of quality that our measure of CG could generate, given that it is also based on patenting.

Product market Relatedness: We controlled for product market relatedness to avoid its confounding influence on the effect of interdependence on integration (Datta & Grant, 1990).

We measured relatedness by the extent of overlap between the technology codes assigned to targets and acquirers by SDC Platinum. This database assigns three digit technology codes to acquirers and targets based on the product lines of the firms. The extent of overlap was calculated as the number of codes common to acquirer and target divided by the total number of technology codes of the target and acquirer firms. Unrelated acquirer-target combinations could contribute to implementation difficulties, and encourage structural separation; at the same time, product market relatedness could be associated with similarity in the technological domain, which we measure through CG. In additional analysis, we also simply included a dummy variable for each target firm industry (the acquirer effects controlled for acquirer industry as well), as well as a dummy for whether the target and acquirer were in the same primary 4 digit SIC code. The results are unaffected by these alternative measures of relatedness.

Acquirer size: Larger acquirers may be less willing to grant structural autonomy in a technology acquisition; they may also select targets with characteristics that could correlate with their propensity to patent or generate standalone products. This measure is the log of the number of acquirer firm employees at the time of the acquisition.

Acquirer acquisition experience: Prior acquisition experience was measured as a count of prior technology acquisitions conducted by the acquirer since the beginning of the study period. Acquisition experience could enhance the competence of acquirers at managing the disruptions due to integration; it may also make them more sensitive to such disruptions and lead them to acquire target firms that are less likely to require integration (Haleblian & Finkelstein, 1999; Zollo, 1998)).. It is therefore critical for us to control for acquisition experience to avoid obtaining spurious relationships between structural integration and target characteristics such as interdependence.

Acquirer R&D intensity: Investment in R&D as a percentage of sales (R&D Intensity) for acquirers was calculated from data available from COMPUSTAT. R&D investments could build absorptive capacity, enabling successful utilization of external sources of knowledge (Cohen and Levinthal, 1990; Zahra and George, 2002; Ahuja and Katila, 2001). This could potentially confound the effect of CG on the integration decision, unless controlled for.

*** Insert Table 1 here ***

Tables 1 and 2 show the descriptive statistics and correlations for the variables used in the analysis. About 51% of the sample underwent structural integration after the acquisition. Target firms were small and young on average (93 employees, 8 years old at time of acquisition). In about 50% of the cases, the target's technologies pertained to a component product, signaling high levels of interdependence.

*** Insert Table 2 here ***

The correlation table reveals that the highest correlation between two variables is 0.41 ($p<0.001$). It seems unlikely that estimation would be affected by any serious multi-collinearity problems. The correlation between COMPONENT and STINTEG is significant and in the predicted direction, although it should be noted that these variables are dichotomous. Acquisition experience is associated with structural integration, suggesting that the process costs of acquisition integration decline with integration experience, making integration more likely (Zollo and Singh 2004). Before turning to the results, we now describe the analytic techniques used.

Analytical techniques

Given the dichotomous nature of the dependent variable, our primary estimation approach was to use logistic regression models for panel data. We report three alternate estimations – random effects logit, conditional fixed effects logit, and simple logit regressions with standard errors clustered by acquire - for the following reasons: The random effects estimates are most efficient in the usage of data, while the fixed effects model potentially imposes the most powerful control on unobserved heterogeneity (Greene, 2000). However, the fixed effects conditional maximum likelihood model calculates the likelihood of structural integration of a target firm conditional on the actual number of structural integration decisions made by the acquirer across its targets. This technique means that acquirers that show no variance in their structural integration decisions across targets will not contribute anything to the log-likelihood, and will therefore be dropped from estimation. Thus, conditional fixed effects estimation will under-utilize the data- as can be seen from Table 3, only 165 observations are used in the fixed effects model (column labeled "fe"). We therefore estimated both the random and fixed effects models and conducted a Hausman test to assess whether there were any significant differences in the vector of coefficients estimated by fixed and random effects; the null hypothesis of "no differences" cannot be rejected in our data, which implies that the random effects model is appropriate.

We also find that the results from the simple logit model with clustered standard errors (the column marked "logit" in Table 3) and from the random effects models are statistically identical - indicating that the panel structure of the data does not influence our results much. This is not surprising given our set of controls for acquirer level variables –notably experience. (In specifications without the acquirer experience variable, we find that the acquirer effects are significant). We report all three models for the reader's reference.

