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DEFINING AND DEVELOPING COMPETENCE: A STRATEGIC PROCESS PARADIGM

RITA GUNTHER McGRATH
Graduate School of Business, Columbia University, New York, New York, U.S.A.

IAN C. MacMILLAN and S. VENKATARAMAN
The Wharton School, Sol C. Snider Entrepreneurial Center, University of Pennsylvania, Philadelphia, Pennsylvania, U.S.A.

In this paper, competence is defined in operational terms as the degree to which the firm or its subunits can reliably meet or exceed objectives. Two antecedents to competence (and thus competitive advantage) are then developed and defined. These are the 'comprehension' of the management team working on developing competence and the 'deftness' of their task execution. Empirical results from a study of 160 new initiatives in 40 organizations from 16 countries suggest that: (1) it is feasible to operationalize and measure these constructs; (2) comprehension and deftness are important correlates of an organization's degree of competence as defined; and (3) a process-centered paradigm for understanding competence development shows promise.

INTRODUCTION

A preoccupation of strategic management researchers is to understand superior performance of firms. Strategy is thus seen as the 'quest for rents' (Bowman, 1974). In a departure from the industrial organization theory framework (Porter, 1980, 1985) scholars have recently revived interest in the 'resource-based' view of the firm (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984, 1989), where a key tenet is that competitive advantages emerge through processes of resource accumulation and deployment, leading to idiosyncratic endowments of proprietary assets (Penrose, 1959; Wernerfelt, 1984; Prahalad and Hamel, 1990; Mahoney and Pandian, 1992; Amit and Schoemaker, 1993; Peteraf, 1993). In this paper, we seek to extend this theme, both theoretically and empirically.

We first focus a theoretical lens upon the management processes through which activities at the subunit level of firms are translated into potential competitive advantages for the firm as a whole. Next, we describe a means of operationalizing and measuring the extent to which these processes are or are not occurring. The essence of our argument is that unless processes occur which lead to the reliable and repetitive achievement of desired outcomes at the business unit level, future competitive advantage for the firm cannot reasonably be contemplated.

Finally we present results from a study of 160 organizational subunits in 40 firms in 16 different countries. These results suggest that we have identified important antecedent processes to emerging competitive advantage. Further, the results suggest a sequence in the relationships among these processes which we had not foreseen in our initial theory development. We conclude with a discussion of our findings and implications for further study.

Key words: strategy process; competence; team effectiveness; competitive advantage

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TOWARD A DYNAMIC VIEW OF COMPETITIVE ADVANTAGE

In the strategy literature there are two major paradigms for explaining sustained superior performance.

The first of these paradigms draws upon the concepts of industrial organization economics. Traditional I/O economics emphasizes barriers to competition, and takes the position that industry effects will explain the greater part of persistent above-normal returns (see Mason, 1939, 1949; Bain, 1959). Numerous theoretical and empirical studies support this view. The result, as Teece, Pisano, and Shuen (1991: 5) note, is that particular industries are more or less attractive because they contain 'structural impediments to competitive forces' and thus allow participating firms to sustain competitive advantage, once obtained.

The second paradigm for explaining superior firm performance suggests an alternative perspective—that firms are fundamentally idiosyncratic. Over time, they accumulate unique combinations of resources and abilities which allow them to garner rents on the basis of 'distinctive competence' (Selznick, 1957). Advantage thus stems from proprietary assets not easily purchased, stolen, imitated or substituted for (Dierickx and Cool, 1989; Barney, 1991; Peteraf, 1993). The most potent of such assets are posited to be intangible or tacit (Prahalad and Hamel, 1990; Itami, 1987; Nelson and Winter, 1982), further contributing to inimitability and limiting the encroachment of homogeneity.

Proponents of the resource-based view would argue that the influence of such idiosyncratic firm effects can be considerable and, moreover, can be persistent over time. Rumelt (1991) found that stable long-term differences in business units account for 46 percent of the variance in returns to business units, some six times more important to the explanation than are stable industry effects. He concludes that 'business units differ from one another within industries a great deal more than industries differ from one another' (1991: 168).

Our position in this paper is that scholars need to understand both the key factors that shape success and performance in an industry (Vasconcellos and Hambrick, 1989) as well as the processes by which firms accumulate and deploy resources at the business unit level to effect superior performance within the industry. Thus, we concur that industry norms will tend to produce a distribution of levels of performance for industry players. We also concur that the deployment of idiosyncratic resources will determine a given firm's position within that industry distribution.

What is of concern to us in this paper is how firms develop idiosyncratic resources which can then be deployed to competitive advantage. We suggest that strategy research would benefit not only from studies of the specific factors which create a specific advantage, but also from studies of the managerial processes by which advantages are generated and deployed. Echoing Simon's (1976) distinction between 'substantive rationality' and 'procedural rationality,' we shall argue that the processes used to develop new sources of advantage are as important to the long-run competitive vitality of a firm as the content of any given advantage. We now turn to this question.

Where do new advantages come from?

In the face of eventual appropriation, all rent-generating competitive advantages have a limited life. This implies that the pursuit of new advantages is a critical strategic responsibility, a conclusion that echoes Rumelt's point that '... the task of general management is to adjust and renew these resources and relationships as time, competition and change erode their value' (1984: 558).

A principal mechanism through which organizations develop new competitive advantages is through the pursuit of new initiatives—attempts to add new products, markets and technologies to its current repertoire. Such attempts require the firm to obtain new resources and combine them with, or reconfigure, resources it already possesses. As Burgelman (1983) points out, initiatives may occur with strategic intent (which he terms 'induced' strategic change) or as a result of relatively unplanned, serendipitous activity undertaken without particular reference to a conscious corporate strategy ('autonomous' behavior). In either case, the pursuit of new initiatives appears to be central to the preservation of requisite variety, itself essential to adaptability (Van de Ven, 1986; Miller, 1983).

Initiatives can lead to advantage in a number of ways. Let us describe three. First, in undertak-

ing new initiatives, a firm may utilize resources which are already at its disposal to tap new market areas, entering the new market with lower cost, with greater efficiency or with a more attractive offering, than competitors. This was the strategy pursued by General Electric Financial Services, which over the course of two decades parlayed skills, assets and systems developed initially to support their installment loan portfolio into a broad array of financial service offerings.

Second, the intention of the new initiative might be to contribute to the 'absorptive capacity' (Cohen and Levinthal, 1990) of the firm. By entering small, less challenging markets initially in order to learn, it can develop product, market or technology assets. Such a strategy was pursued by the Asahi Glass corporation when it focussed on watch faces in the early stages of its liquid crystal diode display business, and by Kyocera who made scissor blades when they first entered industrial ceramics. In both cases, the firms took initiatives with the intention of building technological assets for the long term, despite modest profits in the first markets entered. An extension of this strategy for taking new initiatives is to pursue simultaneously many products, markets and technologies with modest investments in any given effort. This is in effect an 'options' strategy (Bowman and Hurry, 1993).

Third, firms are sometimes fortunate, and happen upon a source of competitive advantage through luck. The well-known 'Post-it' note business of the 3M Corporation exemplifies a case in which an organization actually possessed an attractive combination of proprietary assets, but only recognized and capitalized on these assets after considerable delay.

Whatever the source, new initiatives provide 'the means for extending the frontiers of the corporate capabilities and for the discovery of additional synergies in the large, relatively unique resource combinations constituted by such firms' (Burgelman, 1983).

ON THE WAY TO ADVANTAGE: EMERGING COMPETENCE

Let us retrace our discussion so far. We suggested that all rent-generating competitive advantages will erode over time. A key problem for strategists is thus to manage the development of new sources of advantage to replace those which are no longer able to yield rents.

