Tacit knowledge transfer and the knowledge disconnect

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Abstract

Purpose – The purpose of this paper is to look at some of the factors that influence the transfer of tacit knowledge between two product development partners.

Design/methodology/approach – Research involved the collection of both qualitative and quantitative data. The qualitative data was based on 13 interviews with various individuals, representing three companies, charged with integrating external technology. The quantitative portion of the data was collected through an online survey. The survey was executed by soliciting responses from managers of 39 discreet projects involving various types of external technology integration, representing five different companies.

Findings – The paper provides evidence that trust, early involvement, and due diligence influence the extent of meeting technology transfer expectations and tacit knowledge transfer expectations. It also finds that the subject of tacit knowledge transfer, content and process, is poorly understood. While managers and project leaders saw the value of tacit knowledge, there were different perceptions of the goals successful knowledge transfer and a lack of processes to manage its process. While project managers may feel that they have tacit knowledge transfer in hand, they have not managed to transfer the knowledge needed for long-term product management.

Research limitations/implications – There are a number of limitations affecting the scope of these findings. For one, our survey respondents were all project or product managers. Future research should include a broader base of participants, both horizontally and vertically. Second, interviews and surveys were confined to a total of five US companies in three industries. Future research would benefit from a larger sample size, as well as greater sample diversity in terms of firm size, industry, and cultural context. Lastly, the measure of tacit knowledge transfer needs additional validation.

Practical implications – The paper offers several recommendations to help managers begin to think of tacit knowledge as an independent entity and manage it accordingly.

Originality/value – This paper offers empirical support for some of the factors that influence the extent of meeting technology and tacit knowledge transfer expectations. Moreover, it offers a unique model that highlights how different levels of an organizational hierarchy are governed by significantly different goals and expectations with regard to tacit knowledge transfer.

Keywords Product development, Knowledge transfer, Knowledge management, Tacit knowledge, Project management, United States of America

Paper type Research paper

Introduction

In the current era of heightened competition, time-to-market constraints, rapidly evolving technologies, and lean staffing, companies are increasingly augmenting their research, development and product portfolios with externally developed technology and innovations. A 2003 study of senior executives of forty international companies covering an array of industrial categories revealed that, on average, 45 percent of their innovations came from external sources. Half of those interviewed indicated that the percentage of external innovations would continue to grow over the next three years; none said it would decline (Linder *et al.*, 2003).

> **" Senior managers are often focused on the strategic issues –
> they are looking for the right 'technology acquisition'
> matches. "**

While it is clear that corporations have embraced the promise of external innovations, those involved are quick to acknowledge that there is more work to be done to realize their full potential. Nearly two-thirds of the respondents of a 2002 survey of executives from 200 global companies said that they were not close to realizing the full potential of external innovations and ideas (Rigby and Zook, 2002).

These external innovations are not being fully realized for a number of reasons. Our own discussions with product development practitioners indicate that the corporate appetite for external innovations has outpaced the development of sound methods, practices and processes that allow the acquiring party to integrate the product, service or technology into their portfolio. Often, external innovations are very different entities compared to the homegrown innovations that have been the foundation of many companies and as such they need to be treated differently and tended to with a different set of tools. There are a number of factors to be considered and rethought; selection criteria, strategic fit, sourcing strategies, tacit knowledge transfer, deal structuring (acquire, license, joint development, etc.), relationship management, and due diligence activities to name just a few.

The intent of this paper is to focus in on one of these factors, the integration of tacit knowledge from an external source, and investigate some of the factors that influence the transfer of tacit knowledge from one organization to another. The integration of tacit knowledge can be fundamental to an endeavor's success (Leonard and Sensiper, 1998). As a result, many firms and management researchers are paying an increasing amount of attention to the active management of tacit knowledge across the value chain (Cormican and O'Sullivan, 2003).