RESULTS

Table 3 shows the results for hypotheses 1 and 2 that are obtained from random effects logit estimations. These results support both hypotheses. In column 1, we enter all the control variables: characteristics of the target firm such as its age (TARAGE); size (TEMPLOY); quality (VALEMP, as measured by amount paid per employee; and PREPAT, the number of patents filed by the target firm prior to the acquisition); relatedness between target and acquirer (PEROVLAP); the size of the acquirer and its R&D intensity (LNEMP and RNDSAL); and acquisition experience (EXP). We also include acquirer firm effects. The only variable that is significant in this block is EXP, which has a positive coefficient. Other controls are not significant.

*** Insert Table 3 here ***

In column 2 we enter COMPONENT and CG. We find support for H1, as target firms whose technology pertained to a component technology, were more likely to be structurally integrated ($p<0.05$). CG has a negative main effect on structural integration, which is however insignificant. In column 3 we enter the interaction term between COMPONENT and CG. As predicted in H2, the interaction term is negative and significant ($p<0.01$). The full model has a Wald χ^2 of 24.35 and is significant at the 1% level (11 df), with a McFadden pseudo-R^2 of 12%. Columns 4 and 5 replicate the specification in column 3 with a conditional fixed effects and logit model with clustered standard errors respectively. While the specific coefficients and significance levels differ between the fixed and random effects (as would be expected given the different sample sizes and model assumptions involved), they are statistically indistinguishable with the Hausman test. The coefficients of the logit model and of the random effects model are also statistically equivalent. Taken together, we interpret these results as strong and robust support for our hypotheses.

To ease interpretation, in Figure 2 we plot the probability of structural integration for component and standalone technology acquisitions based on the estimated coefficients, holding other covariates at their mean, and one standard deviation above and below their means (Bowen & Wiersema, 2004; Hansen & Lovas, 2004; Hoetker, 2007). Figure 3 depicts the estimated interaction effect, by showing how the probability of structural integration changes with increasing levels of common ground, for component technology and standalone product acquisitions separately. As before, these are plotted holding the other covariates constant at their mean, and one standard deviation above and below their means. This figure clearly shows that the probability of structural integration is higher for component technology acquisitions than for standalone product acquisitions when common ground is at zero or even at its mean (=0.093). However, as the level of common ground increases, as predicted in H2, the probability of structural integration for component technology acquisitions as opposed to standalone product acquisitions decreases substantially. Finally, since the coefficient of the interaction term in maximum likelihood models may not be directionally the same as the interaction effect for every observation (Ai & Norton, 2003; Hoetker, 2007), we also calculate the z- statistic for the interaction effect for each observation using the logit estimates and the

STATA program “inteff”. This is plotted in Figure 4, which shows that the interaction effect is negative for every observation, and is significant at the 5% level for all but 13 of the observations.

DISCUSSION

Taken together, our results provide evidence in support of our arguments that despite the known adverse consequences of structural integration in technology acquisitions, interdependence motivates structural integration, but common ground can substitute for structural integration as an alternate means of coordinating interdependence.

Implications for theory

This study has implications for three bodies of literature: acquisition management, the link between interdependence and organization, and renewal through external development.

Large sample empirical work on post-merger integration has tended to focus on the “linking” aspects of integration, in which the emphasis is on how the distinct acquirer and target organizational units are connected through teams, integrating managers and incentives (Ranft, 1997; Zollo and Singh, 2004). Studying structural integration – which involves “grouping” activities within organizational boundaries- throws into stark relief the costs and benefits of post merger integration (Nadler and Tushman, 1997). Integration may enhance the ability to coordinate interdependencies, while simultaneously increasing the costs of organizational disruption to the target firm. As others have noted, acquirers thus face a dilemma in which they must choose between coordination and autonomy (Puranam et al, 2006). We argued that in the presence of significant levels of interdependence between the activities underlying the capabilities of the acquired and acquiring firms, as when they acquire component technologies, the gains from coordination obtained from structural integration dominate the costs of disruption caused by loss of autonomy. The structural integration decisions in our sample adhered to such a cost-benefit calculus. Interdependence thus helps explain why acquirers pursue post merger integration in technology acquisitions despite the significant disruptions it is known to cause (Paruchuri et al, Forthcoming).