This development process occurs in organizational subunits, specifically those activities and resources assembled by those responsible for pursuing new product, market or technology initiatives. The organizational subunit which houses the initiative, and the managerial team responsible for this subunit, are thus an appropriate focus for any study of the processes through which advantages are created. Thus the focal unit for our discussion below is the management team responsible for an initiative.

Consider the circumstances in which new initiatives are undertaken. They tend to occur in conditions where information is either missing or difficult to interpret. As Daft and Weick (1984) note, this implies that decisions and actions must be pursued in the face of uncertainty and ambiguity. So concepts of planning, control and learning which are perhaps appropriate for the management of more mature businesses are inappropriate or destructive to new initiatives (Block and MacMillan, 1985; Kanter, 1983). As a consequence, the team managing an initiative is likely to experience gaps between the objectives they seek to achieve and results they actually achieve. Indeed, the learning generated by attempts which fail may actually be an important part of the process of generating new advantages (Maidique and Zirger, 1985).

To complicate the situation still further, advantages are often only recognized *ex post* (in a process akin to Burgelman's (1988) concept of retrospective rationalization). Thus, as in the 'Post-it' note case, a firm may take an initiative, develop some new competence at combining resources and only discover markets for this new combination long after the competence has developed. To return to the language of resource-based theory, the 'distinctive competences' that will be generated through new initiatives are often not known at the outset.

This means that if we are to begin to understand how competence-based competitive advantage emerges without even knowing what it is at the start, we need an intermediate construct which would allow scholars to assess *contemporaneously* whether an initiative is making progress toward the creation of new advantages, or whether those responsible are simply propagating 'mistakes' (Van de Ven, 1986).

To do this we argue first that competitive advantage can hardly evolve from any initiative unless those responsible can develop competence at what they are doing. Next we suggest that competence be thought of as a purposive combination of firm-specific assets (or resources) which enables it to accomplish a given task (Teece *et al.*, 1991).

The above argument allows us now to suggest that a useful indicator that potential advantage is emerging is when there is an increasing convergence between the objectives of an initiative and its results, for unless such convergence is occurring, it is difficult to argue that the team is developing competence, and without competence there can hardly develop advantage. So, to the extent that those involved in an initiative are able consistently and reliably to achieve objectives we can increase our confidence that they are developing new competences at combining resources in new ways, which new competences may eventually be deployed to competitive advantage. To the extent that an initiative fails to deliver to its objectives repeatedly and reliably, it seems less probable that it will yield future competitive advantages.

Although many factors may underlie eventual success at developing competence and thence competitive advantage, the focus in this paper is on one of the central and necessary requirements for competence, namely convergence between objectives and results.[1] The use of such a proxy is consistent with received theory. Virtually every definition of competence in the literature refers to some purpose the firm is able to achieve (Amit and Schoemaker, 1993), preferably in a manner superior to that employed by other firms (Prahalad and Hamel, 1990).

If one accepts that increasing convergence on objectives is an indicator of emerging competence (and thus a necessary precursor to future competitive advantage), the degree of competence in an initiative can be assessed by the extent to which *ex ante* objectives are being realized in *ex post* results, and the level of competence of an organizational subunit can thus be defined as its *ability to reliably and consistently meet or exceed its objectives*.

This definition is fairly straightforward to operationalize. The most important advantage of this proxy operationalization is that it opens the opportunity for contemporaneous empirical study of the processes underlying the emergence of advantage, rather than limiting us to *ex post* assessments of how an organization obtained an advantage in the past.[2]

Now if the desirable state of affairs is to achieve convergence between intended and realized objectives, we suggest that two processes must take place at the project team level if such convergence is to occur. The first involves the process by which those pursuing an initiative come to understand precisely what combinations of resources will allow it to achieve objectives. This results in a quality which following Weick and Roberts (1993) we term 'comprehension.' The second process involves creating working relationships which allows those responsible for the initiative to execute effectively in light of this comprehension. Our view of this process is akin to Weick and Roberts' (1993: 374–375) description of the emergence of a 'collective mind' in which activities performed by a group are interrelated so that desirable outcomes may be achieved and undesirable outcomes avoided. We shall term a group which has developed such a collective mind one which operates with 'deftness'. In particular, group deftness allows an organization to perform in the face of complexity beyond the ability of any individual in the organization to grasp.

Our central thesis is graphically depicted in Figure 1: a necessary precursor to competitive advantage, and hence rent, is the emergence of competence, defined as the ability of an initiative to reliably meet or exceed its objectives. Competence, in turn, cannot develop absent the emergence of comprehension and deftness. We

[1] Note that this convergence need not be with the original objectives—as the initiative unfolds new objectives are likely to be set. What is important is whether there is convergence between results and the most recent objectives.

[2] Note that we are not proposing a competing paradigm to the content-oriented focus of the current work on competence and competitive advantage. There is much useful work to be done to uncover the nature of true core competences, to determine how they develop and diffuse through the organization, and to identify what aspects are likely to yield rents (as did, for example, Collis, 1991). Rather, we seek to offer a parallel, process-oriented paradigm which we have found to be tractable and operationalizable.

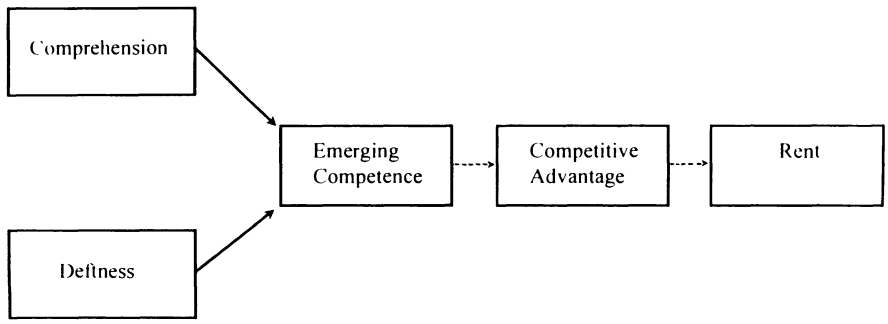

Figure 1. Conceptual model

turn now to a detailed discussion of these two concepts.

ANTECEDENTS TO COMPETENCE: COMPREHENSION

To be able to reliably and consistently meet or exceed objectives presupposes that those responsible understand which combinations of resources, assembled in which sequences and applied to which situations, will lead to this desirable result. For most organizations, this implies an understanding of interrelationships of enormous complexity. In even simple tasks there are literally hundreds of potential resource combinations and allocations which must be made to achieve even prosaic results. The modest process of cake-baking, for example, requires a precise combination of ingredients, temperatures, volumes and timing, faults in any one of which will result not in a cake, but in a mess. Over time the mechanics of cake-baking have been codified and simplified, with the result that now virtually anyone can bake a cake without a rich understanding of the chemistry involved.

New initiatives, however, are a different matter. Absent a cookbook, those pursuing a new initiative are initially faced with unknown and intricate causal relationships which exceed the ability of any individual to grasp. Furthermore, individuals are poor processors of complexity. They have been empirically demonstrated time and again to misjudge true probabilities, to apply inappropriate heuristics, to base decisions on biased estimates and to otherwise fail to grasp the true nature of causal relationships in phenomena they encounter (Kahneman, Slovic, and Tversky, 1982).

Often what little is know about the causal relationships is embedded in the minds of individuals, where it is retained in the form of inarticulatable know-how or skill. Weick and Roberts (1993) suggest that 'comprehension' is the outcome of a process by which elements of individual know-how and skill become linked. This linkage allows a group of people working together to respond *as if* the complexity of the system in question were understood by the group, even though such understanding would be beyond the cognitive capabilities of any single member. In their words, 'when we say that a collective mind "comprehends" ... we mean that heedful interrelating connects sufficient individual know-how to meet situational demands' (1993: 366).