The next section of the paper will review some of the literature on tacit knowledge transfer and offer some related hypotheses. We then provide an overview of our research methodology, and test our hypotheses using a combination of quantitative and qualitative data. Lastly, we outline implications for managers and future research.

Literature review

Tacit knowledge is defined by Michael Polanyi as knowledge that cannot be articulated or verbalized; it is a knowledge that resides in an intuitive realm. Polanyi (1966, p. 4) concisely captures this notion with the phrase:

> We know more than we can tell.

Tacit knowledge is the antithesis of explicit knowledge, in that it is not easily codified and transferred by more conventional mechanisms such as documents, blueprints, and procedures (Kreiner, 2002). Tacit knowledge is derived from personal experience; it is subjective and difficult to formalize (Nonaka *et al.*, 2000). Therefore, tacit knowledge is often learned via shared and collaborative experiences (Nonaka and Takeuchi, 1995); learning knowledge that is tacit in nature requires participation and ''doing.''

Because of the personal nature of tacit knowledge exchange, Roberts (2000) suggests that an important factor in this process is trust. She contends that the levels of risk and uncertainty that are associated with tacit knowledge transfer are reduced by trusting relationships. While many elements of the integration of external technical knowledge can be governed and defined by legal contracts, the very nature of tacit knowledge places it beyond the influence of contractual agreements. Roberts (2000, pp. 429-443) asserts that:

> The exchange of knowledge, and particularly tacit knowledge, is not amenable to enforcement by contract; hence, the importance of trust in the exchange of knowledge.

Additionally, Roberts (2000, pp. 429-443) advises that social and cultural influences must be taken into consideration:

> The technologically mediated communication will be more successful when it is between agents who share common social, cultural and linguistic characteristics. It will be less effective when agents are from diverse backgrounds, particularly in the early stages of interaction. Over time, agents will develop an appreciation of their partner's social context. Together they will establish their own social norms and expectations of one another, thereby enabling the development of trust and with it the successful exchange of knowledge. The presence of a relationship of trust between individuals indicates an ability to share a high degree of mutual understanding, built upon a common appreciation of a shared social and cultural context. Both trust and mutual understanding, developed in their social and cultural contexts, are prerequisites for the successful transfer of tacit knowledge.

In general, human beings view trust as one of the foundations to a healthy relationship. ''Relationship strength,'' is the blanket term used by Cavusgil *et al.* (2003) to describe inter-firm relationships where both parties hold each other in high regard. The broader concept of relationship strength has been defined by other researchers, and is characterized by mutual trust, commitment, and high quality and frequent communications (Granovetter, 1973; Kraatz, 1998; Morgan and Hunt, 1995). Personal and professional networks with high levels of relationship strength have been suggested to correlate to tacit knowledge transfer (Cormican and O'Sullivan, 2003; Cavusgil *et al.*, 2003).

Similar to trust, shared goals or a shared vision also lead to relationships in which knowledge and technology are more freely exchanged. Cisco is a renowned leader in partnering and acquiring new technologies. They have very clear criteria for acquiring technology.

> Acquisitions are regarded as a means to acquire technical knowledge. A potential acquisition candidate should share a common vision and chemistry with Cisco (Acksteiner, 2000, pp. 1-10).

Cisco has proven that shared goals lead to a more effective integration of external technology. In fact 30-40 percent of Cisco's revenue is from acquired companies. This suggests that shared goals create a more open environment, regardless of the type knowledge or technology acquisition (e.g. licensing, JDA, JV, Acquisition). Thus:

> *H1.*
> Tacit knowledge transfer is likely to be more successful when there is higher trust amongst internal and external project team members.

The success of external technology integration can also be strongly influenced by the early involvement of both the source and recipient. First, early involvement is more likely lead to the type of long term relationship on which trust is built. As stated by Kogut and Zander (1992, p. 390):

> To the extent that close integration within a supplier or buyer network is required, long-term relationships embed future transactions within a learned and shared code. In fact, the trading of know-how among firms often requires the establishment of long-term relationships.