We also note that with few exceptions, prior literature does not focus on the antecedents of structural integration decisions at all. Instead, most studies examine the consequences of integration decisions on performance (eg. Zollo and Singh, 2004; Puranam, Singh and Zollo, 2006; Paruchuri, Nerkar and Hambrick, 2006), with some providing rich case based insights into mechanisms that can alleviate the disruptive consequences of integration (eg. Ranft and Lord, 2002, Graebner, 2004; Schweizer, 2005). To the extent that any of these studies note any positive performance consequences for integration mechanisms, they may be said to point (at least implicitly) to the benefits of integration. However, the insight articulated by Haspeslagh and Jemison (1991) that ultimately integration must be beneficial because it helps to manage interdependence has not received much empirical attention. Our study is one of the few that attempts to directly study the relationship between interdependence and integration in acquisitions, and more importantly, the conditions under which interdependence may be managed without integration.

By explicitly studying the link between interdependence and integration in acquisitions, our study also helps to advance our knowledge of the sources of value creation in acquisitions (Seth, 1990). Typically, scholars have relied on the concept of relatedness to model the potential for synergy in acquisitions (Singh & Montgomery, 1987) as well as implications for post-merger integration strategies (Datta and Grant, 1990). However, the broad conceptualization of relatedness masks finer variations in terms of similarity vs. complementarity of resource, as well as the extent of effort needed to coordinate resources across acquiring and acquired organizations (i.e. interdependence)(John & Harrison, 1999; Markides & Williamson, 1996). Our study shows that related acquisitions (as measured in terms of overlap in product/technology codes or identical primary SIC codes) could still differ in their degree of interdependence, leading to distinct integration choices, and possibly distinct performance outcomes.

The link between technology and organization has been the backbone of various theories of organization design, in the guise of the principle that specific patterns of interdependence map onto specific forms of co-ordination (Levinthal & Warglien, 1999; Mintzberg, 1980; Sanchez & Mahoney, 1996; Thompson, 1967; Williamson, 1985). Yet, some of the classical empirical evidence for this intuitive proposition has been severely critiqued for not establishing a clear direction of causality from interdependence to organization, and for confounding measures of the two (Perrow, 1987; Scott, 1998). In our study, the nature of technological interdependence between acquirer's and targets can be observed before the structural integration decision thus eliminating any possibility of reverse causality. Further, in our study interdependence was inferred from attributes of the technological capabilities of the target firm, while the resulting organizational structure was inferred from the structural integration decision, allaying any concerns about confounded measurement.

. Our study however goes beyond providing robust evidence for the link between interdependence and organization. This study also highlights the contrast between formal measures to coordinate interdependence (such as structural integration) and informal coordination based on common ground. Several scholars have argued that common knowledge aids coordination (Becker & Murphy, 1992; Camerer & Knez, 1997; Postrel, 2002), and that common ground within the firm may be a basis for its coordination advantages over the market (Demsetz, 1988; Kogut & Zander, 1996). However, common ground as a means of coordination is salient in the context of technology acquisitions because of the significant costs of disruption that formal coordination mechanisms – such as structural integration- impose. Given the "costliness" of structural integration, coordination based on common ground becomes an attractive substitute when it exists. The analogy to formal contracting and trust is striking (Poppo & Zenger, 2002).

Finally, our analysis highlights the paradox inherent in attempts to renew capabilities through external development strategies such as technology transfers, partnerships and acquisitions (Arora & Alfonso, 1990; Kale & Puranam, 2004; Schilling & Steensma, 2002). The very mechanisms that help to assimilate externally sourced capabilities can potentially destroy them, because measures to improve coordination are often costly in terms of motivation losses (as in the case of technology acquisitions). Put differently, how to link externally sourced organizational capabilities to internal ones without damaging them? Building common ground offers a resolution to this paradox as it can help coordinate interdependence – manage the linkage- without recourse to disruptive formal mechanisms. Much like absorptive capacity (Cohen and Levinthal, 1990), common ground represents an instance in which some degree of knowledge overlap helps with the acquisition of non-overlapping knowledge and capability. However, rather than the similarity of knowledge and its beneficial effects on search and learning stressed in absorptive capacity arguments (Zahra and George, 2002), we argue that a form of shared knowledge - common ground- serves as a powerful coordinating mechanism that helps link activities across organizations and avoid the usage of formal coordination mechanisms that can impose costs of disruption when linking capabilities form external sources with internal ones.