Now at the start of a new initiative, such comprehension is generally limited. Decisions about how to achieve a projects' goals must be made on the basis of assumptions, rather than on well-understood relationships among the many variables (Block and MacMillan, 1985). Indeed, the goals themselves may not be obvious. Similarly, there is apt to be considerable uncertainty about what factors will drive goal attainment (see Vesper, 1990; Block, 1989; Block and MacMillan, 1993; Vasconcellos and Hambrick, 1989; Kanter, 1983, 1988). As those on the team gain experience, however, a number of processes take place which either promote or interfere with the development of comprehension. Processes by which seldom-occurring events are treated (March, Sproull, and Tamuz, 1991), by which newcomers are socialized (Burgelman, 1988) and by which the kinds of information regarded as legitimate are decided (Daft and Lengel, 1986), are examples of processes through which comprehension is either fostered or inhibited.

Clearly, the process by which comprehension

develops is crucial to the development of competence–in fact, superior comprehension to competitors can itself be the source of competitive advantage. Ikea, the Swedish furniture maker, is an example of a firm which developed superior comprehension. Obstruction by competitors early on in the firm's history forced Ikea to develop completely different methods of warehousing, distributing and sourcing products in the face of being shut out of the usual industry relationships. The new methods Ikea was in part forced to learn allowed it to build and maintain a differentiated low-cost position as compared to furniture makers utilizing more established channels. In this way, Ikea's management team were able to build a deep comprehension of the factors which shaped the firm's highly effective low-cost strategy.

This discussion allows us to generate the following proposition:

> *Proposition 1: Degree of competence development, as measured by the ability to achieve or exceed objectives, will be positively associated with the level of comprehension of the focal group.*

If development of comprehension among a group represents a critical antecedent of its ability to reliably achieve objectives, a second important antecedent reflects the nature of the group's interrelationships. We next turn to a discussion of this issue.

ANTECEDENTS TO COMPETENCE: DEFTNESS

The literature which speaks most directly to the relationship between interpersonal processes and organizational outcomes is that which examines teams. Indeed, a veritable avalanche of publications urge organizations to use teams to pursue a broad variety of objectives. Thus, Miller identifies 91 'teamwork' articles in a data base search of publications which appeared between 1986 and 1990. Unfortunately, as Miller points out, this literature is 'producing answers to questions that managers are not asking' (1992: 83). It is clear that we do not yet have a parsimonious way of operationalizing or measuring the essence of productive interpersonal interactions within an organization, nor is the mechanism by which group behavior translates to organizational performance clear.

Here again, the concept of 'heedful interrelating' developed by Weick and Roberts (1993) offers a useful set of ideas. First is the notion that effective outcomes require effective group processes—in our context here, 'heedful' processes. As they note, 'facts by themselves are of no help if they cannot be communicated or heard or applied or interpreted or incorporated into activities or placed in contexts, in short, if they are not addressed mindfully' (1993: 373). Second, they draw a strong distinction between the level of a group's development, and the level of its 'collective mind.' A group can be very undeveloped (in the developmental-stage sense) yet possess a well-developed collective mind. This suggests a need for the student of strategy to depart from traditional group development concepts and move toward an understanding of how group characteristics drive heed, and hence performance.

Weick and Roberts are silent on the specific operational characteristics we might expect to find associated with a group which operates 'heedfully' (and which is hence able to create increasing levels of competence). We propose to address this point through a construct which we call 'deftness.' Deftness, in our view, is a quality in a group which permits heedful interactions to be conducted at minimal cost. Specifically, we argue that deftness allows those in a new initiative to minimize opportunity, transactions and agency costs which would otherwise be necessary to foster heedful interactions. Let us consider each in turn.

Opportunity costs

In a new team, members simply cannot immediately trust one another's skills, aptitudes and capabilities. Trust of this sort requires time to develop (Larson, 1992). This implies first that significant emphasis will be placed upon building interactions on the part of higher-priced people (such as highly skilled employees) than would be optimal in a team in which a portion of such interactions could be carried out by lower-priced people. Second, time and effort which could otherwise go into the performance of task functions will be directed instead at developing patterns of relationship. These two conditions suggest that activities will be more costly in a

group which has not yet developed a pattern of efficient interrelation.

Transaction costs

When a team is first formed, there is apt to be considerable confusion with respect to who is supposed to do what, what information will be required for each person to perform their tasks, what priorities are, what appropriate roles are and so forth. This confusion imposes upon the team costs involved in continually renegotiating the implicit (or explicit) contracts governing interrelations. These costs manifest themselves in a variety of ways. For example, investments may be required to overcome paralyzing conflicting demands (Mintzberg, Raisinghani, and Theoret, 1976) or to engage in persuasion and bargaining (Guth and MacMillan, 1986).

Agency costs

In any collective action, interpersonal trust plays a major role in ensuring that the fruits of the collective action are obtained and distributed in an efficient and fair manner (Arrow, 1974). Trust is thus an important lubricant. Interpersonal trust promotes efficiency, in the sense that it allows team members to exercise 'social control' upon each other (Larson, 1992: 91). In a new team, people are brought together who lack knowledge about one another's aptitudes, motivation and level of commitment. Such a team lacks the history of repetitive interactions which render people predictable to one another, and aids the development of trust. Absent trust, resources must be invested to create forms of control other than social control. Further, investments must be made in checking and evaluating performance, as well as in establishing sanctions and rewards. Thus teams lacking deftness are likely to incur substantial agency costs of monitoring team members, establishing mechanisms to ensure performance or shore up missing skills and capabilities, and creating a structure in which lack of performance or other transgressions are adjudicated.

What are the implications of this discussion? It means that deftness represents a second necessary antecedent for the development of competence. Teams which are not deft will find the creation of heedful patterns of relationship to be difficult. This can be put in propositional form:

> *Proposition 2: Degree of competence of development, as measured by the ability to achieve objectives, will be positively associated with deftness of the project team.*

In summary, we have argued that in part sustained superior performance, conceived as the ongoing ability to earn rents, stems from competitive advantages created by the firm's idiosyncratic assets. We have suggested that by undertaking new initiatives firms can create such advantages, but only when they develop new competences—new ways of combining resources—that are difficult for competitors to appropriate. However, the specific competences that will lead to advantage are often difficult to identify *ex ante*. We have suggested that an early indicator of a potential advantage is when the gap between performance and targets for the initiative begins to narrow, which we take to be a signal of increasing competence on the part of the team. Whether or not one agrees with this line of reasoning, it is difficult to imagine an initiative which would generate advantage absent an ability to reliably and predictably attain its objectives.

If increasing competence is a necessary (although not necesarily sufficient) condition for the creation of new advantage, we suggested that two fundamental processes are an essential precursor to the establishment of competence: the achievement of comprehension and of group deftness.

In the next section, we address the methodology used to research these ideas. We first describe how we measure the degree of comprehension, deftness and competence. It is worthwhile to note that our measures are intended to assess where initiatives stand with respect to levels of these constructs, not how managers established the levels. Thus, we seek to measure the degree to which competence, comprehension and deftness have emerged. We then describe the research design, sample, and tests of the two propositions.

METHOD

Level of analysis

The research design builds upon insight developed through extensive fieldwork. Although the study

is exploratory, considerable effort was taken to develop instruments and to collect data which can easily be replicated and validated in other settings, and upon which future work will accumulate.

