How Buyers Cope with Uncertainty when Acquiring Firms in Knowledge-Intensive Industries: Caveat Emptor

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The acquisition of knowledge often underlies merger and acquisition strategies. But knowledge, as a strategic asset, creates special problems for an acquiring firm. This paper examines the impact of knowledge on merger and acquisition strategies both theoretically and empirically.

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Abstract

Knowledge is frequently the focus of corporate acquisitions. It often cannot be acquired in efficient factor markets due to asymmetric information and because it may be bundled in teams or networks. However, variations in quality are harder to observe for knowledge-based assets than for tangible assets. This creates information dilemmas for buyers and, accordingly, a risk of overbidding, whenever a target is in a knowledge-intensive industry.

This study found that most buyers took steps to mitigate the information dilemmas associated with knowledge-based assets. Specifically, buyers coped by (1) offering lower bid premia; (2) using contingent payment (e.g., stock or earnouts); and (3) increasing information both through lengthy negotiations and by avoiding tender offers.

However, when the two firms drew on unrelated forms of expertise, buyers did not apply these strategies. It may be that a buyer's information needs are lower if little postacquisition integration is anticipated. An alternative explanation is that unrelated buyers may not be fully aware of the information dilemmas that they face. If so, they may be especially at risk of overbidding.

The contingency relationship identified here with respect to related expertise warrants further study. Both the resource-based and diversification literatures presume that relatedness is universally important. This study suggests that it may be particularly relevant when there are knowledge-based assets.

(*Knowledge*; *Human Capital*; *Mergers and Acquisitions*)

Though knowledge may be a key factor in explaining firm performance (Prahalad and Hamel 1990), it also poses serious management challenges (Coff 1997, Szulanski 1996). For example, since knowledge may be maintained at the group, organization, and network levels, it is often "bundled" with other resources (Nonaka 1994). This bundling, along with tacitness, makes knowledge difficult to acquire in traditional factor markets or even through strategic alliances (Kogut and Zander 1992, Liebeskind 1996, Mowery et al. 1996).

It is therefore not surprising that knowledge-based assets are often the key motivation behind corporate acquisitions (Barney 1988, Chi 1994, Haspeslagh and Jemison 1991). Indeed, recent acquisition activity seems to focus on knowledge-intensive industries such as business services, health services, software, and precision medical equipment (*Mergers & Acquisitions Journal* 1999).

However, knowledge-based assets are harder to assess than tangible assets (Chi 1994). First, it is difficult to observe asset quality. For example, financial statements rarely provide meaningful information about such assets. Second, buyers cannot be certain about what will be transferred due to turnover and tacitness (Flamholtz and Coff 1994, Zander and Kogut 1995).

The amount of asymmetric information may also depend on whether the buyer and target draw on similar knowledge bases. Related buyers are probably better able to assess targets since they are steeped in the knowledge base. Asymmetric information, in turn, is linked to the buyer's risk of overpaying or buying a "lemon" (Akerlof 1970, Giammarino and Heinkel 1986, Hirshleifer and Titman 1991). Unfortunately, while there is ample reason

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to believe that knowledge-based assets pose hazards, there is little research exploring these problems or how buyers cope.

This study proposes steps that buyers may take to cope with the information problems and tests whether they take these steps. The following section elaborates on the uncertainty associated with acquiring targets in knowledge-intensive industries (see Figure 1). This analysis is followed by hypotheses about how buyers cope—especially when they are in unrelated industries. I then present the research methods, results, and implications for future research.

Knowledge-Intensive Industries and Information Dilemmas

Industry-level Variation in Knowledge-intensity

This study focuses specifically on knowledge that resides in people—in other words, *human capital.* That is, although knowledge may be embedded in routines, information systems, or networks (Nelson and Winter 1982), I will focus specifically on knowledge that employees carry home with them each day. Of course, the individual-level knowledge at issue here is an essential building block for knowledge at the group, network, and organization levels as well (Nonaka 1994).

Like physical capital, knowledge is an input in the production process for all industries. Also like physical capital, industries vary greatly in the amount and type of the resource used (Farjoun 1994, Foss and Eriksen 1995). For example, although a motel chain and a pharmaceutical firm might both rely on knowledge, the amount and type of knowledge are vastly different.

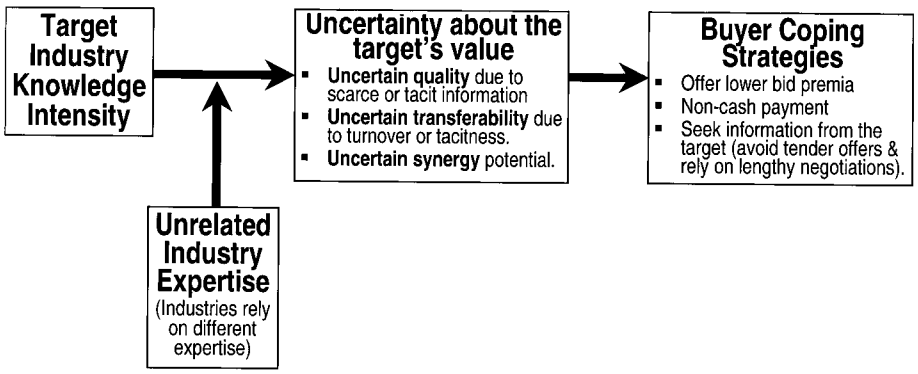
Of course, knowledge also varies among firms within industries. This is a fundamental assumption underlying the resource-based view. Nevertheless, systematic industry-level variation in knowledge may be even more substantial due to fundamental differences in markets, technologies, and the expertise deployed.

Some industries—particularly those that employ professionals—rely heavily on general knowledge or education (Raelin 1991). External educational institutions or professional associations develop and maintain much of the knowledge deployed in these industries (Freidson 1988). Where industries draw extensively on such outside sources, then, the knowledge is relatively general and explicit. That is, knowledge gained from universities is general because it is applicable in more than one setting or firm (Becker 1983). Education is also explicit in the sense that it is both codifiable and teachable (Polanyi 1966). As we shall see, industries like computer software, pharmaceuticals, and management consulting draw heavily on this form of knowledge. Of course these are merely the building blocks for knowledge that ultimately becomes cospecialized with other firm resources.

Other industries develop and maintain knowledge through firm-sponsored formal or informal training (U.S. Department of Labor 1996). Informal training especially tends to be industry- or firm-specific (Arrow 1974, Lynch 1991). For example, employees may have to learn industry-specific language to describe the competitive environment or production processes (Spender 1989, Tsoukas 1996). In addition, informal training may be relatively tacit in that workers must learn through direct experience or apprenticeship with co-workers (Polanyi 1966). The measures used in this study suggest that mining, chemical manufacturing, and market research rely on informal training and mentoring to maintain employee knowledge.