One way to build this long-term relationship is to start the relationship as early as possible. Chaudhuri and Tabrizi (2002) found that some of the best acquisitions, for example, start teamwork early in the acquisition process. Developing relationships during the early phases of product development is also important because this is where tacit knowledge is prominent in the knowledge sharing process. Once a product reaches the commodity stage, tacit knowledge is not important because the product/knowledge is easily imitated. Thus:

> *H2.* Projects where the joint relationship is started earlier in the development process are more likely to be more successful in tacit knowledge exchange.

Due diligence is a critical step of any alliance formation (Mitsuhashi, 2002). It is during this stage that potential partners exchange confidential information, assess competence and reliability, and negotiate terms of the partnership. At its base, due diligence is about collecting

information to reduce the risk and uncertainty associated with a transaction (Mitsuhashi, 2002; Rhodes *et al.*, 2003). The nature of the due diligence process can vary greatly among firms. It can vary in formality, participation (i.e. who participates), length, breadth, and the way in which due diligence information is communicated to the ultimate project team.

If done correctly, due diligence can increase the likelihood of a successful partnership between firms (Chaudhuri and Tabrizi, 2002). Besides technical capability, an important aspect of the process is looking at strategic and cultural compatibility. This type of compatibility is critical in the transfer of tacit knowledge. As discussed earlier, shared goals and vision can enhance the transfer of tacit knowledge. In addition, a strong due diligence process can enhance mutual trust among partners, which in turn can encourage tacit knowledge transfer.

H3. More complete due diligence will increase tacit knowledge transfer.

Research methodology

This section describes the approach taken to collect primary research data using in-depth interviews (qualitative) and an online survey (quantitative).

Qualitative study

The qualitative data collected was based on 13 interviews with various individuals, representing three companies, charged with integrating external technology (see Table I). The effort was concentrated on gathering information relative to transfer of tacit knowledge as a focused initiative during the integration of external technology. Interviewees fell into three distinct categories:

1. *Senior managers.* People who were directly responsible for developing strategies for outsourcing innovation through the external technology sources.

2. *Mid-level managers.* People who had the tactical responsibility to internally integrate external innovation, almost acting as an integration manager.

3. *Project managers.* People who had direct responsibility to execute the day-to-day activities of integrating external technology.

The in-depth interviews provided a forum that encouraged the respondents to share as much information in an unconstrained environment. The individuals interviewed were selected based on their willingness to share information, and they were considered to be ''strategic thinkers'' (able to see the value of what we are trying to accomplish and not blurred by the day-to-day tactical deliverables of a typical project manager). Most are responsible for optimizing and leveraging the acquisition of external technology and its associated knowledge base, and in most instances these individuals have been involved in an acquisition failure related to lack of effective tacit knowledge management.

The interviews were recorded and subsequently transcribed. Using the management-research question hierarchy defined by Cooper and Schindler (2001, p. 329) to guide the development of our interview protocol, a semi-structured interview protocol was used to explore the following areas:

■ If there was a formal processes for determining whether or not to engage external sources of innovation.

■ What elements of external technology integration are purposely managed?

Table I Organizational position of individuals interviewed			
	Senior management	*Mid-level management*	*Project management*
Company A	5	2	1
Company B	1	1	2
Company C	1	0	0

- What elements contribute to the success or failure of technology integration?

- The type of external technology integration.

- Metrics for success.

- Active integration/transfer of tacit knowledge.

- How to improve knowledge integration.

- Do the current commercialization processes help or hinder the integration of external technology/knowledge?

Quantitative methods

The quantitative portion of the data was delivered through an online survey. The online survey was executed by soliciting responses from individuals involved with 39 discreet projects that involved various types of external technology integration, representing five different companies in the commercial transportation, digital imaging, health care/pharmaceutical industries. All of the respondents were project managers, except for two cases where the respondents were key technical people responsible for a major technical deliverable.