The research explores the emergence of competence by project groups involved in important corporate initiatives. The level of analysis is the project level, which follows the precedent set by many other scholars studying the creation of new, productive combinations of resources (e.g., Burgelman, 1983; Ancona and Caldwell, 1988; Gersick, 1988; Kogut and Zander, 1992; Leonard-Barton, 1991). The study is field based—we concur with Clark, Chew, and Fujimoto (1987: 738) that 'Any study of the development process faces several problems in acquiring data. Publicly available information on R&D either is not project-specific or does not provide evidence on the outcomes of the development process or the operating characteristics of the firm. A study of this kind thus requires collection of data in the field.'

The choice of corporate initiatives and their associated project teams as the level of analysis determines in large part the remaining research design. Since archival data do not provide the level of detail or the expert perceptions needed to test the propositions, the primary source of data is within-firm, within-group, but the study samples across multiple firms.

Measurement and operationalization of key constructs

Three constructs are of concern: competence, comprehension and deftness. Our purpose was to assess the level of each construct achieved by members of a project team undertaking an important new initiative within an organization. We elected to utilize a survey administered to a relevant 'expert' group, namely those working on the project team, including the project manager leading the team.

For each construct, questionnaire items were developed item-by-item, from the relevant literature which tapped aspects of that construct. For comprehension, items were derived that reflect the team's confidence that they know and understand the most important drivers of a new initiative. The items are thus taken primarily from the corporate venturing/innovation literature. For deftness, items reflect the extent to which members of a team find that interactions proceed smoothly, with minimal effort. These items are derived primarily from the teamwork/group process literature with particular regard to indicators of task group effectiveness. Competence items reflect how well the project is performing with respect to achieving basic objectives, such as staffing, budget and revenue objectives. These also were derived from the literature on corporate venturing. The complete set of items, with associated citations, can be found in the Appendix.

Respondents scored each item on 1–5 Likert-type scales. Higher scores are associated with higher levels of the construct. Each team's average response for each item was first calculated. These average scores were then totalled, providing the overall score for each construct. This approach has the advantage that when scores are averaged for several team members, and these average scores totalled for a large number of items, assumptions about normality are more easily justified, adding to our confidence that parametric statistical methods are appropriate.

Adequacy of the measures

As this study seeks to develop new measures, it is appropriate to address questions of reliability, validity and other possible problems. Let us address each in turn.

Reliability

One-quarter of the sample (40) was randomly selected. This subset was then used to calculate Cronbach coefficient alphas, which are reported in Table 1A. As can be seen in the table, all alphas were considerably above the 0.7 level advocated by Nunnally (1978).

Most other common forms of reliability check are not appropriate for this study. We would expect to find change over time in the variables of interest, so intertemporal stability is not meaningful as a reliability check. We would expect to find some differences in assessment among the multifunctional members of the innovation team, hence inter-rater reliability is not meaningful.

Table 1A. Means, standard deviations, skewness, alpha coefficients

Variable	Range	Mean	S.D.	Skewness	Alpha	Alpha U.S.A.	Alpha U.K.	Alpha Japan
Emerging competence	21–43	32.2	3.98	−0.37	0.85	0.86	0.71	0.86
Comprehension	37–71	56.0	6.43	−0.68	0.88	0.87	0.87	0.94
Deftness	37–65	54.2	5.99	−0.76	0.90	0.90	0.85	0.93
Culture 1 = U.S., 0 = other	0–1	0.72	0.44	-	-	-	-	-
Sector 1 = Service 2 = Manufacturing 3 = Other	1–3	1.72	1.01	-	-	-	-	-
Firm size, number of employees	10–725,000	29,527	91,176	-	-	-	-	-
Project team size	2–100	17.2	23	-	-	-	-	-
Project age (years)	1–32	2.94	4.16	-	-	-	-	-

Note: The data set has been partitioned into two parts. One quarter of the data set was used to calculate Cronbach alphas, the balance was used to test the regression models

Table 1B. Pearson correlation coefficients

Comprehension, deftness and competence		
Variable	Comprehension	Deftness
1. Emerging competence	0.29^{**}	0.40^{***}
2. Comprehension	–	0.41^{***}

$^{**}p < 0.01$; $^{***}p < 0.001$

Validity

Construct validity was sought for this study by our extensive use of the extant literature to create our measures. This provides linkages and cumulativeness with previous work.

To begin to explore convergent validity we also calculated alpha coefficients for respondent subsets from the United States, the United Kingdom and Japan. These were the three largest subsets from different countries. All alphas were above the 0.7 level as can be seen in Table 1A, suggesting that the measures also seem to be reliable, even in samples from very different cultures.

External validity was addressed by having the research results 'reality-checked' via actively discussing the results with project leaders, as well as on many occasions with the project team members, knowledgeable peers and superiors not part of the team, yet within the same organizations. Their high levels of agreement with the results and the willingness of the sponsoring firms in the sample to continue funding the research provide evidence of the external validity of these results.

Biases

The project leader is the individual with arguably the greatest amount of external access and also substantial expertise on the current status of the project. For each construct, the mean scores of the project group were separated out and compared with the score of the project leader. Correlations among leader's score and the mean of the team's scores were positive and significant, somewhat reducing our concern about common response bias.

Harman's one factor test was used to address concerns of common method bias, as is suggested by Podsakoff and Organ (1986). Responses to items from all constructs were pooled and subjected to a factor analysis. The factor analysis yielded seven factors with eigenvalues greater than one, with items from each construct loading cleanly and separately on different factors, which reduces our concerns about common method bias.

An additional test was conducted with regard to common method issues. For the larger project teams (six or more), subsets of responses from different members of the team were separated out. For each of these subgroups, mean scores

for each variable were calculated. In other words, if there were six group members A, B, C, D, E and F in a project team, we calculated the competence score using the responses of A and B, the deftness score using the responses of C and D, and the comprehension score using the responses of E and F, and so on. Correlations among these mean scores were then calculated. The correlations were all in the predicted direction and significant at the $p < 0.05$ level. Since different respondents completed the questionnaires for each construct, this correlation could not have occurred as a result of common response bias.

Aspiration level adjustment

A potential problem with the competence score, the primary dependent variable used in the study, is that by setting easy objectives a project team could theoretically generate a high score, regardless of actual performance. This is a concern in light of the literature which suggests that there is a tendency for people to drop their aspiration level when confronted with disappointment (Cyert and March, 1963; Lant, 1992; Levitt and March, 1988). To control for this, an 'ambitiousness' variable was developed, which requested respondents to assess whether each objective for the project should be increased, decreased or remain the same. The sum of their responses for each item was used to create an ambitiousness score, which was used as a control variable in the analyses.

Study design and sample

Firm selection

The data for the study were collected from 160 projects underway in 40 different firms in 16 different countries. Projects were identified by senior executives in the firms that participated. While the sample was a convenience sample, we show below that there is high variety along a number of variables important in the study of innovations.

Project and team selection

The senior executives identified members and the leader of the project teams. All individuals who were classified as part of the management team for the project were included in the response set. The smallest project in the study had two people working on it, while the largest had 100. Median project size was six individuals.

Potential confounds and control variables

We sought to control for a variety of factors which might influence the progress of the project. We controlled specifically for industrial sector, firm age, project age, project size and culture.

Size is often argued to influence a variety of outcomes (Hannan and Freeman, 1984). Theorists have proposed that with increasing size there is an increasing decoupling of objective setting from the execution process (Daft and Weick, 1984; Aldrich and Auster, 1986). To control for size effects, we used two measures: size of firm measured by number of employees and size of project team by number of team members.

Age of the project may also influence emergence of competence. Reliable roles and routines are only learned over time (Nelson and Winter, 1982). This means that new projects are at a disadvantage compared to established projects when it comes to integrating project goals and execution of the project.