Alternative explanations and Limitations

As with any non-experimental study, particularly one relying on archival data, we must subject our interpretation of our results to the possibility of alternate explanations. These can be classed into counter explanations based on a) unobserved features of acquirers (such as their competence at target selection and integration) which may motivate them to acquire particular kinds of companies as well as choose certain integration strategies for them, resulting in spurious correlations between target characteristics and integration decisions b) unobserved features of targets (such as their quality or culture) that correlate both with their technology characteristics as well as with how acquirers manage them and c) alternative interpretations of the measures for interdependence and common ground.

We account for the first category of alternate explanations through our robustness checks using fixed effects models (Table 3), which effectively control for all stable acquirer features that influence both independent and dependent variables. In addition we also controlled for size, R&D intensity and acquisition experience of the acquirer, each of which could possibly affect both the dependent and independent variables. With regard to the second category, as we have noted, we cannot implement the fixed effects approach to deal with the issue of target unobserved heterogeneity since targets are not acquired repeatedly. We therefore control for target features such as age, size, quality (measured both as number of prior patents as well as the amount paid per employee by the acquirer) as well as industry relatedness with the acquirer. In addition, we specify and find support for an interaction effect between component technology and common ground in influencing the likelihood of structural integration, which seems difficult to reconcile with alternative explanations based on unobserved features such as target quality.

Finally, we believe our controls also help rule out alternative interpretations of our measures. For instance, since we explicitly control for target age, size and quality, it seems unlikely that the effects of interdependence, measured by the classification of the target as a component technology, could be attributed solely to these sources. We measured the existence of common ground – shared knowledge that is known to be shared- through the use of patenting data. Specifically, we have argued that since patents are public knowledge and they indicate knowledge about particular technology domains, patenting by both acquirer and target in the same technology class indicates the existence of common ground. However, there are two potential issues with the use of patent data in this manner- the existence of patents may indicate superior target quality, regardless of the domain of patenting, and patenting by the target firm may indicate that the acquirer is interested in the IP behind a specific technology rather than a capability for further innovation (in which case the acquirer may justifiably chose not to integrate). By controlling for the stock of patents filed by the target firm prior to the acquisition, we believe we have accounted for the "patent as a signal of quality" explanation, as our results show the effect of patenting in the same technology class, controlling for the number of total patents of any kind filed by the target prior to the acquisition. We cannot directly eliminate the "IP as the sole motivation" explanation with our data; but if that explanation were valid, then it is hard to see why the existence of patents should negatively moderate the effect of interdependence on structural integration. In sum, we believe our results provide sound insights on the relationships between interdependence, structural integration and common ground in technology acquisitions.

This is not to say that our study is free of limitations. In the interests of tractability, we have made several simplifying assumptions for specifying and testing the hypotheses in this study. We have assumed for instance that the technological interdependence between target and acquirer is the only relevant form of interdependence and that the coordination requirements with the product development teams of the target dictate the organizational treatment of the entire target firm. We believe these assumptions are reasonable given that the objective of technology acquisitions, by definition, is to acquire technological capabilities, and because product development forms the bulk of activities in the small young organizations that are typically targets for this kind of acquisition. Clearly such an approach to classifying acquisitions would be inappropriate for larger transactions in which technology may play at best a peripheral role.

Reliance on patenting data to measure common ground is also not free of problems- the most prominent of them being that when the target firm files no patents prior to acquisition, we code this as a case of zero common ground. We would hesitate to interpret this literally as saying that there is no common ground at all; instead there is more likely to be (or indeed “more quantity of”, with a continuous measure) common ground if there is patenting in common technology classes than if there isn’t. Despite this weakness, we use the patent based measure because of three important offsetting strengths. First, patenting provides an objective measure of the existence of certain kinds of knowledge. Second, the technology class scheme used to classify patents presents a fine grained, objective and reliable categorization of the domains in which this knowledge exists. Third, critical to our definition of common ground is the aspect that it is knowledge that is shared and known to be shared. Because patenting information is in the public domain (as opposed to privately held unpatented knowledge), patents readily signal to acquirer and target not only that they share some overlapping domains of knowledge, but also that the existence of this knowledge is known to be shared.