Note that these types of knowledge are not mutually exclusive and may be correlated. General knowledge is

Figure 1 Coping with Knowledge Intensity in Acquisitions



often a starting point from which to generate specific knowledge (Arrow 1974). For example, Helfat (1994) describes firm-specific knowledge in corporate R&D. Here, firms typically hire highly educated employees who then acquire and/or create firm-specific knowledge. Thus, general knowledge may serve as a signal to identify high-aptitude employees who are essential in creating specific knowledge (Spence 1973).

Industry Knowledge Intensity and Uncertainty About the Target's Value

In general, markets have much less information about the quality of a firm's knowledge base (whether general or specific) than its physical capital. It is almost as if balance sheets are provided for some industries but not for others (since the primary assets of knowledge-intensive industries are systematically excluded). While physical assets are adequately measured in financial statements, knowledge is excluded—particularly when embodied in people (Flamholtz and Coff 1994). Thus, for more knowledge-intensive industries, publicly available financial information is less useful.

This difference in available information about firms in knowledge-intensive industries is a central theme of this article: it is more difficult for buyers to assess the value of targets in such industries. The value of knowledge-based assets is less certain than that of tangible assets for three fundamental reasons: 1) quality is more difficult to observe or measure; 2) the buyer cannot be certain what can be transferred; and 3) the prospects for synergy are difficult to assess.

Uncertain Quality of Knowledge-Based Assets. Quality refers to an assessment of the target's "stand alone" value independent of the buyer. On this issue, the failure of financial statements to provide accurate information is only part of the dilemma. Presumably, targets could provide any additional information required. However, targets may not always cooperate wholeheartedly. It may be in their interest to provide inflated assessments of knowledge-based assets, particularly if they own stock and would benefit from overpayment. Alternatively, if they don't like the prospect of being acquired, they may withhold important information. In any event, the information provided might be suspect and would be harder to verify than, say, historical cash flows.

For example, short product life cycles may mean that the value of a software manufacturer depends greatly on the promise of new products. Future success, then, depends largely on the quality of the software designers. To some extent, past success may serve as an indicator. However, the buyer is more interested in the capability of software development than in the existing product line. If turnover or depreciating skills mean that the software team is not high quality, the product pipeline may not be promising, and the target would be worth less to the buyer. A target, in this case, may hide information that suggests limitations in its capabilities from the buyer.

However, even if targets cooperate enthusiastically, knowledge may be hard and/or costly to convey (Haspeslagh and Jemison 1991, Teece 1982). If knowledge is tacit, there may be no way to convey it in the time required to negotiate an acquisition (Polanyi 1966, Zander and Kogut 1995). Furthermore, even explicit knowledge may be sufficiently complex that (especially compared to tangible assets) it is hard to convey in negotiations.

Uncertainty About What Can Be Transferred. The stand-alone value is not a complete representation of the uncertainty that buyers face. An acquisition is a major organizational change, and it is not clear that all of the organization's capabilities would be retained through such an event. Even if buyers could fully evaluate the *going concern* value of a target's knowledge-based assets, there would still be uncertainty about what assets could be transferred through an acquisition.

While buyers can be fairly certain about whether tangible assets can be transferred, human capital is much less certain. Since acquisitions can be used to break "inefficient" implicit contracts, some buyers may consider turnover desirable (Shleifer and Summers 1988). Discipline of this type is most strongly associated with poorly performing targets (Walsh and Kosnik 1993). However, the changes associated with friendly acquisitions (e.g., well-performing targets) may also push employees to initiate job searches since such changes may also break implicit contracts (Lee et al. 1996, Walsh and Ellwood 1991). The IBM/Lotus transaction is illustrative because the creator of Lotus Notes, Raymond Ozzie, threatened to quit unless IBM retained the CEO of Lotus (*Wall Street Journal* June 13, 1995).

Uncertain Synergy. Synergy is the additional value that the buyer hopes to achieve by integrating the two firms' unique capabilities (Barney 1988). The prospect of synergy injects even more uncertainty into a buyer's valuation since the combined capabilities cannot be observed a priori in assessing the synergy. Since it is speculative, buyers may tend to overestimate their own ability to generate synergy (Hayward and Hambrick 1997, Roll 1986).

While estimating synergy might be difficult in many acquisitions, it may be relatively easier for physical assets than for human capital. In the case of tangible assets, it may be as simple as checking whether a machine is tooled

in metric or English increments. This can be accomplished with reasonable certainty before the acquisition is consummated.

In contrast, synergy with a human capital intensive firm may require knowledge transfers that are difficult to predict. It may be hard to specify, a priori, how much knowledge will be transferred and whether the knowledge can be deployed in a new setting—even if targets cooperate enthusiastically (Haspeslagh and Jemison 1991, Polanyi 1966, Teece 1982). There simply may be no way to convey tacit knowledge in the time required to negotiate an acquisition (Zander and Kogut 1995). Furthermore, even explicit or general knowledge may be sufficiently complex that it is hard to convey in negotiations (especially compared to tangible assets).

Avoiding Overbidding: Dilemmas Created by Uncertainty and Asymmetric Information

The uncertainty associated with targets in knowledge-intensive industries may create several types of dilemmas for buyers. If information about knowledge-based assets is scarce and the transferability of assets is uncertain, buyers may have a hard time determining the target's value. This uncertainty may mean that the risks of winner's curse and of adverse selection are greater for targets in knowledge-intensive industries.

The Winner's Curse. The winner's curse occurs when buyers bid based on imperfect information. Even if all bidders have unbiased estimates of a target's value, the highest estimate is, by definition, above the true value (Giliberto and Varaiya 1989). If bidders fail to adjust their offers down from their estimates, the highest bid will always exceed the value of the target—the winner will be cursed.

Given that this problem arises from uncertainty about the asset's value, knowledge-based assets might exacerbate the risk. That is, if firm-level variation in the quality of knowledge-based assets is hard to assess, the risk of winner's curse may be more severe in knowledge-intensive industries. Bidders' assessments of the target's value may be more widely dispersed when there are knowledge-based assets, and the winner faces an even greater risk of bidding above the target's true value.

Adverse Selection. Adverse selection is a related problem associated with uncertainty in valuations. Akerlof (1970) described how used car buyers respond to imperfect information. Specifically, buyers formulate offers based on the expected value of a given car—accounting for the possibility that it will turn out to be a lemon. As a result, owners of high quality cars are unable to get what they feel are fair offers. While they might provide buyers with signals of quality, these are suspect because sellers have an incentive to overstate the value. Accordingly, these "discounted" offers are lower than the true value, and high quality cars are kept from the market. Thus, the used car market may contain a disproportionate number of lemons.

If buyers face more uncertainty for targets in knowledge-intensive industries, these industries may operate like markets for lemons. Targets with strong knowledge-based assets may get lower bids (smaller premia) than the owners feel are appropriate since it is harder for buyers to assess such assets. This might lead to a disproportionate number of "lemons" seeking to be acquired in knowledge-intensive industries.