In addition, the way that project teams operate is seen to differ from culture to culture (Hofstede, 1993). We therefore coded projects as to whether they originated in firms based in the United States, or not in the United States, to control for cultural effects. In this study, 72 percent of the projects were in firms originating in the United States.

Finally, to control for possible intersectoral differences (Kogut, 1985) in execution we coded whether the project was being executed in the service, manufacturing, commercial or other sectors. In this study, 56 percent of projects originated in the service sector, 28 percent in the manufacturing sector, 3 percent in the retail sector and the remainder were identified as belonging to other, unidentifed sectors.

So, although this study is exploratory, we did include controls for the effect of other variables which might be expected to exert a strong influence upon the development of competence, as measured by teams' perceptions of their performance to objectives.

RESULTS

Descriptive statistics

Table 1A presents the means, standard deviations, and reliabilities for the variables in this study.

All variables had means close to the center of their range and were only very mildly skewed. Further, there appears to be adequate variance across all the indices, so assumptions of normality are reasonable.

Tests of propositions

In addition to the correlations presented in Table 1B, the propositions are tested by the use of standardized, ordinary least-squares regression models. The use of regression allowed us to control for all the potential confounds described above. The results are reported in Table 2.

Proposition 1: Comprehension

There is a strong positive correlation (0.29) between comprehension and competence ($p < 0.01$). The regression results in Table 2 show a positive and significant beta ($p < 0.01$) for comprehension in a univariate model (Model 1) and a univariate model with context controls (Model 1a), a positive but weakly significant beta ($p < 0.1$) in a bivariate model with deftness (Model 3), but a positive yet insignificant beta for a bivariate model with deftness and with context control variables (Model 3a).

Comprehension is also significant in the model which controls for ambitiousness (Model 4 in Table 3), but is not significant in the model which includes both deftness and ambitiousness (Model 6 in Table 3). It appears that comprehension is only significant as a correlate of emerging competence when deftness is not included in the model.

Table 2. Regression results
Models used (independent variables in regression)
1. Comprehension; 1a. Comprehension with firm and context control variables
2. Deftness; 2a. Deftness with firm and context control variables
3. Deftness and comprehension; 3a. Deftness, comprehension and control variables

	Model 1	Model 1a	Model 2	Model 2a	Model 3	Model 3a
Sample size	113	69[†]	113	69	113	69
F statistic	10.34***	1.88+	22.11***	2.98**	12.53***	2.79**
Adjusted R^2	0.07	0.07	0.16	0.15	0.17	0.15
Comprehension	0.29**	0.26**	–	–	0.15+	0.15
	(3.22)	(2.16)			(1.63)	(1.23)
Deftness	–	–	0.41***	0.37***	0.34***	0.32***
			(4.70)	(3.26)	(3.62)	(2.67)
National culture	–	0.12	–	0.15	–	0.12
		(0.91)		(1.23)		(0.91)
Industrial sector	–	−0.20	–	−0.20	–	−0.18
		(−1.61)		(−1.65)		(0.91)
Firm size (no. employees)	–	−0.03)	–	0.00	–	0.00
		(−0.21)		(0.00)		(0.00)
Project size (no. mgmt. team members)	–	0.03	–	0.00	–	0.00
		(0.21)		(0.00)		(0.00)
Project age	–	0.06	–	0.07	–	0.07
		(0.43)		(0.64)		(0.61)

Dependent variable: Competence
$^{+}p<0.10$ $^{*}p<0.05$ $^{**}p<0.01$ $^{***}p<0.001$
Notes: One-tailed tests are used where the direction of the beta coefficient was predicted. The first number represents the standardized beta coefficient, followed by significance level.
The data set has been partitioned into two parts. One-quarter of the data set was used to calculate Cronbach alphas, the balance was used to test the regression models, so $n=113$ in the regression models.
The number in parentheses is the t statistic.
[†]Control data were not available for all the projects in the sample.

Table 3. Regressions with ambitiousness as a control
Models used (independent variables in regression)
1. Comprehension with controls for ambitiousness
2. Deftness with controls for ambitiousness
3. Deftness, comprehension and controls for ambitiousness

	Model 4	Model 5	Model 6
Sample size	113	113	113
F statistic	10.45***	17.61***	12.19***
Adjusted R^2	0.14	0.23	0.24
Dependent variable	Competence	Competence	Competence
Comprehension	0.23**	–	0.10
	(2.62)		(1.13)
Deftness	–	0.37***	0.33***
		(4.43)	(3.65)
Ambitiousness score	0.27***	0.28***	0.26**
	(3.12)	(3.33)	(3.09)

Dependent variable: Competence
$^{+}p<0.10$ $^{*}p<0.05$ $^{**}p<0.01$ $^{***}p<0.001$
Notes: One-tailed tests are used where the direction of the beta coefficient was predicted. The first number represents the standardized beta coefficient, followed by significance level.
The data set has been partitioned into two parts. One-quarter of the data set was used to calculate Cronbach alphas, the balance was used to test the regression models, so $n=113$ in the regression models.
The number in parentheses is the t statistic.

Thus the results offer only moderate support for Proposition 1.

Proposition 2: Deftness

Proposition 2 is strongly supported. There is a stong positive correlation (0.41) and significant ($p < 0.0001$) relationship between deftness and emerging competence. Deftness is consistently positive and highly significant as a correlate of competence: in a bivariate model and alone with context controls (Models 2 and 2a in Table 2); as well as in a model with comprehension and with comprehension plus controls (Models 3 and 3a in Table 2).

It is also significant in both the models which control for ambitiousness (Models 5 and 6 in Table 3).

These results support our contention that it is very difficult to become competent as a group when group processes are clumsy or awkward. Deftness thus appears to be a fundamentally important construct for the study of emerging competence.

Overall, the results suggest that deftness is a highly significant correlate of the ability of a firm to become competent, as defined by the ability to achieve or exceed objectives. The results for comprehension were weaker, which we discuss below.

DISCUSSION

Interdependence between comprehension and deftness

The essence of our theoretical argument has been to contend that scholars of strategic management must begin to understand the processes by which new competitive advantages are continually created. We proposed that emerging competence, comprehension and deftness are all antecedents to the ability of a firm to generate new sources of competitive advantage. Further, we have shown that it is possible to develop an operationalizable definition of these constructs, which can be used to measure, *ex ante*, whether a project appears to be progressing in a desirable direction. Using this definition, we have identified, operationalized and empirically demonstrated a linkage between emerging competence and deftness.

The predictions we made with respect to comprehension were not borne out by our initial results, suggesting a need for further investigation. The results indicate that comprehension generally

correlates with emerging competence, but only when deftness is not included in the regression models. The high positive correlation (0.40:$p < 0.001$) between comprehension and deftness led us to consider whether there might be interdependence between deftness and comprehension. We thus performed a further analysis in which we regard deftness as the dependent variable and comprehension as the independent variable. The results of this set of analyses are shown in Table 4. Both without and with controls there is a highly significant relationship between deftness and comprehension.

What might such a result suggest? Perhaps, rather than operating relatively independently upon emerging competence, the processes which create deftness are in some part dependent on the degree to which comprehension is emerging. Perhaps, in fact, comprehension is a necessary antecedent to deftness. Such an argument makes certain intuitive sense; after all, it is unlikely that a project team can operate deftly if it fails to comprehend the nature of the problems it faces. For example, members of a team can hardly trust each other to perform necessary tasks when the tasks themselves are unknown. It may well be that deftness has the greater influence upon competence, while comprehension in turn influences deftness. The investigation of this relationship, while beyond the scope of the current study, offers a of provocative question for future research.