We are also keenly aware that insights from models of the choice of organizational form do not directly have consequences for performance. Indeed our theoretical framework and resulting predictions depend on the assumption of optimal decision making by acquirers, which involves a choice of structural integration as a response to coordination requirements. Such an assumption about optimal choice characterizes many rational choice theories of organizations, such as structural contingency theory, agency theory and transaction cost economics (Eisenhardt, 1989). However, the traditional legitimacy of this assumption aside, we also believe it to be a plausible one. For instance, Pablo (1994) found that managers weigh task interdependence significantly in their integration decisions in a policy capture exercise, as they view post-acquisition integration as the means by which to achieve coordination and control between acquirer and target firms.

Finally, in the interests of developing the coordination perspective, we have consciously relegated issues of incentive conflict to the background. For instance, as we have noted, the benefits from structural integration extend beyond the coordination effect to include superior cooperation because of aligned incentives, and interdependence can create problems for cooperation as well as coordination (Heath and Staudenmayer, 2000). It is therefore possible to derive H1 even if coordination problems could be assumed away, as indeed can H2; it is possible to interpret the effect of common ground as leading to a reduction in moral hazard and an increase in the effectiveness of mutual monitoring. However, our goal has been to show that the converse is also possible, in the sense that even assuming away incentive conflict, these hypotheses can be derived purely from a coordination perspective. Ultimately, we believe there is little to be gained from pitting incentive conflict and coordination failures as competing explanations for the failure of collective action within or between organizations (Dosi, Levinthal& Marengo, 2003; Gulati et al., 2005). The management of interdependence requires solving both types of problems, and a fruitful approach may involve delineating the interactions between coordination challenges and incentive conflict, rather than simply assuming one or the other away.

Conclusions

A coordination perspective helps explain why structural integration may be necessary in technology acquisitions despite the costs of disruption this imposes, as well as the conditions under which it becomes less (or un-) necessary. We show that interdependence motivates structural integration, but pre-existing common ground offers acquirers an alternate path to achieving coordination, which may be less disruptive than structural integration. The key implications for capability renewal through external sources are the importance of interdependence as a criterion to assess the attractiveness of external capabilities, as well as the value of creating and harnessing common ground between source and recipient organizations.