Buyer Coping Strategies for Targets in Knowledge-Intensive Industries

A given buyer should take steps to cope with uncertainty in its estimate of a target's value. Figure 1 lists the coping strategies that are the focus here. Buyers may (1) offer lower bid premia, (2) offer contingent (noncash) forms of payment, and (3) seek better information from the target. The overarching proposition is that buyers apply these strategies when acquiring targets in knowledge-intensive industries.

Reduce the Bid Premium Offered

The information and uncertainty dilemmas put buyers at risk of overpaying. If an adverse selection problem arises, the firms that want to be acquired may be of a disproportionately lower quality than those that do not. The classic response to the threat of adverse selection is to reduce the offer price (Akerlof 1970). That is, where buyers have imperfect information, they may discount their offers to reflect the probability that the target will turn out to be a lemon. The winner's curse problem requires a similar response. That is, if the buyer is aware of uncertainty in its valuation of the target, it should reduce the offer price. If all buyers reduce their offers in this way for targets in knowledge-intensive industries, bids may be systematically lower, and the winner may not be "cursed" (Thaler 1992). However, some discounting may already be present in the stock price—that is, the price should reflect uncertainty about a target's future.

Typically, a premium above the target's pre-announcement stock price is ascribed to expected synergy or preemptive bidding (Fishman 1989, Hayward and Hambrick 1997). However, if it is hard to determine whether knowledge can be applied, buyers may be conservative in predicting synergy from knowledge-based assets. Also, while the stock price reflects all assets, the premium only includes assets the buyer expects to transfer (i.e., after turnover).

Preemptive bidding is the use of a high premium to preempt other bidders from emerging (Fishman 1989). However, competing bidders might not get the benefit of a fair auction for targets in knowledge-intensive industries. If the first bidder secures the target's cooperation, subsequent bidders may be viewed as hostile. Information asymmetries and the threat of turnover make enthusiastic cooperation essential for knowledge-based assets, and additional bidders would in this case find it harder to create value. Buyers may therefore be able to offer lower premia without attracting other bidders into the arena. If target shareholders only compare the offer with other transactions within that industry, they may consider lower premia to be acceptable. Therefore:

H1. *As target industry knowledge intensity increases, the bid premia offered by buyers decreases.*

Offer Noncash/Contingent Consideration

Another strategy that may reduce the risk of overpaying is to use a medium of exchange that is contingent upon the value created (Chi 1994). In this way, buyers may use noncash consideration when they are less certain about the actual value that will be created (Eckbo, et al. 1990). Whereas cash has a fixed value that does not depend on the outcome, stock, securities, or earnouts are more flexible. In contrast, when there is great confidence, buyers may use cash to preempt other bidders (Fishman 1989). Contingent consideration performs two important functions: it limits the buyer's risk of overpaying; and if the target is closely held, it provides an incentive for the seller to help manage the transition process. Thus:

H2. *As target industry knowledge intensity increases, the portion of the offer in cash (as a percent of the total consideration) decreases.*

Seek Better Information from the Target

Lower offers and noncash payment focus primarily on how buyers can reduce the risk of overpaying assuming a given amount of asymmetric information. A different way of approaching the problem would be to try to secure better information. Accordingly, when the target is in a knowledge-intensive industry, there should be differences in the length of negotiations and the use of tender offers.

Negotiation Time. If publicly available information is less useful for targets in knowledge-intensive industries, buyers might need to obtain more information through negotiations. This need for information may mean that such targets require lengthier negotiations.

Lengthy negotiations may be especially necessary if the buyer wants to integrate the target's knowledge, since the two management teams must establish an ongoing working relationship. Lengthy integrative negotiations may be needed to work out the details of the relationship (Pruitt 1983). Typically, the acquisition literature assumes that bid premia are the focal point of negotiation (Haunschild 1994, Walkling and Edmister 1985). However, the premium is relatively simple compared to the complexity of establishing the parameters of an ongoing relationship. Thus:

H3. *As target industry knowledge intensity increases, negotiation time increases.*

Tender Offers. Tender offers also affect the amount of information available from the target. These arms-length transactions provide relatively limited opportunities for information exchange. While they are not necessarily hostile, tender offers are more likely to be resisted—increasing the required bid premium (Huang and Walkling 1987, Walkling and Edmister 1985).

However, even where a tender offer is friendly, negotiating directly with the shareholders implies that there may be a relatively restricted information flow. For the reasons stated above, this restriction can be a serious problem if the target is in a knowledge-intensive industry. Since the strategic assets must often be integrated to generate synergy (Chatterjee 1986, Haspeslagh and Jemison 1991), this type of distance may prevent the buyer from gaining access to key information. Thus, tender offers may be a relatively undesirable method for acquiring targets in knowledge-intensive industries.

H4. *As target industry knowledge intensity increases, tender offers are less likely (controlling for hostile transactions).*

Knowledge and Diversification Strategy: How Do Unrelated Buyers Cope?

The hypotheses presented above are based on the assumption that buyers have less complete information about targets in knowledge-intensive industries than they do in other industries. *Relatedness,* however, is another factor that may influence and moderate the degree of asymmetric information. Relatedness is the extent to which the buyer and target industries draw on similar forms of expertise. One possibility is that unrelated buyers face more severe information problems because they lack key expertise. If so, such buyers should be more likely to apply coping strategies. This scenario assumes that related and unrelated buyers have comparable information requirements.

However, relatedness may also serve as a proxy for diversification strategy and, as such, would have implications for the intended postacquisition integration. The

diversification strategy, in turn, impacts the nature and quantity of information needed to assess the target's value to the buyer. The following discussion examines whether unrelated buyers are more or less likely to apply the coping strategies described above.

Are Unrelated Buyers More at Risk of Dilemmas Arising from Asymmetric Information?

Different buyers do not necessarily face the same risk of information-based dilemmas. When a buyer and target are in unrelated industries, the buyer may lack access to the target's industry knowledge base and may be at greater risk of falling prey to the dilemmas described above. For example, one might require years to absorb even the explicit portion of a biochemist's knowledge-base (e.g., that which is codified in textbooks). Thus, a buyer without that knowledge (compared to a buyer with that knowledge) may face difficulties acquiring a biotechnology firm. Though the buyer might absorb such information over time from the target or from other sources, tacit or technical knowledge is harder to convey in negotiations than information about tangible assets. A buyer with related expertise, on the other hand, would be in a better position to assess the value and potential of ongoing research.

Indeed, the concept of core competence in the diversification literature implies related expertise (Kim and Kogut 1996, Prahalad and Hamel 1990). That is, a corporation should be more adept at managing businesses that rely on similar knowledge bases. Otherwise, management may lack expertise to add value (Williamson 1975). Based on this, it is not surprising to find that knowledge-based resources are associated with related diversification (Chatterjee and Wernerfelt 1991).