To manage the emergence of competence, our process-oriented paradigm suggests, strategic managers need to focus attention on the emergence of comprehension (which correlates with deftness) and on deftness (which correlates with emerging competence). Our results suggest that a focus on these processes deserves as much attention as is given to resource allocations and product/market/technology choices which are the traditional emphasis of strategic management theories. In this field, the instruments used in the research have proven useful as tools to facilitate this process, in that they highlight areas in which the development of comprehension and deftness can be facilitated by conscious management intervention.

Table 4. Regressions with deftness as a function of comprehension
Models used (independent variables in regression)
1. Comprehension
2. Comprehension with context controls

	Model 7	Model 8
Sample size	113	69
F statistic	21.7^{***}	2.08^{*}
Adjusted R^2	0.16	0.08
Dependent variable	Deftness	Deftness
Comprehension	0.40^{***} (4.67)	0.34^{**} (2.82)
National culture	–	0.02 (0.13)
Sector (industry or service)	–	−0.08 (−0.61)
Firm size	–	−0.08 (−0.62)
Project size	–	0.12 (0.90)
Project age	–	−0.06 (−0.43)

$^{+}p<0.10$ $^{*}p<0.05$ $^{**}p<0.01$ $^{***}p<0.001$

Notes: The first number represents the standardized beta coefficient, followed by significance level.

The data set has been partitioned into two parts. One-quarter of the data set was used to calculate Cronbach alphas, the balance was used to test the regression models.

The number in parentheses is the t statistic.

This argument adds support for the merits of a strategic process paradigm for managing the evolution of competence. Both the research results and the management interventions we have observed suggest that a process focus is at least as useful for the strategic management level of the organization as a content focus, and that it is possible to develop useful tools to assist managers in navigating this relatively unresearched process territory.

This set of outcomes has significant implications for research which we now discuss.

Implications for research

Both comprehension and deftness correlated positively with the perceived competence level of project groups. This supports resource-based theory's contention that competitive advantage is to some extent related to processes at work within the organization. Further, our findings lend support to the idea that firms deploy characteristic patterns of process (or routines) which over time, we speculate, lead to enduring heterogeneity. It is this heterogeneity among firms which many authors have linked to the long-term expectation for rent (Peteraf, 1993). The constructs developed in this study thus offer potential to enrich future inquiry.

Comprehension

Studies which assess organizational learning processes (broad vs. narrow problem search, for example) could use the operationalization of the 'comprehension' construct as a dependent variable. This has value in and of itself, as the learning literature finds solid dependent variables to be few and far between (Huber, 1991). The emergence of comprehension as a correlate of emerging competence, through its impact on deftness, gives additional weight to the literature suggesting that management of learning is one of the essential determinants of long-term organizational survival (see, for example, Senge, 1990)—organizations which are 'fast learners' are able to rapidly mobilize themselves to overcome new challenges. Our results suggest that it is the process by which comprehension is developed that needs to be most carefully managed if the firm is to develop deftness and hence new competences. The field could therefore use more inquiries on the processes through which comprehension develops.

Deftness

Generalizing from one setting to another has often been a difficulty with group-based research. We believe that a contribution to theory of this article has been the development operationalization and testing of the construct 'deftness.' The measures can be used to assess deftness levels across many kinds of organizational settings. This construct appears to have a powerful positive effect on the ability of groups to meet their objectives. As conceived, deftness gets at the heart of what makes groups work effectively, in that they are able to perform with minimal additional coordination costs.

When a group is deft, its members will tend to have high confidence in each other. In such a situation, tasks may be delegated, monitoring may be fairly casual and detailed task planning can often be ignored. Contrast this situation with one in which people operate without mutual confidence. There is then likely to be reluctance to delegate tasks, significant expenditure of energy upon planning and monitoring and substantial double-checking. Such a process for coordinating activities is highly resource-intensive.

Next, consider the effects of inter- and intragroup information flows (as is central to the work of Ancona and Caldwell, 1988). Even in a team with utmost mutual confidence, inadequate information flows will tend to increase the cost of transactions. Take, for example, the case of a well-intentioned (and confident) project team member who does not know what information others on the team require. A natural inclination is to send other team members *every* piece of information which might possibly be useful. Under such circumstances, individuals are often forced to expend enormous amounts of time and effort simply sorting through the excess data they have been given in an effort to find the limited information which is relevant. In an information-deft environment individuals get *all* the information they require. The difference is that they get *no more*. This reduces to an absolute minimum the investment in sorting which each person must make, and dramatically reduces the cost of both information transmission and

information sorting in which each member of the group must engage to get the job done.

We thus argue that deftness is a central construct to emerging competence because it captures the extent to which a group possesses a 'developed collective mind' (Weick and Roberts, 1993), as evidenced by an interpersonal infrastructure which permits them to effectively address opportunity, agency and transaction cost problems. A group whose members know that others know what to do, are motivated to do it, are competent to do it and can be depended upon to do it will require minimal expenditure on incentives or monitoring and control devices. Similarly, to the extent that essential information flows exist, are smooth, error-free and relatively complete, the group should be able to execute necessary transactions without costly inter- and intra-group contracting.

It should be clear from our discussion that 'deftness' as conceived is an independent construct from the group-development and group-behavior literature. Deftness does not imply that teams work 'together,' nor does it necessarily imply absence of conflict, nor does it imply high satisfaction or high morale. Indeed, many of the deft groups observed in the field research openly and frequently disagreed with one another, challenged one another and questioned one another's assumptions. This echoes the conclusion of Eisenhardt and Bourgeois, who found that conflict was a 'necessary but not sufficient condition for effective strategic choice' (1992: 35) and whose characterization of effective top management teams is entirely consonant with the idea of deftness developed here. Deftness should therefore not be confused with the idea of 'teamwork,' and may indeed not even require the existence of a recognizable 'team.' Our findings lend additional weight to Hambrick's (1993) conclusion that scholars should begin to reconsider the 'team' label for effective working units in organizations.

Although we believe we have developed a measure for how deftly those responsible for a project operate, we have not yet addressed the fascinating question of what causes some teams to achieve deftness, while others do not. The genesis of deftness offers a fruitful topic for future work. Such inquiry is apt to be a central concern for studies of strategic alliances, joint ventures, mergers and acquisitions and the increasing use of networks to manage organizations. How important is it, for example, for a team to have consensus to be deft? Can a group be largely dissatisfied and be deft? Are there predictable stages in the emergence of a deft group, which correspond with the stages of group development?

Competence

In our discussion (for the sake of conceptual clarity) we have presented the process of competence development as more-or-less linear, evolving in a sequence in which comprehension helps groups develop deftness, which in turn helps them develop competence, a precursor to later advantage. While such a presentation makes for a straightforward narrative, we do not mean to imply that new competences unfold neatly in this manner. If we adopt Weick's (1979) perspective on organizational objectives, quite a different interpretation may be made of our results.

If we apply Weick's ideas, groups which achieve something which is desirable (whether accidentally or with intent) construct an organizational reality to explain this outcome. They may thus 'enact' a reality in which they genuinely believe they knew what they were doing and that they worked together well, whether or not (in the light of some objective perspective) this is the case. The distinction between such a view and the one we have presented lies in the causal relationships among the constructs. We have proposed competence as an outcome. Weick's perspective would hold that the outcome precedes a retrospective rationalization of the causes of that outcome, a rationalization which those creating it may or may not originate with conscious intent to deceive.

The question of disentangling causal relations among process perceptions and outcomes may be examined using our measures and methods. One might envision, for example, that longitudinal research capturing these data for a group of teams over time could discover what emerges first. Alternatively, researchers might acquire lagged performance data which would allow causal inference with respect to current perceived team attributes to be tested. In either case, this study offers constructs which may be used to study these fascinating aspects of the nature of enactment.