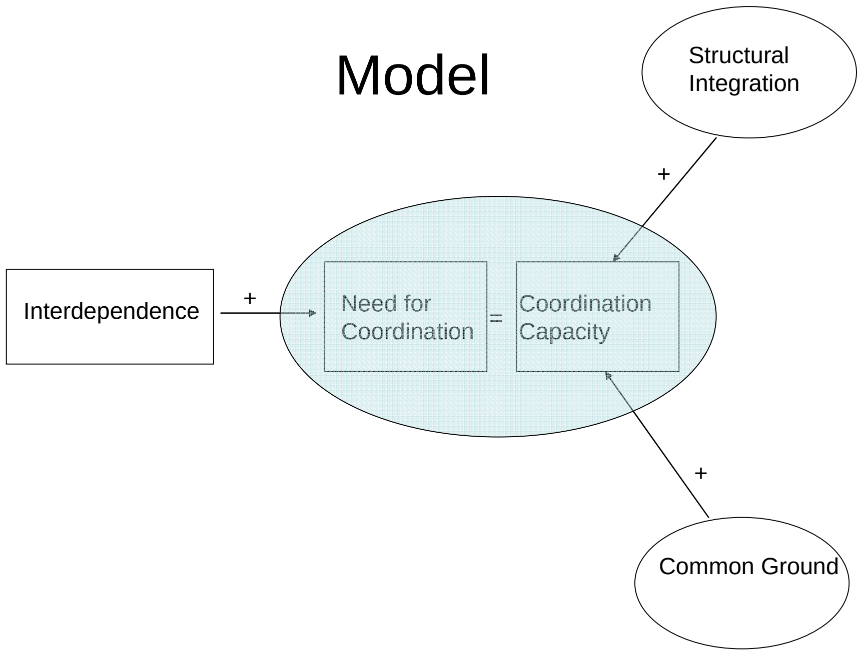

Figure 1: Theoretical Model

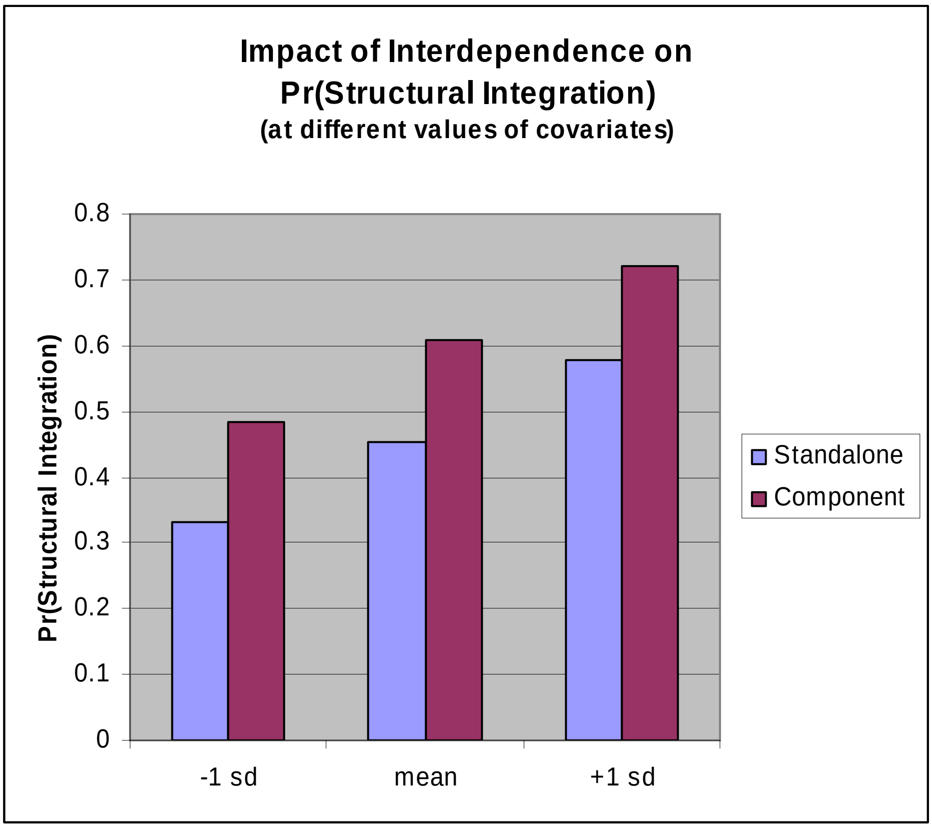

Figure 2: The main effect of interdependence (Component technology)