The information dilemmas and governance problems in managing diverse business units may be very much like those that unrelated buyers face. If so, relatedness may moderate the extent of information problems. While it may be especially important for targets in knowledge-intensive industries, relatedness may not be particularly useful in evaluating tangible assets. Thus, the most serious information dilemmas should occur for unrelated buyers and targets in knowledge-intensive industries. If so, the interaction of these two attributes should predict an even greater reliance on the coping strategies described above.

Unrelated Diversification May Require Less Information

An alternative may be that unrelated buyers of targets in knowledge-intensive industries do not intend to integrate the two firms. This scenario, in turn, would reduce the buyer's information needs. That is, tacit information is primarily required to assess the value that could be created through integration (Nahavandi and Malekzadeh 1988, Zander and Kogut 1995). Datta and Grant (1990) support this proposed difference in acquisition objectives in their finding that unrelated acquisitions result in less postacquisition integration.

If unrelated buyers do not seek synergy through knowledge transfers, they may have many other objectives for the acquisition. Rational explanations include the buyer's intentions to create value through internal capital markets, through entering new markets, or by facilitating market discipline (Trautwein 1990). Nonrational explanations include managerialism or hubris.

Whatever the objective, if the target is not to be integrated, buyers primarily seek financial information (Walter and Barney 1990). Specifically, such buyers are often most concerned about the target's cash flows. Although financial information may not fully represent the target's assets, information about cash flow is available, and these buyers may be less at risk for information dilemmas than related buyers who intend to fully integrate the firms.

If buyers are able to obtain the financial information they seek, they may not need to discount the bid premia or offer contingent consideration (e.g., stock). In addition, information-seeking strategies might not be necessary because cash flow is relatively easy to confirm. This implies that an alternative would be that unrelated buyers are actually less likely to rely on the coping strategies.

Whether unrelated diversification actually requires less information or puts buyers at a greater risk of overbidding, the proposed relationship focuses on how related expertise may moderate the need for the coping strategies described above. Thus:

H5. *The relationship between target industry knowledge intensity and the coping strategies (premia, noncash payment, negotiation time, and tender offers) is moderated by the extent to which the buyer and target industries draw on related expertise.*

Data and Methods

The hypotheses above suggest that coping strategies should vary with target industry knowledge-intensity and relatedness. These hypotheses were tested using OLS, poisson, and logistic regression on key transaction parameters. The following is a description of the data and measures along with a brief discussion of their limitations.

Sample

The sample for this study was drawn from ADP's mergers and acquisitions database, which contains all publicly announced transactions totaling over $1 million. The database provides descriptive data for the buyer and target

along with basic transaction parameters. I have selected all full acquisitions (218) that closed in the years 1988–1989 which could be cross referenced in COMPUSTAT or Compact Disclosure to obtain control variables.

In general, this eliminated transactions involving small private firms for which such information was not public. In the case of the buyers, many of the private firms were partnerships assembled to conduct a single transaction. Here, the industry coding was not sufficiently reliable to measure relatedness. Also, most of these partnerships were found to involve members of the target's management team and thus were management buyouts rather than corporate acquisitions.

Primary Measures

Dependent Variables. The hypotheses predict that coping strategies will be used for targets in knowledge-intensive industries. Variables indicating these strategies were compiled by ADP from SEC filings, news reports, and, in some cases, interviews with management. The BID PREMIUM is the extent to which the offer exceeds the target's market value two months before announcement (log transformed). The PERCENT CASH is the portion of the offer that is in cash. NEGOTIATION TIME is the number of days from the announcement of the buyer's interest to the date that the transaction closed. Finally, TENDER OFFER indicates whether the transaction was a tender offer.

Target Industry Knowledge Intensity. I used two measures of industry-level knowledge intensity that were based on measures of human capital from the U.S. Census and the Bureau of Labor Statistics National Longitudinal Survey of Youth (NLSY). The NLSY survey tracks a panel of 12,000 people from 1979 forward. All respondents are reinterviewed each year and have reported their work histories, education, and the informal training required to come up to speed at their current jobs. For this study, the 1989 survey was used to match the time period of the acquisitions. Industry averages were calculated using the respondent's three-digit industry code. These variables, education and informal training, are described below.

General Knowledge/Education. Years of schooling is the most common measure of human capital (Becker 1983, Mincer 1974). Average industry education was calculated from U.S. census data and ranges from the high school level (12 years of school) to some graduate school (17 years). While some firms in each industry are above and some are below the average, the measure still helps to indicate which industries rely heavily on educated employees. Though it reflects explicit or codified knowledge, the complexity may make it hard to convey to those who do not have the same educational background. The potential mobility of such assets may pose a greater risk of turnover, which should introduce uncertainty into the target's estimated value.

Specific Knowledge/Informal Training. NLSY respondents were asked about the number of hours of training required in the last year to maintain their skills. This number of hours of training was used as an indicator of firm-specific knowledge. The hours of training were then aggregated at the respondent's industry level (3 digit). This measure reflects the average hours of informal training required to upgrade or maintain knowledge in each industry and ranges from 0 hours to 55 hours of training.

Table 1 shows examples of high and low human-capital-intensive industries based on the two measures. Some industries (e.g., software) seem to import more knowledge from educational institutions while others (e.g., mining) rely on informal training to bring employees up to speed. Furthermore, these measures are not mutually exclusive. Some industries (e.g., economic and marketing research) rely on highly educated individuals and still require a great deal of informal training. Still other industries (e.g., hotels and motels) rely on neither form of human capital.

Table 2 presents a correlation matrix for all of the variables. While general and industry-specific knowledge are related, the modest (.11) association is far from 1.0 and suggests that these variables capture different types of knowledge. Most of the correlations (75%) between target industry knowledge and the coping strategies are significant. This significance is notable since knowledge has not been carefully studied in the context of corporate acquisitions. Associations among dependent variables are generally significant but vary widely. These correlations are consistent with relationships reported in other research. For example, bid premia are higher for noncash offers, for tender offers, for hostile transactions and when there are multiple bidders (Morck et al. 1988; Walkling and Edmister 1985).

Unrelated Industries. Buyers in unrelated industries are identified by comparing the expertise profiles for the buyer and target industries. The measure used here draws from Farjoun's (1994) expertise-based industry profiles and from Klavens' (1990) expertise-based relatedness measure. Farjoun (1994) used industry expertise profiles to identify industry groups. He compared industries using 41 two-digit occupational categories as clustering variables from the Occupational Employment Survey. Klavens (1990) used the top two occupational categories for an industry to predict diversification patterns.