Projects were selected by using personal and professional networks. In addition, we elected to use the knowledge life cycle (Birkenshaw and Sheehan, 2002, pp. 75-83) as a tool to screen projects participating in the online survey. Knowledge progresses along the curve through four stages:

1. Creation stage.

2. Mobilization stage.

3. Diffusion stage.

4. Commoditization stage.

The relevance of the knowledge life cycle to tacit knowledge transfer is that as it moves from the creation stage to the commoditization stage, knowledge transitions from highly tacit in nature to highly explicit in nature. For this reason, we screened all projects for the online survey to ensure that at the time of execution, the projects fell within either the creation or mobilization stage (at the diffusion stage, tacit knowledge begins to become codified and public). Using this type of screening tool ensured that the survey was focusing on those types of projects where tacit knowledge and technology transfer were most critical. As shown in Table II, projects that fell into the diffusion and commoditization phases were excluded from the survey.

Descriptive statistics and construct measurement

Table III provides descriptions and sources for the key quantitative variables used in our empirical analyses, as well as the basic descriptive statistics.

Dependent variable

We were unable to find existing variables that measured the transference of tacit knowledge. Using some of the information from the qualitative research and consulting colleagues in our

Table II Knowledge life cycle phase for survey responses				
	Creation	*Mobilization*	*Diffusion*	*Commoditization*
Company A	7	14	0	0
Company B	5	11	0	0
Company C	0	1	0	0
Company D	0	1	0	0
Company E	1	0	0	0
Totals	13	26	0	0

Table III Variable measurements and descriptive statistics				
Variable	Measurement	n	Mean	SD
Dependant				
TACITGOALS	The expectations of the tacit knowledge integration were met for this program. (0-6, where 0 = strongly agree, 6 = strongly disagree)	39	2.0	1.4
TACITOWN	Combination of a company's ability to solve field issues and configure the technology without the help of their external technology partner (all elements rated from 0-6, where 0 = strongly agree, 6 = strongly disagree)	39	6.3	4.5
Independent				
TRUST	Common factor from 5 trust variables (high degree of trust over the life of the project, honest communication between companies, acting as ''one team'', same project goals, and similar process goals (all elements rated from 0-6, where 0 = strongly agree, 6 = strongly disagree)	39	7.5	5.4
INITIATION	Project initiation (formal or informal) on the NPD continuum (1-5, 1 = ideation/R&D, 5 = full scale production)	39	2.2	1.2
DUEDIL	The level of due diligence (0-3, where 0 = none, 4 = high)	35	2.7	2.0
Control				
PERFORM	Sum of assessment that project met performance goals (0-1 where 0 is exceeded goals, 2 is did not meet goals) and met customer satisfaction goals (0-4 where 0 = extremely satisfied, 4 = not at all satisfied)	39	2.1	1.4
TECHNOLOGY	Comparison of external technology with firm's own internal core competencies (1-5 where 1 is complimentary technology and 5 is radically different technology)	39	2.9	1.4

professional networks, we devised our own variables for the survey. The primary measurement for effective tacit knowledge transfer is a variable that is composed of two measurements of a corporation's ability to integrate knowledge into their organization and leverage that knowledge without the help of their external technology partner. We entitled this variable tacit knowledge ownership (TACITOWN). Since this measure had not been used before, we wanted to obtain a second measure of tacit knowledge transfer. Therefore, we also asked respondents to record a perceptual measure of meeting tacit knowledge transfer goals (TACITGOALS).

Independent variables

As a measure of trust (TRUST), we performed a factor analysis on the respondent's assessment of the following areas:

- mutual trust;
- honesty in information sharing;
- the ability for the project team to act like ''one team,'' instead of two teams from independent companies;
- shared project goals; and
- shared the same vision of how the goals would be accomplished.