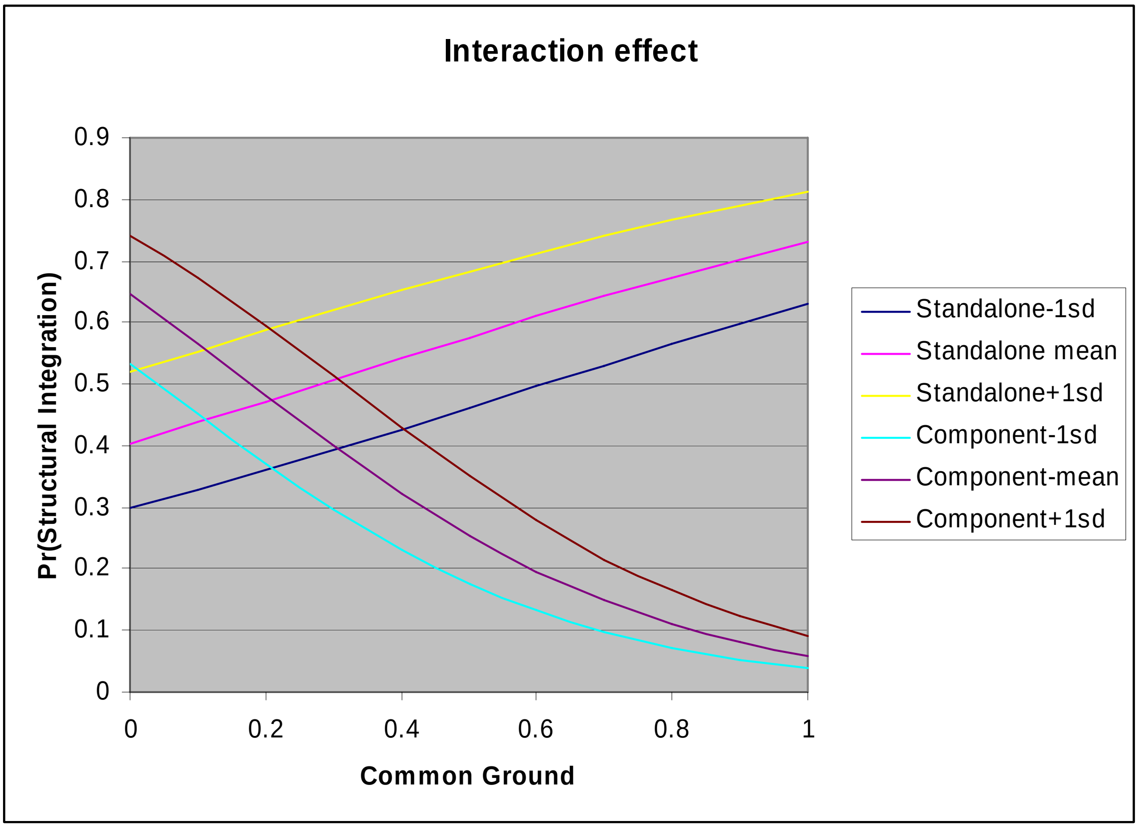

Figure 3: Interaction between Component technology and Common ground

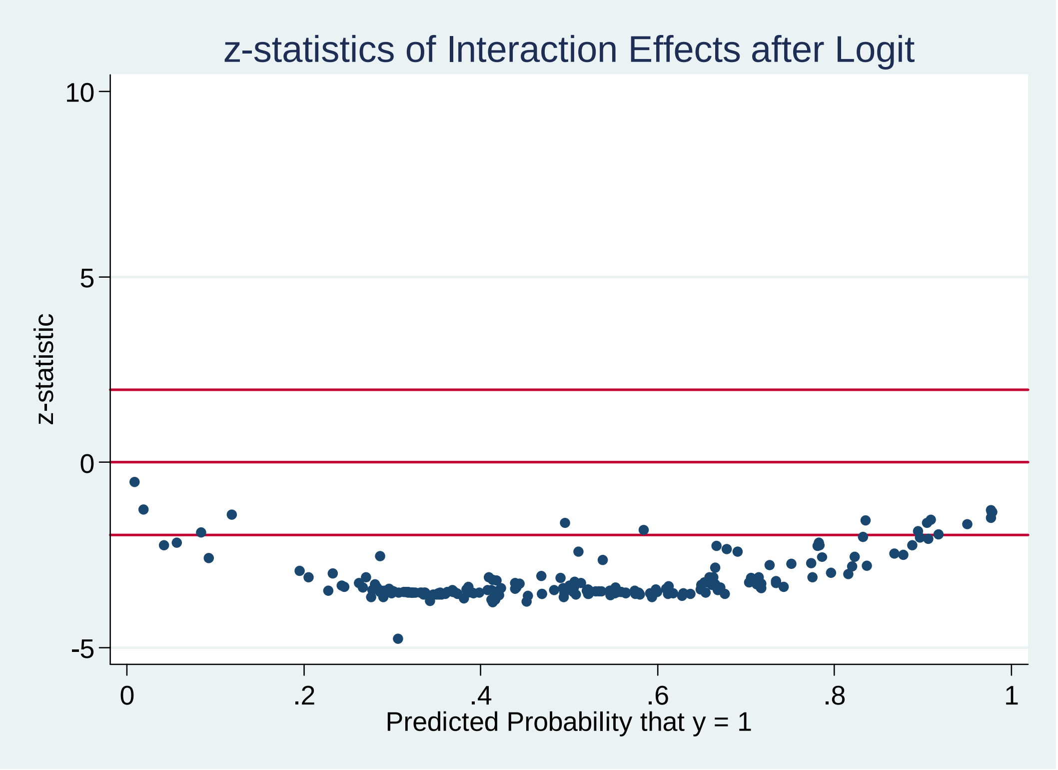

Figure 4: Plotting the z-statistic of the interaction effect for each observation