The Occupational Employment Survey, used by both

Table 1 Examples of Human Capital Intensive Industries by Measure

Measure of Human Capital	High Human Capital Intensity	Low Human Capital Intensity
Education (*years of schooling*)	• Computer software • Pharmaceuticals • Advertising • Management consulting • Economic and market research	• Knife/blade manufacturing • Waste/garbage disposal • Glass manufacturing (bowls, blocks, etc.) • Hand tool manufacturing • Carpet/floor coverings
Informal Training (*hours with supervisor*)	• Guided missile manufacturing • Acids & chemical manufacturing • Furniture manufacturing • Aircraft parts manufacturing • Retail home improvement stores	• Advertising • Vending machine operators • Carpet/floor coverings • Economic and market research • Gypsum/plaster manufacturing

Klavens (1990) and Farjoun (1994), is conducted annually by the Bureau of Labor Statistics. It contains detailed occupational breakdowns by 3-digit SIC code. Specifically, for each industry, it provides the percent distribution of employees in 823 occupational categories.

In contrast to past research that has used this data source, this study draws on 823 five-digit codes to calculate the same basic Euclidean distance criterion.[1] The finer delineation of expertise may make this measure sensitive to the buyer's core competence. For example, agricultural engineering and nuclear engineering cannot be differentiated using 41 categories. The Euclidean distance between industry expertise profiles ranges from 0 to 1 and is expressed as follows:

$$UNRELATED_{EXP} = \sum_{o=1}^{823} \sqrt{(EB_o - ET_o)^2}$$

where EB_o is the percent of the employees in the buyer's primary industry in occupation o; and ET_o is the percent of the employees in the target's primary industry in occupation o.

Control Variables. A number of important contextual factors were controlled in the regression analyses. These controls fall into four categories: (1) the context under which the transaction took place; (2) transaction parameters that are not the subject of hypotheses; (3) characteristics of the buyer; and (4) characteristics of the target firm. The specific controls are as follows:

• *Change in S&P 500 Index.* The change in the Standard & Poors Composite 500 Index indicates market volatility prior to the announcement. During the period studied, the S&P ranged from about 2900 to 3800, suggesting a great deal of change. Volatility might impact estimates of value creation and might make stock a less desirable medium of exchange from the target's perspective.

• *Multiple bidders.* This binary variable indicates whether there were competing bidders (about 12% of the time). Not surprisingly, this variable is associated with higher bid premia, tender offers, and hostile transactions. It is relatively rare to have multiple bidders for targets in knowledge-intensive industries.

• *Hostile.* ADP records the target's response to the offer with special focus on whether the offer is contested (about 4% of the sample). Here a 1 indicates that the offer was resisted. Hostile transactions are associated with higher bid premia, tender offers, and cash payment. Interestingly, there is no clear association with target industry knowledge-intensity.

• *Buyer Market Value.* This is the buyer's market value prior to the acquisition (obtained from COMPUSTAT). The buyer's size is an indication of the resources at the buyer's disposal and thus of their ability to conduct an acquisition. Among other things, large buyers are more likely to be unrelated (.26) and tend to offer more cash (.11).

• *Target sales.* Sales reflect the target's size (obtained from COMPUSTAT). Size is an indicator of how complex the transaction will be. Prior to the 1980s, size alone was considered to be a sufficient takeover defense. While innovations in financing have reduced this effect dramatically (Jensen 1988), it remains an important contextual factor.

• *Target sales growth.* This is the target's growth in sales over the 5 years prior to the acquisition. This was calculated using COMPUSTAT data and indicates whether the target has a proven track record before the announcement. It is important to note that unrelated buyers seem to rely more heavily on this track record ($r = .10$).

Some dependent variables are correlated (see Table 2) and might reasonably be used as controls in predicting

Table 2 Means, Standard Deviations and Correlations

	$\bar{x}$	σ	1	2	3	4	5	6	7	8	9	10	11	12
1. General knowledge	13.27	1.00	1.000											
2. Specific knowledge	4.39	5.30	0.111***	1.000										
3. $UNRELATED_{EXP}$	0.59	0.31	−0.203***	0.002	1.000									
4. Bid premium	0.42	0.61	−0.063†	−0.074*	−0.116***	1.000								
5. Percent cash	88.11	29.66	−0.118***	−0.072*	0.250***	−0.081**	1.000							
6. Negotiation time	127.00	123.22	0.014	−0.027	−0.271***	0.293***	−0.229***	1.000						
7. Tender offer	0.28	0.45	−0.160***	−0.084**	−0.070**	0.395***	0.100***	0.170***	1.000					
Control Variables														
8. Change in S&P500	0.01	0.04	−0.026	0.018	−0.064*	0.075**	0.116***	−0.119***	−0.005	1.000				
9. Multiple bidders	0.12	0.32	−0.113***	0.018	−0.038	0.309***	0.033	0.173***	0.311***	0.068**	1.000			
10. Hostile	0.04	0.16	−0.036	0.030	−0.043	0.147***	0.045†	−0.063*	0.262***	−0.009	0.232***	1.000		
11. Buyer market value	6,699.18	6,342.72	0.138***	−0.026	0.263***	−0.156***	0.106***	−0.134***	−0.116***	0.080**	−0.104***	−0.187***	1.000	
12. Target sales	833.60	2331.30	−0.212***	0.039	0.129***	0.208***	0.049	0.060	0.310***	0.101***	0.265***	0.193***	0.223***	1.000
13. Target sales growth	3.67	9.68	0.041	−0.003	0.101***	−0.196***	0.071**	−0.068**	−0.191***	0.026	−0.069**	−0.097***	0.155***	−0.044

Significance is as follows: *** = .001, ** = .01, * = .05, † = .1

other dependent variables (e.g., bid premia and the percent cash are clearly intertwined). However, since there is no consensus about causality among these variables and some are dichotomous, they were not modeled simultaneously. A single grand model of takeovers is beyond the scope of this study.

Limitations of Data and Measures

While the data are relatively unique and are well suited to studying the implications of industry-level knowledge, there are some limitations with respect to the sample and the measures. Like most studies of acquisitions, this sample is made up of relatively large publicly held firms—partnerships and service firms are underrepresented. In spite of this, there are enough service firms (34%) to provide variation in knowledge intensity and thus to test the hypotheses. Still, the total population of acquisitions is probably somewhat more knowledge-intensive than this sample (e.g., 47% of the acquisitions in full ADP database were in service industries). In a more representative sample, then, knowledge may play an even greater role. While this limitation is a concern, it should mean that the results actually understate the impact of knowledge intensity.

In addition, knowledge is measured at the industry- rather than at the firm-level. The 54 three-digit industries represented in this sample do provide variance in knowledge. For example, average industry education ranges from the high school level (12 years of school) to some graduate school (17 years). However, firms within an industry may differ greatly in their ability to create and apply knowledge (Conner and Prahalad 1996). The measures do not indicate a given target's knowledge intensity relative to other firms in that industry.

Results

The over-arching proposition in this study is that buyers apply a pattern of coping strategies when acquiring targets in knowledge-intensive industries. While the correlations in Table 2 suggest that knowledge intensity is associated with most of the coping strategies as predicted, it is possible that other factors might account for the relationships. Tables 3–6 present regressions (OLS, Poisson, and logistic) that control for many of these factors to test how robust the associations are. Note that the summary of results in Table 7 is particularly useful for evaluating whether a pattern of coping strategies was observed.