Our assumption was that there was a limited number underlying dimension of trust that determined the responses to these questions. In fact, all the questions loaded heavily on one factor.

To measure how early the partnership started in the product development cycle, we asked them to identify when they established a contact with the partner on the product development continuum (INITIATION). To measure the level of due diligence (DUEDIL), we

simply asked the respondents to rate the level of due diligence performed for that particular project.

Control variables

The challenge of tacit knowledge transfer will differ according to the type of technology being developed. One of the most critical factors is if the firm has any prior familiarity with the technology; therefore, we asked respondents to assess the degree to which the technology was complementary or radically different from the firm's core technologies (TECHNOLOGY).

For the perceptual measure of tacit knowledge transfer, it was important to control for any bias in answers that might occur if a project was particularly successful or unsuccessful, therefore, we controlled for project success. Secondary research uncovered many different measures for project success. Griffin and Page (1996), for example, developed a model of success and failure measurement. Based on these metrics, we measured project accomplishment (PROJACCOMP), which is a combined measure of the respondents' perception of the project's achievement of performance goals and customer satisfaction goals.

Findings

Quantitative analysis

Insofar as the type of external technology acquisition was concerned, joint development agreements were the most popular, with a fairly even distribution of the remainder of the categories. All of the projects that fell into the classification of ''other'' were a combination of licensing and one of the other categories. The majority of the working relationships were first time endeavors. When asked if they had done prior work with their external technology partner, 77 percent of the respondents answered no.

With regard to tacit knowledge, 42.5 percent of the respondents agreed that there was a conscious distinction amongst the team between tacit knowledge integration and technology transfer. While 75 percent of the respondents agreed that the project team managed the integration of tacit knowledge into their organization, 92.5 percent of the respondents indicated that they have no process to help the team distinguish between complex, tacit knowledge and technology transfer.

A correlation matrix of the project success metric and their correlation to hypothesis specific variables can be found in Table IV. There is a strong positive correlation between perceptions of tacit knowledge transfer and trust. However, there is also a strong correlation between the respondents' perception of the project successes and the level of trust in the partnership, suggesting that this is an important control variable to include. Interestingly, there was a negative correlation between the two measures of tacit knowledge transfer, suggesting that they are measuring different things. This is discussed later in the paper.

Table IV Variable correlation matrix							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
TACITGOALS (1)	1						
TACITOWN (2)	$-0.272 \sim$	1					
TRUST (3)	0.509**	-0.152	1				
INITIATION (4)	0.215	-0.217	0.231	1			
DUEDIL (5)	0.106	0.353*	0.136	-0.071	1		
PERFORM (6)	0.597**	0.023	0.433**	0.068	-0.031	1	
TECHNOLOGY (7)	0.089	0.207	0.074	$0.290 \sim$	-0.159	0.151	1

Notes: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

As shown in Table V, the regression analysis only showed support for *H1*, which stated that there was a positive relationship between perceptions of trust between the two partners and tacit knowledge integration. This relationship held even when controlling for perceptions of overall project performance.

Qualitative analysis

Analysis of the qualitative data from interviews and the open-ended survey questions provided greater evidence for our set of hypotheses. A strong theme was the relationship between trust and tacit knowledge exchange. A team member for a project that missed its goals commented that:

> Building relationships is key to success. Our project manager created an environment of mistrust.

The project manager of another project that performed poorly stated:

> We ended up suffering major trust issues that led to schedule delays, budget overruns, and licensing disagreements.

While the project manager for high achieving project that met its tacit knowledge integration expectations asserted that:

> Team building is very important, as it gains the level of trust required to obtain the finer elements of the product and process.