Limitations

As with any study, the research presented here has its limitations. Since our focus has been on intra-firm factors which are related to competitive advantage, this study does not speak to the impact on performance of market structure, industry evolution or competitive dynamics, so readers should bear in mind that these factors are likely to have a significant impact on the rents a firm is able to garner. Further, at this stage we cannot state whether the relationships supported by our work will hold beyond the context of a new initiative in an established organization.

An additional limitation to generalizing from our findings is that they are based on perceptions of inside 'experts.' Fortunately, the threat to our conclusions is less severe in this study than in other studies based on perceptions.

For one thing, we have asked our respondents to rate objective organizational characteristics. As Spector (1992) argues, the danger of information distortion under these conditions is more limited than when subjective characteristics or personal feelings are being rated. Further, since we have obtained measures of our constructs from a number of knowledgeable insiders, not merely from a single source, individual biases and distortions would tend to be mitigated.

We concur with Crampton and Wagner's (1994) conclusions from a meta-analysis of 42,934 correlations published in 581 articles that a broad condemnation of self-report measures is inappropriate, and that what the scholarly community must do instead is isolate and address areas in which precept–percept effects are likely to materially influence the conclusions which can be drawn. We suggest that the danger to our data is modest. Consider our sample. Respondents in our study are all individuals of some skill, judgement and talent, else it is difficult to imagine why they would be allocated significant responsibilities in new initiatives which are central to the corporate future. We may judge, therefore, that their perceptions must correspond enough with objective reality at least to keep them in their current task and employment. Since we ask them to react to questions about matters which affect key tasks and relationships on the job, we can have confidence that for the most part the responses given will have a reasonable correlation with 'objective' reality. However, a future study should obtain alternative measures of the key constructs, where possible, to limit qualms about the accuracy of the measures.

Caution should also be exercised in making causal inferences from the results presented here. While it is tempting to believe that the development of high levels of comprehension and deftness will 'create' competence, it must be borne in mind that the venturing process is highly uncertain. Emerging competence may be influenced by many factors beyond the ability of a team to control, even a team which operates deftly and with comprehension. We mean to make far more modest claims. In our view, comprehension and deftness are important and necessary antecedents to competence, but possessing these attributes does not guarantee that competence will emerge.

By choosing to define competence as the ability to meet objectives, other possibly fruitful definitions are necessarily ignored. There may be many other useful ways to consider and measure competence. What this study has attempted to do is describe and utilize one way, in the interest of opening up this fascinating research area for further empirical scholarly inquiry.

CONCLUSION: TOWARD A COMPLEMENTARY PARADIGM FOR CONSIDERING COMPETENCE

This paper was undertaken with the objective of offering a new paradigm for thinking about how organizations become competent—a major challenge for strategic management in the 1990s. We sought to provide a dynamic, process-oriented framework, one which complements a rich stream of work examining the content of proprietary assets used by firms to yield abnormal profits. We identified two processes which are central to the emergence of competence, namely the emergence of comprehension and deftness. We concluded that comprehension affects deftness, while deftness affects competence in an interlocking series of processes which play out as a new initiative unfolds.

This paper supports the pursuit of a new

paradigm in strategy research in three ways. We will elaborate on each.

1. Definition, operationalization and instruments

It has often been noted that common terms and empirical operationalization would constitute a significant advance for the field. A clear definition and operationalization of key constructs is developed here, together with instruments which have been tested for reliability and validity to the fullest extent possible. The measures are parsimonious, easy to obtain, easy to analyze, and rich in that each construct has a number of component items, any of which may be analyzed separately.

The article has developed one way of looking at competence and demonstrated that it is feasible to perform analyses on measures developed from this view. It provides some confidence that this approach to measuring competence achievement is practical, and opens the door to its being used in other contexts and measured in a variety of ways.

2. Within-firm data, at the locus of activity

We present empirical, intra-firm results which support to some extent the theoretical framework we sought to develop and the methodology we are using to test it. The data collected and results obtained for the article are at a level at which managerial action can be taken. Since the data may be compared across many projects and many firms, it sets the stage for the development of a longitudinal, cumulative, intra-firm data base which may be used to test a number of future hypotheses. The difficulty of obtaining such data has been often cited as a major stumbling block to firm-level and intra-firm research, particularly into constructs relevant to innovation (Venkataraman, MacMillan, and McGrath, 1992).

Similarly, data on comprehension and deftness are collected at the same time as data on competence, which reduces the problem of selective recall.

3. Process and content themes

In its treatment of both comprehension and deftness, the article measures the relative impact of content and process upon the emergence of competence, where the comprehension score is a measure of content understanding (what do we know and how well do we know it?), and the deftness score is a measure for how well group processes are operating. Further, both content and process are moderated by the inclusion of contextual variables. This demonstrates first that such an approach is feasible, and second that it may be possible with the increased sample of the future research program to begin to tease out the relative contribution made by each.

In conclusion, it is our hope that this article makes a contribution to furthering the theoretical accumulation and empirical study so necessary to further inquiry into resource-based views of strategy.

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APPENDIX

The following describes each of the key variables and what items are used to develop each in detail.

Competence represents the extent to which *ex post* results are in the neighborhood of or above *ex ante* expectations. This construct stems directly from the definition of competence. The level of competence, it is argued here, can be assessed by the extent to which purposes are achieved, or objectives are realized.

Hence, to measure the extent to which the team has developed competence, respondents are asked to 'assess the performance of your project over the last 2 months' where a score of 1 indicates that results were far worse than expected, and a score of 5 indicates that results were far better than expected. These scores are applied to 10 generic kinds of business objectives, described in the innovation/corporate venturing literature as more or less universal to new products. The use of 'subjective' ratings of competence follows the logic articulated by Ancona and Caldwell (1992) who note that: 'We use subjective ratings of performance because these ratings are most often used to make budget and promotion decisions, they are related to final performance evaluations, and more "objective" results are often a product of "subjective" ratings.'

The items, and literature sources for each, are reported below (numbers refer to questionnaire item numbers).

Items comprising the construct 'competence'

Respondents are requested to 'Please assess the performance of your project over the last 2 months, on each of the following dimensions'	Reference source
Meeting budget objectives	Block (1982: 24, 26, 32) Ancona and Caldwell (1992: 324) Sykes and Block (1989: 162)

	Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting staffing objectives	Block (1982: 29) Block and MacMillan (1985: 5) Van de Ven (1986: 602) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting major deadlines	Block and MacMillan (1985: 7) Sykes and Block (1989: 163) Van de Ven (1986: 590–607)
Meeting quality objectives	Hauser and Clausing (1988: 63–73) Block and MacMillan (1985: 7) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting reliability objectives	Block and MacMillan (1985: 7) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting cost objectives	Block (1982: 24, 26, 32) Block (1989: 26) Block and MacMillan (1985: 5) Sykes and Block (1989: 162) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting efficiency objectives	Block (1982: 26) Sykes and Block (1989: 162) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting user/client satisfaction objectives	Block and MacMillan (1985: 7) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting service objectives	Block and MacMillan (1985: 7) Van de Ven, Hudson, and Schroeder (1984: 91)
Meeting objectives overall	Block (1982: 26) Block (1989: 23) Sykes and Block (1989: 162)

Comprehension represents the extent to which the project team is confident that it understands cause/effect relations for the most critical factors relating to success of the initiative.

The operationalization of comprehension is derived from several literatures. First is the corporate venturing/innovation literature, in which the acquisition of knowledge and subsequent reduction in uncertainty is seen as a key process (see Block and MacMillan, 1993; 1985; Dougherty, 1992). Second is learning theory, as discussed by March (1991), in which he proposes that the amount of

knowledge possessed by an organization about '*m*-dimensional' space is strongly related to performance. The specific factors about which a project team should be developing such knowledge are taken from the articles cited below.