Do Buyers Offer Lower Bid Premia for Targets in Knowledge-Intensive Industries?

Models A through D in Table 3 predict the bid premium. Models A and B test hypotheses using general knowledge (e.g., education), while Models C and D use specific knowledge (e.g., informal training) to test the same hypotheses. Model A and Model C both provide some support for H1—buyers offer lower premia for targets in knowledge-intensive industries. The R-Square (.21) suggests that the model fits about as well as other studies of bid premia (Hayward and Hambrick 1997, Walkling and Edmister 1985).

As Model B illustrates, general knowledge has a greater impact on bid premia once we include the interaction with $\text{UNRELATED}_{\text{EXP}}$. This is consistent with H5, which suggests that relatedness moderates the relationship between knowledge intensity and the coping strategies. This finding indicates that unrelated buyers do not reduce their offers when the target's industry relies on general knowledge. One explanation advanced earlier was that information needs are less critical when buyers don't intend to integrate the two firms or to make major changes in the target. This interaction was not supported in Model D for specific knowledge.

Do Buyers Offer Less Cash for Targets in Knowledge-Intensive Industries?

H2 predicted that buyers of targets in knowledge-intensive industries would offer noncash payment to shift risk to the target and provide incentives to help make the transaction successful. In Models E and G (Table 4), the coefficients for both general and specific knowledge are significant and negative as predicted. This suggests consistent support for H2 regardless of which measure of knowledge intensity is used.

Models F and H present the interactions with relatedness. Here, both general and specific knowledge have greater impacts on PERCENT CASH once the interaction with $\text{UNRELATED}_{\text{EXP}}$ is included. The sign on the interaction indicates that unrelated buyers are actually more likely to use cash. This result provides further support for H5 and is consistent with the reasoning that unrelated buyers may actually have more modest information needs—unrelated buyers certainly do not appear to mitigate their risk by offering stock.

Do Buyers Seek Information from Targets in Knowledge-Intensive Industries?

There are also numerous significant findings with respect to information-seeking strategies. Table 5 presents results for models of negotiation time, and Table 6 presents models predicting tender offers. All models are highly significant and seem to explain a reasonable portion of the variance. In addition, there is support for both H3 and H4—when the target is in a knowledge-intensive industry, negotiations are more lengthy and tender offers are less

Table 3 Regressions on Bid Premium[a]

	A Education (Main Effects)	B Education (Interaction)	C Training (Main Effects)	D Training (Interactions)
Model FIT				
Adjusted R-square	0.21	0.22	0.21	0.20
F	6.37***	6.08***	6.41***	5.72***
N	165	165	165	165
Hypotheses				
General knowledge	−0.354*	−0.825**		
	(0.196)	(0.331)		
Specific knowledge			−0.039*	−0.060†
			(0.021)	(0.040)
General K* $UNRELATED_{EXP}$		1.008*		
		(0.574)		
Specific K* $UNRELATED_{EXP}$				0.041
				(0.068)
Controls				
$UNRELATED_{EXP}$	0.023	−2.682†	0.031	−0.030
	(0.040)	(1.542)	(0.040)	(0.109)
Change in S&P 500 index	1.273***	1.252***	1.317***	1.302***
	(0.308)	(0.306)	(0.309)	(0.310)
Multiple bidders	0.049	0.057†	0.053†	0.052
	(0.033)	(0.033)	(0.033)	(0.033)
Hostile	−0.077	−0.077	−0.090	−0.086
	(0.084)	(0.083)	(0.084)	(0.084)
Buyer market value	0.014	0.015	0.010	0.011
	(0.010)	(0.010)	(0.010)	(0.010)
Target sales	0.016*	0.016†	0.020**	0.021*
	(0.008)	(0.008)	(0.008)	(0.008)
Target sales growth (5 yr)	−0.026	−0.027	−0.033†	−0.032
	(0.021)	(0.021)	(0.021)	(0.021)

[a]Standard errors are shown below each coefficient. Significance as follows: *** = .001, ** = .01, * = .05, † = .1. One-tailed tests are used for main effects since the sign was hypothesized, while two-tailed tests are used in other cases.

likely. The finding is not sensitive to the measure of knowledge intensity.

Negotiation Time. Models I and K in Table 5 present regressions on NEGOTIATION TIME (the number of days between the announcement date and the deal closing). Poisson regression is used to predict NEGOTIATION TIME since it is essentially a count of days. The models are both significant and seem to fit the data. OLS regressions (not presented) indicated that the R-Square was approximately .24. H3 was supported because both general and specific knowledge have positive main effects. That is, as target industry knowledge-intensity increases, the length of negotiations also increases.

In addition, the interaction between knowledge-intensity and $UNRELATED_{EXP}$ is significant and negative for both measures of knowledge (Models J and K). This provides additional support for H5. Furthermore the pattern remains consistent with the idea that buyers with unrelated diversification strategies have more modest information requirements.

Tender Offers. Models M and P in Table 6 are logistic regressions predicting the probability of tender offers. The fit is reasonably good, with adjusted Pseudo R-Squares of .37 and .35 (respectively) and significant Chi-square statistics.[2] There is support for H4 since tender offers are less likely when the target is in a knowledge-intensive industry.

The interaction terms are added in Models N and P. Again, the interactions are significant, providing further support for H5. The positive signs on the interactions sug-

Table 4 Regressions on Medium of Exchange (% of Offer in Cash)[a]

	E Education (Main Effects)	F Education (Interaction)	G Training (Main Effects)	H Training (Interactions)
Model Fit				
Adjusted R-square	0.10	0.13	0.10	0.11
F	4.02***	4.65***	3.90***	4.03***
N	216	216	216	216
Hypotheses				
General knowledge	−114.553***	−286.636***		
	(43.452)	(72.834)		
Specific knowledge			−10.571**	−25.143**
			(4.304)	(8.044)
General K* $UNRELATED_{EXP}$		359.617***		
		(123.324)		
Specific K* $UNRELATED_{EXP}$				28.127*
				(13.162)
Controls				
$UNRELATED_{EXP}$	24.844**	−939.565**	29.045***	−13.570
	(8.735)	(330.837)	(8.511)	(21.654)
Change in S&P 500 Index	37.041	39.902	50.981	44.787
	(64.696)	(63.567)	(65.109)	(64.623)
Multiple bidders	14.266*	16.482*	16.835*	16.101*
	(7.490)	(7.398)	(7.496)	(7.440)
Hostile	13.346	7.587	6.875	9.675
	(16.271)	(16.107)	(16.551)	(16.463)
Buyer market value	−1.483	−1.075	−2.348	−2.470
	(2.033)	(2.002)	(2.021)	(2.005)
Target sales	−0.920	−1.230	0.122	0.224
	(1.850)	(1.821)	(1.818)	(1.804)
Target sales growth (5 yr)	3.767	4.240	1.610	2.926
	(4.939)	(4.855)	(4.911)	(4.908)

[a]Standard errors are shown below each coefficient. Significance as follows: *** = .001, ** = .01, * = .05, † = .1. One-tailed tests are used for main effects since the sign was hypothesized, while two-tailed tests are used in other cases.

gest again that unrelated buyers do not avoid tender offers that might exacerbate information dilemmas. This result is also consistent with the pattern of findings in the other interactions. That is, unrelated buyers may need less information if they don't seek to build synergy.