Table 1

Descriptive Statistics

Variable	*n*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Description*
Structural Integration	207	0.507	0.501	0	1	Coded =1 if acquired firm structurally integrated, else =0
Component	207	0.502	0.501	0	1	Target technology pertains to a standalone (0) rather than a component (1) product
Common Ground	207	0.093	0.247	0	1	The number of technology sub-classes in common between acquirer and target firms/Total number of target technology sub-classes
Industry Relatedness	207	0.246	0.381	0	1	SDC Technology codes in common between target and acquirer/Total number of target codes
Target Age	207	8.029	6.93	0	30	Target age (years)
Target Employees	207	92.88	99.28	3	500	Target size (employees)
Dollars per Employee	207	2.515	4.352	0.02	32.5	Amount paid per employee in target firm (mill $)
Prior patents	207	1.304	4.838	0	47	Number of pre-acquisition patents filed by target firm
R&D Intensity	207	10.44	5.67	0.6	31.4	Acquirer R&D intensity (%)
Log (Employees)	207	9.177	1.584	5.112	11.918	Log (Acquirer number of employees)
Experience	207	3.903	5.07	0	25	Acquirer prior acquisitions

Table 2
Correlations

	1	2	3	4	5	6	7	8	9	10
1.Structural integration	1									
2.Target Age	0.004	1								
3.Target Employees	-0.048	0.405	1							
4.Dollars per Employee	0.008	-0.232	-0.319	1						
5.Industry Relatedness	0.001	-0.054	0.133	0.124	1					
6.R&D Intensity	0.070	-0.079	-0.071	-0.021	0.203	1				
7.Log (Employees)	0.078	-0.126	-0.115	0.236	-0.081	-0.109	1			
8.Experience	0.296	-0.150	-0.114	0.024	0.107	0.312	0.283	1		
9.Component	0.178	0.085	0.091	0.006	0.120	0.085	0.112	0.147	1	
10.Common ground	-0.07	0.118	0.372	-0.030	0.106	0.054	0.170	-0.005	-0.008	1
11.Prior patenting	-0.002	0.023	0.07	-0.057	0.042	0.061	0.080	0.024	0.040	0.328

Correlations> 0.136 are significant at p<0.05 in two-tailed tests

Table 3: Likelihood of Structural integration

Random effects (re), Fixed effects (fe) and logit with clustered standard errors (logit)

Estimation method	re	re	re	fe	logit
DV: Structural Integration (INTEG)					
Component (COMPONENT)		0.636**	0.985***	0.698+	0.974***
		0.326	0.34	0.475	0.276
Common Ground		-0.207	1.387	1.774	1.356
		0.771	0.984	1.281	1.06
Component X Common Ground			-4.741***	-4.139**	-4.741***
			1.78	2.098	1.39
Target number of employees (TEMPLOY)	-0.000	-0.0002	0.0002	-0.0016	0.00018
	0.001	0.002	0.002	0.003	0.002
Target age (TARAGE)	0.018	0.015	0.013	0.0157	0.013
	0.026	0.027	0.026	0.039	0.026
Transaction value per employee in target firm (VALEMP)	0.002	0.006	0.014	0.011	0.014
	0.038	0.039	0.038	0.045	0.043
Prior patenting stock of target firm (PREPAT)	-0.069*	-0.064	-0.054	-0.073	-0.01
	0.042	0.043	0.046	0.05	0.043
Industry relatedness (PEROVLAP)	-0.119	-0.243	-0.371	0.034	-0.381
	0.447	0.447	0.451	0.536	0.451
Acquirer R&D intensity (RNDSAL)	-0.105	-0.346	-1.028	-1.152	-1.042
	3.203	3.15	3.037	6.634	2.63
Log (Acquirer number of employees) (LNEMP)	-0.021	-0.044	-0.072	0.157	-0.07
	0.125	0.124	0.117	0.624	0.109
Acquirer acquisition experience (EXP)	0.185***	0.177***	0.173***	0.162*	0.169***
	0.053	0.052	0.05	0.085	0.026
Constant	-0.425	-0.428	-0.278		-0.28
	1.223	1.212	1.147	n.a.	1.108
Acquirer effects	Included	Included	Include	Included	Not Included
n	207	207	207	165	207
2	14.59*	18.28**	24.35***	21.97**	121.36***
Log Likelihood	-130.43	-128.44	-123.68	-62.8094	-123.71
McFadden Pseudo R2	0.07341	0.087525	0.121341	0.553783	0.12112816

+p<0.10 (one tailed); * p<0.10
*p<0.05 ***p<0.01 ;
Numbers below coefficients are standard errors

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