To measure the extent to which members of a project team feel they understand cause/effect relations on the most significant drivers for their projects, respondents are asked to score 16 items on a scale in which a 1 is equivalent to 'we have no idea at this stage' and a 5 is equivalent to 'we know exactly.' Two sets of items are used: one which is tailored toward projects intended to generate revenues directly, and one which is tailored toward projects not intended to generate revenues directly. The items used to measure 'comprehension' are as follows.

Items comprising the construct 'comprehension'

Projects intended to generate revenues directly	Reference source	Projects not intended to create direct revenue
Key sources of revenue	Vesper (1990: 99) Block (1989: 22–28) Block and MacMillan (1985: 4–8) Vesper (1990: 486)	Key sources of funds
Who key customers are	Block (1989: 23, 26) Vesper (1990: 99, 122, 160) Gorman and Sahlman (1989: 239, 240)	Who key clients or users are
The customer need being satisfied	Dougherty (1990: 60, 66) Vesper (1990: 55) Long and Ohtani (1986: 463) Vesper (1990: 13, 160) Kanter (1987: 15) Block and MacMillan (1985: 4–8)	The client/user need being satisfied
The competition you face in filling this need	Gorman and Sahlman (1986: 439) Vesper (1990: 55) Hoad and Rosko (1964: 76–81) Block (1989: 22–28) Ancona and Caldwell (1992: 329)	The competition you face in filling this need
Where, when and how customers will use your offering	Gorman and Sahlman (1986: 231–248) Vesper (1990: 122) Block and MacMillan (1985: 4–8) Block (1989: 22–28)	Where, when and how clients will use your offering
Risks to the customer of buying your offering	MacMillan (1983: 6, 8) Vesper (1990: 199)	The risks to the client of using your offering

How to price your offering	Vesper (1990: 160, 121) Block and MacMillan (1985: 7, 8) Block (1989: 22–28)	How to assess the value of your contribution
Legal or regulatory matters affecting your business	Vesper (1990: 99–100, 133) Block (1982: 28)	Legal or regulatory matters affecting your business
The main sources of risk to your firm	Vesper (1990: 121, 101) Block (1982: 26, 27, 28) Sykes and Block (1989: 159) Block and MacMillan (1985: 5)	The main sources of risk to your firm
Support services which must be provided	Block (1989: 20) Day and Wensley (1988: 15)	Support services which must be provided
The cost of resources	Long and Ohtani (1986: 463) Kanter (1987: 15) Block and MacMillan (1985: 5) Block (1989: 26)	The cost of resources
How key operations need to be carried out	Vesper (1990: 57) Long and Ohtani (1986: 463) Block and MacMillan (1985: 6) Block (1989: 20)	How key operations need to be carried out
Factors which interfere with operations reliability	Vesper (1990: 99) Block (1989: 26) Block and MacMillan (1985: 6)	Factors which interfere with operations reliability
Factors which interfere with output quality	Block and MacMillan (1985: 6) Block (1989: 26)	Factors which interfere with output quality
Cost of your operations	Sykes and Block (1989: 162) Kanter (1987: 15) Block and MacMillan (1985: 6)	Cost of your operations
Major bottlenecks preventing improved operations	Block (1989: 22) Block and MacMillan (1985: 7) Block (1982: 31)	Major bottlenecks preventing improved operations

Deftness represents the extent to which the processes by which a team solves problems are effortless, effective and well-honed. A higher score is always associated with greater process 'deftness' for a team.

To tap the deftness of a group, project group members are asked to position their projects on a five-point scale between two semantic differentials. A score of 1 implies processes which are clumsy or unresponsive, requiring substantial expenditures of resources to coordinate tasks and solve problems. A score of 5 on the other hand indicates maximum effortlessness of task coordination and problem solving.

The wording of these items is drawn primarily from writers examining intra-organizational and team political processes. Exact items, together with reference sources for each are presented below (item numbers refer to item numbers in the survey instrument).

Items comprising the construct 'deftness'

Less deft pole	Reference source	More deft pole
Concept overall	'In other groups, members become highly skilled at working together, resulting in a performing unit that becomes increasingly capable over time . . . become able to anticipate one anothers' next moves and to initiate appropriate responses to those moves even as they occur.' Hackman (ed.) (1990: 6) We are here talking about team effects. Let us assume we are working in a group whose functioning depends on interaction between specialists in several areas. As in any such group, we will develop a set of routines over time. We will learn what other members can do, will do, and want to do. We will learn what they mean when they say something—e.g., 'soon'. And we will learn how to solve recurrent conflicts. The point is that no two groups will develop the same social structure. In particular, some groups will end up with more efficient patterns of interaction.' Wernerfelt (1989: 7)	
Few of the others in the team always know what to do	Ansoff (1979: 77) Mohrman (1979: 201) Pettigrew (1973: 233) Wernerfelt (1989: 7)	All the others on the project team always know what to do
Few of the others in the team are competent to do what is needed	Ansoff (1979: 77) Cook and Wall (1980: 51) Guth and MacMillan (1986: 315)	All the others in the team are competent to do what is needed
Few people on the team can depend on one another to do what is needed	Guth and MacMillan (1986: 315) Cook and Wall (1980: 51) Mohrman (1979: 200, 201) Tushman (1977: 212) Wernerfelt (1989: 7)	All people on the team can depend on one another to do what is needed
Few people on the team know what information is important to the others	Ansoff (1979: 100) Mohrman (1979: 200) Pettigrew (1973: 169)	All people on the team know what information is important to the others
On this project, there are many hidden agendas	Alutto and Acito (1974: 160–167) MacMillan (1983: 10) Guth and MacMillan (1986: 314) Mohrman (1979: 200, 201) Pettigrew (1973: 234)	On this project, there are very few hidden agendas
Important information often gets held up	Ansoff (1979: 100) Guth and MacMillan (1986: 314)	Information flows quickly

	Pettigrew (1973: 169, 234) Tushman (1977: 210)	
Important information often gets withheld	Ansoff (1979: 100) Guth and MacMillan (1986: 314) Pettigrew (1973: 169, 234) Tushman (1977: 210)	Information never gets withheld
Important information is often distorted	Ansoff (1979: 100) Guth and MacMillan (1986: 314) Pettigrew (1973: 169, 234) Tushman (1977: 210)	Information is always accurate
New people joining the project find it very difficult to be accepted	Ansoff (1979: 84) Buchanan (1975: 67, 68) Guth and MacMillan (1986: 315)	New people joining the project are very easily assimilated
Few people on the team understand one another	Ansoff (1979: 98, 108) Guth and MacMillan (1986: 314, 321) Tushman (1977: 210) Wernerfelt (1989: 7)	All people on the team understand one another—we all 'speak the same language'
Few people on the team can depend on one another to implement decisions	Ansoff (1979: 108) Cook and Wall (1980: vol. 53: 39) Pettigrew (1973: 26) Wernerfelt (1989: 7)	All people in the team can depend on one another to implement decisions
Information needed to move the project forward is simply not available	Hackman (1990: 11)	We have all the information that we need to move the project forward
The project is very short of key skills	'To perform well, a group must . . . bring adequate knowledge and skill to bear on the task work' Hackman (1990: 9) Pinto and Prescott (1990: 323)	All key skills are in place
Team members are uncomfortable challenging one another	Kiernan (1993: 12–13) Pascale (1990: 256) Stata (1989: 70)	Team members are very comfortable challenging one another
There is little agreement that correct decisions are being made	Wernerfelt (1989: 7) Stata (1989: 70)	There is general agreement that correct decisions are being made