Discussion and Implications

The hypotheses concerned two related questions. First, are buyers more likely to adopt coping strategies for targets in knowledge-intensive industries? Second, are unrelated buyers more or less likely to adopt coping strategies for such targets? Table 7 summarizes the findings and helps to make the overall patterns more salient. The following discussion examines what we can conclude and identifies directions for future research.

Do Buyers Adopt Coping Strategies for Targets in Knowledge-Intensive Industries?

There is evidence that buyers adopt the proposed coping strategies for targets in knowledge-intensive industries. First, all of the raw correlations were in the predicted directions and, with the exception of negotiation time, all were significant. Second, these relationships were robust when controls were added. In all cases, the main effects were significant in the predicted directions.

Therefore, there seems to be a pattern consistent with the predicted coping strategies for both general and specific knowledge. As shown in Table 7, buyers do offer lower bid premia and less cash for targets in knowledge-intensive industries. In addition, buyers appear to initiate information-seeking strategies through more lengthy negotiations and by avoiding tender offers for such targets.

Table 5 Poisson Regressions on Negotiation Time (Days)[a]

	I Education (Main Effects)	J Education (Interaction)	K Training (Main Effects)	L Training (Interactions)
Model Fit				
Chi square/df ratio	88.97***	84.57***	87.46***	85.72***
N	218	218	218	218
Hypotheses				
General knowledge	0.950***	3.611***		
	(0.080)	(0.134)		
Specific knowledge			0.149**	0.309***
			(0.008)	(0.014)
General K* $UNRELATED_{EXP}$		−5.986***		
		(0.235)		
Specific K* $UNRELATED_{EXP}$				−0.340***
				(0.025)
Controls				
$UNRELATED_{EXP}$	−0.420***	15.647***	−0.447***	0.095*
	(0.017)	(0.631)	(0.016)	(0.042)
Change in S&P 500 Index	−1.816***	−1.883***	−2.014***	−1.955***
	(0.115)	(0.114)	(0.116)	(0.116)
Multiple bidders	0.203***	0.184***	0.170***	0.168***
	(0.014	(0.014)	(0.014)	(0.014)
Hostile	−0.086**	0.003	0.012	−0.030
	(0.037)	(0.037)	(0.037)	(0.037)
Buyer market value	0.004	−0.008*	0.016***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)
Target sales	0.069***	0.074***	0.060***	0.060***
	(0.004)	(0.004)	(0.004)	(0.004)
Target sales growth (5 yr)	0.232***	0.226***	0.257***	0.246***
	(0.011)	(0.011)	(0.010)	(0.010)

[a]Standard errors are shown below each coefficient. Significance as follows: *** = .001, ** = .01, * = .05, † = .1. One-tailed tests are used for main effects since the sign was hypothesized, while two-tailed tests are used in other cases.

Are Unrelated Buyers More or Less Likely to Adopt Coping Strategies?

Almost all of the interactions between knowledge and relatedness were significant and indicated that unrelated buyers are less likely to adopt coping strategies. There was no support for the idea that unrelated buyers are more likely to apply coping strategies when purchasing a firm in a knowledge-intensive industry. As discussed, this may reflect the distinct information requirements of different diversification strategies. In other words, if the buyer does not intend to integrate the two firms, the information requirements may be much more modest and the coping strategies might not be needed. For example, if the buyer intended to create value through internal capital markets, the information requirements prior to the transaction would be primarily issues of cash flow and might be relatively easy to convey (Hill 1988).

Of course, this study does not attempt to observe the buyer's acquisition objectives or whether they actually create value. Therefore, we cannot draw unambiguous conclusions. Other objectives, such as managerialism or hubris (Roll 1986), cannot be ruled out. Asymmetric information may make unrelated buyers more prone to hubris when the target is in a knowledge-intensive industry.

Nevertheless, discipline is probably not a motive for unrelated buyers. The pattern of transaction parameters raises this question because it is similar to that observed for hostile transactions (higher premia, more cash, tender offers, etc.). However, additional analysis revealed that unrelated buyers typically pursue targets that have a strong record of growth.[3] Because the targets were performing well, discipline seems unlikely. In fact, the strong record of growth may even suggest that the buyers

Table 6 Logistic Regressions on Tender Offer[a]

	M Education (Main Effects)	N Education (Interaction)	O Training (Main Effects)	P Training (Interactions)
Model Fit				
Adjusted pseudo R-square	0.37	0.43	0.35	0.38
Chi-square/df	69.77/10***	84.98/11***	65.94/10***	72.55/11***
N	218	218	218	218
Hypotheses				
General knowledge	−6.788***	−21.815***		
	(2.457)	(5.094)		
Specific knowledge			−0.488*	−1.498***
			(0.246)	(0.491)
General K* $UNRELATED_{EXP}$		30.090***		
		(8.220)		
Specific K* $UNRELATED_{EXP}$				2.004**
				(0.812)
Controls				
$UNRELATED_{EXP}$	1.114*	−79.439***	1.347**	−1.635
	(0.490)	(21.989)	(0.477)	(1.275)
Change in S&P 500 Index	6.708†	8.617†	6.559†	6.310
	(4.160)	(4.590)	(4.075)	(4.110)
Multiple bidders	1.185**	1.276**	1.345**	1.364**
	(0.458)	(0.473)	(0.456)	(0.472)
Hostile	1.304	0.855	1.223	1.149
	(1.180)	(1.196)	(1.244)	(1.188)
Buyer market value	0.169	0.212†	0.112	0.088
	(0.116)	(0.124)	(0.114)	(0.117)
Target sales	0.323**	0.318**	0.372***	0.382***
	(0.109)	(0.114)	(0.109)	(0.110)
Target sales growth (5 yr)	−0.066	0.040	−0.209	−0.140
	(0.280)	(0.285)	(0.273)	(0.281)

[a]Standard errors are shown below each coefficient. Significance as follows: *** = .001, ** = .01, * = .05, † = .1. One-tailed tests are used for main effects since the sign was hypothesized, while two-tailed tests are used in other cases.

are signaling their resolve to preempt other bidders from emerging (Fishman 1989).

Implications for Theory

The findings suggest that industry knowledge intensity affects acquisition processes and may be linked to information problems as hypothesized. Since the strategy and organizational theory literatures address issues of tacitness, specificity, and asymmetric information, this study has implications for future research.