During the interview process one project manager stressed the importance of a shared vision and its relationship to technological partnering success and tacit knowledge transfer. In speaking of his external partners he stated:

> Successful partnerships occur when [the partner] really has a good handle on the technologies and they really developed the same vision that we do for the development effort. We've had some [partnerships] before where I don't think the companies shared our same vision and they may have gotten involved to [put up a] smokescreen to slow us down from working with somebody else . . . But, on the ones where we had a really good clear understanding of what each of us was going to get out of it and we all understood the goal – those have always turned out great.

While there was wide agreement on the importance of shared goals in relationship to technology and tacit knowledge transfer, it was also suggested that these sorts of relationships were difficult to acquire. One project manager remarked that:

> It's kind of hard to get one [a relationship with an external technology partner] where everybody really sees the same vision of where the product should go and then really works hard to achieve that and, you know, experiences the same, you know, kind of joy out of it.

While the survey did not find any support for the hypothesis that due diligence would lead to greater tacit knowledge transfer, this was a strong theme for both those who were interviewed and the surveyed participants. Due diligence led to a greater understanding of the technology, and contributed to a more trusting relationships between the two firms. When

Table V Regression analyses for TACITGOALS				
	Model 1a (t stat)	*Model 1b (t stat)*	*Model 1c (t stat)*	*Model 1d (t stat)*
Independent				
TRUST	0.308 (2.212*)			0.325 (2.115*)
INITIATION		0.176 (1.32)		0.149 (1.116)
DUEDIL			0.125 (0.906)	0.097 (0.725)
Control				
PERFORM	0.463 (3.328**)	0.579 (4.346***)	0.540 (3.995***)	0.439 (2.914**)
F	13.754***	10.753***	10.206***	7.210***
Adj R^2	0.402	0.345	0.351	0.429

Notes: Dependent variable=expectations of tacit knowledge integration were met for this program; *Significant at the 0.05 level; **Significant at the 0.01 level; ***Significant at the 0.001 level

asked the open question on the survey, ''can you provide any additional comments that may benefit the integration/transfer of tacit knowledge?'' respondents answered with:

- ''conduct due diligence'';

- ''spend more focused energy on getting to know and understand the remote team members and their hidden agendas''; and

- ''have a strong due diligence process, well defined and executed when acquiring products and/or ventures.''

In the interviews, due diligence was a common theme as well. As an example, one senior manager, when describing a project that went wrong, commented with heart felt passion:

> We just charged right in. To me it's the issue of due diligence. When you look at those things part of the due diligence process, you understand the value and the design history behind the technology. What kind of work actually went in to determine that this is a viable robust technology or product? I have seen some goofy patents and some real trashy work in my lifetime that got into companies because people literally didn't look at what was there and what was done to establish that it actually has properties or performance characteristics that someone claimed it did.

He later then added that project managers should be intimately involved with the due diligence process:

> When a new technology is brought in, the learning curve is very short. So, I really believe that we should have a project manager who will lead the due diligence team. [This person] will ultimately have to deal with [the new technology]. This way, when we bring it in, we will have somebody who knows the full background of the technology.

Interviews also suggest that early partnering in the product development process was important for successful tacit knowledge transfer. One senior R&D manager indicated that, in particular, involvement prior to the implementation of formal processes was key:

> Formal processes early on hinder the integration and development of relationships.

Another senior manager stated:

> Getting involved early encourages co-development and provides a form of due diligence.

These and other quotes suggest that early involvement plays a number of roles. First, it encourages the two organizations to work as one team during the early phases of the product development cycle, when tacit knowledge exchange is most important. Second, it contributes to the development of a trusting relationship. Third, it acts a surrogate for due diligence by allowing each firm to assess the needs and capabilities of its partner.

Knowledge differentiation and the expectations disconnect

One of the interesting findings from the interview process and open answer section of the survey was that there was come uncertainty regarding what tacit knowledge transfer was, and how firms should manage it. This lack of ability or formal process was reflected in the survey. As you may recall from earlier in the paper, while about two-thirds of the respondents indicated that they were attempting to integrate tacit knowledge, 92 percent of the respondents reported no formal process for this. Survey comments included:

> Never addressed knowledge transfer. It was not a goal for the company. Product introduction using the strengths of the individual partners was the focus. Knowledge transfer occurred in an informal and as needed manner.