Strategic Management. Within the strategy literature, this study implies new directions for resource-based theory and for diversification research. First, knowledge is a key component of resource-based theory because it is hard to imitate (Barney 1991, Conner and Prahalad 1996). Although this study examines knowledge at the industry level, the findings might be similar, or even amplified, if firm-level knowledge could be measured and included. This suggests that additional research should study knowledge-intensity using firm-level measures of the construct.

Also, most of the resource-based literature has focused on what resources have potential for a sustainable advantage and not on the management dilemmas that such resources create (Amit and Schoemaker 1993, Reed and DeFillippi 1990). These findings suggest that firms may need to develop competencies that allow them to acquire strategic assets. Further inquiries might focus on how firms develop such competencies (Zollo and Singh 1998).

The second strategy research area, diversification, may

Table 7 Summary of Regression Coefficients for Knowledge Intensity[a]

	Main Effects		Interactions	
	General Knowledge	Specific Knowledge	General* $UNRELATED_{EXP}$	Specific* $UNRELATED_{EXP}$
Bid Premium	—	—	+	
	H1 supported: Buyers offer lower premia for targets in knowledge-intensive industries.		H5 supported for general: Unrelated buyers do not offer lower premia for targets in industries that rely on general knowledge.	
Percent Cash	—	—	+	+
	H2 supported: Buyers use less cash in offers for targets in knowledge-intensive industries.		H5 supported: Unrelated buyers do not offer contingent payment (non-cash) for targets in knowledge-intensive industries.	
Negotiation Time	+	+	—	—
	H3 supported: Lengthier negotiations are required for targets in knowledge-intensive industries.		H5 supported: Unrelated buyers do not use lengthy negotiations for target's in knowledge-intensive industries.	
Tender Offer	—	—	+	+
	H4 supported: Buyers avoid tender offers of targets in knowledge-intensive industries.		H5 supported: Unrelated buyers do not avoid tender offers of targets in knowledge-intensive industries.	

[a]A "—" indicates a significant negative coefficient while a "+" denotes a positive coefficient.

also be informed by this study. There are many anomalous findings regarding the relationship between diversification and performance (Ramanujam and Varadarajan 1989). The interaction between relatedness and knowledge was important in this study and may also be critical in the diversification literature. For example, relatedness may be important for some types of knowledge but not for others. Possibly, some of the inconclusive findings in the diversification literature may be untangled if additional studies conclude that the type of knowledge determines what type of diversification is efficient. Future research should test whether knowledge moderates the relationship between diversification and performance.

This study has also raised the possibility that unrelated buyers may have different objectives. However, the data do not allow us to discern whether unrelated buyers intend to create internal capital markets or enter new markets. For example, it would be interesting if such buyers were systematically more prone to hubris. While this study cannot address this question, the observation that unrelated buyers do not adopt coping strategies suggests that acquisition objectives and value creation are key areas for future research.

Along these lines, internal capital markets may offer a particularly fruitful area of inquiry (Hill 1988). Theoretically, a buyer might be able to take advantage of asymmetric information about firms in knowledge-intensive industries to offer a lower cost of capital than the market (Chatterjee 1986). That is, even if the market reflects all publicly available information (semistrong efficiency), there may be greater asymmetric information about the primary assets for firms in knowledge-intensive industries (Gertner et al. 1994). Over time, the buyer may come to have better information about the acquired unit than is easily available to the market. Additional work might explore whether firms can create value in this way.

Organizational Theory. These findings also underscore the importance of knowledge intensity in market transactions. Much of the knowledge literature has been process-oriented in the sense that it has focused on how knowledge is transmitted and on the role of tacitness (Zander and Kogut 1995, Nonaka 1994). However, the strategic management and finance literatures tend to focus more on the impact of information imbalances on transactions (Chi 1994, Myers and Majluf 1984). This study integrates these perspectives in that it starts with a process-oriented context in which knowledge is the most important asset to be acquired. This study also includes the strategy perspective by focusing on the impact of asymmetric information. Additional research should explore how different types of knowledge impact both market and nonmarket transactions.

Implications for Research Methods

Future research should also identify improved measures of knowledge intensity, relatedness, and coping strategies. The industry-level measures of general and specific

knowledge appear to add relevant information, but they are far from perfect. For example, though the interactions seem more important for general knowledge, we cannot determine whether the result is attributable to the knowledge type or to the quality of the measure. Also, while this study was crafted to examine the impact of industry-level differences in knowledge-intensity, it ignored the rich anecdotal evidence about key contributors and firm-level variation in knowledge intensity. The fact that these measures appear to yield interesting findings highlights the need to develop better operationalizations and study the construct at the firm level as well.

Innovations in measuring relatedness might also be applied in the diversification literature. Most relatedness measures have been based on SIC codes (e.g., product-based relatedness). Current diversification research compares various measures of relatedness and develops new measures based on resources (Hoskisson et al. 1993; Lubatkin et al. 1993; Robins and Weirsema 1995). The expertise-based measure is relatively new and seems to add important information. Future refinements might help to clarify the diversification literature.

The measures and theory surrounding the coping strategies should also be examined further. This study identified a few observable coping strategies, but this is clearly not an exhaustive list. New measures are needed to explore other ways that buyers cope with uncertainty in acquisitions. In addition, while the coping strategies are clearly linked, this study did not attempt to untangle the interrelationships. Future work might develop a simultaneous model of coping strategies.

Implications for Managers

Finally, this inquiry has important practical implications. It builds on Haspeslagh and Jemison's (1991) work by placing the acquisition process in the context of creating a competitive advantage. Increasingly, differences in firm performance are attributed to knowledge because it is hard to acquire and to imitate (Barney 1991, Peteraf 1993, Reed and DeFillippi 1990, Wernerfelt 1984). Dynamic capabilities that allow firms to adapt are also fundamentally knowledge-based (Teece and Pisano 1994). While much of the literature focuses on identifying such resources (Amit and Schoemaker 1993, Peteraf 1993), this study sheds some light on the management dilemmas associated with knowledge acquisition.

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Endnotes

[1]This can also be expressed as: $\Sigma_o^{823}|EB_o - ET_o|$ However, Euclidean distance is usually represented as a squared term.

[2]Chi-square compares the fit of the intercept only model with the specified model ($\Delta X^2 = 2\log(L_1) - 2\log(L_2)$). See Nagelkerke (1991) for a discussion of the adjusted R-Square for logistic models. The unadjusted R-Square is a function of the likelihood of the intercept only model (L_1) and the specified model (L_β). Specifically, $R^2 = 1 - [L_i/L_\beta]^{2/n}$. This ratio is then adjusted so that the maximum is 1 to simplify interpretation.

[3]See the correlation between growth and $\text{UNRELATED}_{\text{EXP}}$ in Table 2. In addition, the analyses were run with a three way interaction that included growth and these were also significant (Knowledge $\times$ $\text{UNRELATED}_{\text{EXP}}$ $\times$ growth).

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