This comment is particularly interesting in the sense that it was from a joint venture, in which one might think would want to leverage the tacit knowledge to drive success. The complex tacit knowledge component was present, but not recognized; therefore, it was not fully leveraged. Another respondent representing a joint development agreement commented:

> The team had a plan for technical documentation transfer, but did not have a plan for tacit knowledge transfer. This caused delays, errors and frustration.

The data also indicated that there are potential misunderstandings about what tacit knowledge actually is. The interview data clearly indicates that very few managers differentiate between technology transfer and tacit knowledge transfer. During the in-depth interviews, we attempted to direct the questioning into the realm of tacit knowledge transfer. Senior management seemed to appreciate the significance of the subject. However, although most agreed that it was an important aspect of external technology acquisition, in all interviews the interviewees strayed away from the subject.

In the survey, we collected data on two measures of tacit knowledge. One was a perceptual measure on the part of the project manager (respondent). The second measure was based on discussion with senior level managers in a number of firms, who indicated that tacit knowledge ownership exists in a realm that extends beyond the normal product launch. We therefore based the second measure on the assumption that projects where tacit knowledge ownership is achieved are capable of continuing product development and management without their external technology partner (TACITOWN). In our survey, there was not a positive correlation between the two measures of tacit knowledge transfer. Based on our interviews, it is likely that this unexpected relationship is due to an expectations disconnect regarding the goals of tacit knowledge management.

As shown in Figure 1, different levels of an organizational hierarchy are governed by significantly different goals and expectations. Senior managers are often focused on the strategic issues for its respective company; in other words, they are searching for the right ''technology acquisition'' matches. These strategic decisions, in many cases, are not for the short-term, but rather the long-term sustainable technology deliverables. Senior managers have an ''expectation'' that the technology acquired will deliver with it the knowledge base (and history) to develop next generation products.

Project managers, on the other hand, are not necessarily interested in the long-term ramifications of tacit knowledge transfer. They have been given the task of executing a technology deliverable with a well-defined schedule. They work to fulfill the scope requirements of their projects and are rewarded on execution, timing, and budgetary compliance. Whatever tacit knowledge they may think they are extracting from their partner is minimally what is required to commercialize the product. The discreet technology is treated as the only deliverable. The project manager is not responsible for the ''next generation'' product that he or she may not be working on anyways.

Conclusions and recommendations

The objective of this study is to determine what key relationships influence the transfer of tacit knowledge between two partners. Overall, we provide evidence that trust, early involvement, and due diligence influence the extent of achieving technology transfer expectations and tacit knowledge transfer expectations. There was strong support in both

Figure 1 Diagram of knowledge disconnect
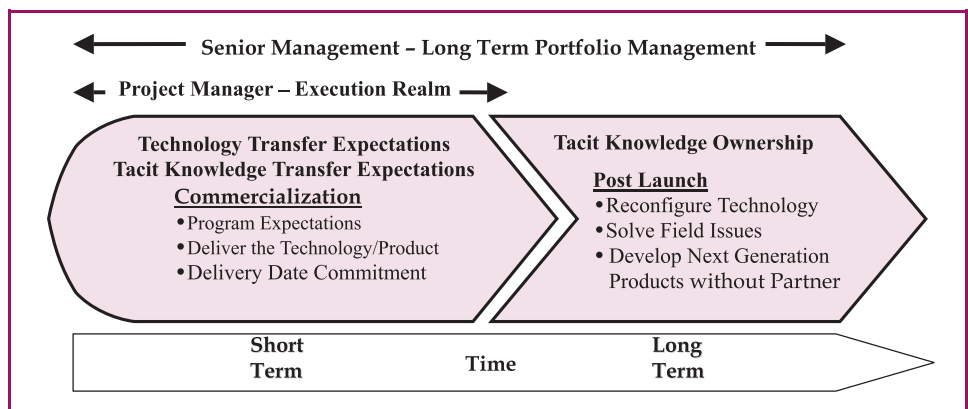
the survey and interview that trust was critical in the perceived success of the transfer of tacit knowledge. While not supported in the survey, interviews suggest that due diligence contributes greatly to the development of trust by enabling the acquiring company to assess what barriers and enablers are present prior to long-term commitment. This, in turn, contributes to greater tacit knowledge transfer. Interviews also supported the hypothesis that early involvement in the product development process contributed to trusting relationships. Moreover, it facilitates perceived tacit knowledge transfer in two other ways: it encourages the two organizations to work together when tacit knowledge exchange is most prevalent and acts a surrogate for due diligence by allowing each firm to assess the needs and capabilities of its partner.

We also found that the subject of tacit knowledge transfer, content and process, is poorly understood. While managers and project leaders saw the value of tacit knowledge, there were different perceptions of the goals successful knowledge transfer and a lack of processes to manage its process. With regard to the goals of tacit knowledge transfer, while senior managers see the long-term benefits of tacit knowledge integration, project level managers are more interested in the tactical initiatives that will deliver immediate results. As a result, while project managers may feel that they have tacit knowledge transfer in hand, they have not managed to transfer the knowledge for long-term product management.

This perception of success may partially explain the lack of dedicated management programs to manage tacit knowledge. However, there may other factors at play. The fact that it is hard to identify and capture tacit knowledge might be one reason that formal processes for its integration are ignored (in most cases until it is too late). Szulanski (2003) found that most difficulties in transferring largely tacit knowledge are a result of the recipients lacking experience to make effective use of new ideas and having an arduous relationship (that is laborious and distant) between the source and recipient. Also, there are problems associated with identifying the precise original tacit knowledge that needs to be transferred (Dayasindhu, 2002). Yet, there is clear evidence that explicit management mechanisms for tacit knowledge management are needed, and that they will differ than those for more explicit types of knowledge (Bolisani and Scarso, 2000; Herschel *et al.*, 2001).

There are a number of limitations affecting the scope of these findings. For one, our survey respondents were all project or product managers. Future surveys should include a broader base of participants, both horizontally and vertically. Secondly, interviews and surveys were confined to a relatively small sample in five US companies in three industries. A larger sample size would add more statistical significance to the results. Future research would also benefit from wider diversity within the sample, in terms of firm size, industry, and geographic regions. While findings were consistent across the three industries and are likely generalizable to a number of other industries, future research should include a broad cross-section of the industries. Perhaps more important, as suggested by Bhagat *et al.* (2002), it is likely that cultural context has an impact on patterns of knowledge transfer and these relationships should also be explored. Lastly, the measure of tacit knowledge transfer needs additional validation. As our findings suggest, it is not clear that perceptions of tacit knowledge transfer are accurate, or consistent among different levels of the organization. Much more research is needed in the development of this measure.

Given these limitations, however, there are still lessons that can be drawn from this study. This, we offer the following recommendations to help management begin to think of tacit knowledge as an independent entity and manage it accordingly:

" Project managers are not necessarily interested in the long-term ramifications of tacit knowledge transfer. "

1. Foster an environment of project team trust between companies where tacit knowledge is to be exchanged. This is a difficult, but manageable task. Herzog (2001), for example, offers a list of specific activities that management can undertake to facilitate trust within and between project teams.

2. Clarify and communicate the long-term goals of tacit knowledge management.

3. Dedicate resources to extract tacit knowledge from external partners.

4. Develop and integrate a system for extracting tacit knowledge into the product development process.

5. Develop project specific tacit knowledge measures to help the team gauge their progress on tacit knowledge integration.

6. Review performance with respect to tacit knowledge measures

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