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Decisional Comprehensiveness and Firm Performance: Towards a More Complete Understanding

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ABSTRACT

Organizational prosperity and even survival can be threatened unless strategic decisions are made through an effective process. But what does an effective decision-making process look like? Analysts and executives have struggled over the years to answer this question. Recently, however, empirical research has produced a consistent answer for one of the most fundamental aspects of strategic decision-making: comprehensiveness. This recent work suggests that higher levels of comprehensiveness are positive for firms facing turbulent conditions but are irrelevant for firms facing stable conditions. While this consistency would seem to be positive, it presents a puzzle: Why are comprehensiveness and performance unrelated in stable environments? In such environments, problems generally believed to plague comprehensive decision-making are less severe. The theory building and empirical results of the present research suggest a solution to the puzzle: comprehensiveness and performance exhibit a relationship more complex than previous studies have been designed to detect. Copyright © 2008 John Wiley & Sons, Ltd.

KEY WORDS strategic decision-making; comprehensiveness; turbulence; performance

INTRODUCTION

Early in the modern era of organizational research, Braybrooke and Lindblom (1963) suggested that organizations must use simplified approaches to strategic decision-making in order to function effectively. They argued that failure to keep things simple could result in information overload, dysfunctional delays, and misallocation of precious resources in the pursuit of a non-existent ‘‘right’’ answer. In the words of Snyder and Paige (1958), failing to focus on just one alternative may block an organization from ‘‘the point where action is possible.’’ Although Braybrooke and Lindblom (1963) and Snyder and Paige (1958) focused on public policy decisions, their work has had an enormous impact on the broader field of decision-making in organizations.

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In the early 1980s, Fredrickson and Mitchell (1984) refined earlier arguments in a project that had substantial influence on theory and practice. They argued that simplified or non-comprehensive decision-making is crucial only for organizations facing dynamic, unpredictable conditions. They reasoned that non-comprehensive approaches facilitate the type of quick decisions needed to take advantage of fleeting windows of opportunity. Fredrickson and Mitchell (1984) also deemed dynamic, unpredictable situations inherently immune to deep understanding, making comprehensive decision approaches irrelevant at best, dysfunctional at worst.

Although the arguments reviewed above are reasonable, a very different view has been supported by many organizational analysts. In its most rudimentary form, this view suggests that rich, comprehensive approaches to strategic decision-making are superior in most situations. Proponents of this perspective believe that concerted effort in the explicit generation and consideration of multiple alternatives is crucial for properly understanding situations and for making good choices. Empirically, Bourgeois and Eisenhardt (1988), George (1980), and Janis (1982) have provided support for this view in qualitative research. Dean and Sharfman (1996), Nutt (1998), and Papadakis (1998) have provided support in quantitative studies using the decision as the unit of analysis. Forbes (2005), Smith, Gannon, Grimm, and Mitchell (1988), and Simons, Pelled, and Smith (1999) have provided support in quantitative studies using the organization as the unit of analysis.

As the work cited above indicates, a fair amount of support for comprehensive decision approaches has emerged. The power of explicit thought, forward-looking analysis, and deep consideration of possibilities has been reasonably well established for strategic decision-making.

Puzzles remain, however. Chief among these is why empirical studies of comprehensiveness and performance typically deliver positive findings when firms from turbulent industries are examined, and when firms from industries mixed on turbulence are examined, but not when firms from nonturbulent industries are examined. For example, Glick, Miller, and Huber (1993), Priem, Rasheed, and Kotulic (1995), and Walters and Bhuian (2004) found positive effects in turbulent industries but no effects in nonturbulent industries. Bourgeois and Eisenhardt (1988) reported positive effects in their study of firms in the highly turbulent microelectronics industry. Miller and Toulouse (1986) provided little evidence for any effects among firms in their stable subsample.

Nonturbulent industries would seem to provide the perfect backdrop for comprehensive decision approaches. In these industries, both time and ambiguity are favorable. From a temporal standpoint, the industry is slow moving, meaning there should be more time to utilize a deep approach when a strategic decision must be made (Fredrickson, 1984). From the standpoint of ambiguity, the industry is relatively straightforward, meaning it is possible to define preferences for alternative actions and to have faith that today's preferences will still hold when the action is ultimately implemented (see March, 1997).

Understanding the puzzle associated with nonturbulent industries is the main purpose of this work. From a research standpoint, understanding why comprehensiveness does not matter in stable environments, or finding that it does matter through complex effects previously unexamined, would add to our stock of knowledge in a longstanding, important area of scholarship (see, for example, Braybrooke & Lindblom, 1963; George, 1980; Janis, 1982; Simon, 1955; Snyder & Paige, 1958). From the standpoint of practice, identification of complex effects might lend enhanced credibility to academic prescriptions, resulting in increased application of findings.

A secondary purpose of this work is to better understand the nature of the comprehensiveness-performance linkage in turbulent industries. Determining whether the positive effects of comprehensiveness are strictly linear in such environments would add to our stock of knowledge, at least at the margin.

THEORETICAL DEVELOPMENT

Comprehensiveness, sometimes labeled procedural rationality or extent of analysis, is defined as follows: the extent to which an organization's upper-echelon executive group tends to utilize an extensive decision

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process when dealing with immediate opportunities and threats (Bourgeois & Eisenhardt, 1988; Dean & Sharfman, 1996; Elbanna & Child, 2007a; Forbes, 2005; Miller, Burke, & Glick, 1998). The nature of the process is paramount. Extensive approaches include high levels of investigatory activity aimed at developing alternative courses of action, evaluating alternatives, and developing multiple criteria to screen alternatives.[1]

Comprehensive processes appear to influence firm performance for at least three reasons. First, these processes help decision makers deal effectively with the complexity inherent in strategic decisions. Decision makers must grapple with a number of difficult questions related to opportunities (e.g., unexpected access to a lucrative foreign market) and threats (e.g., sudden introduction of a new technology by a competitor). What is the exact nature of the opportunity/threat? Is the opportunity/threat transient? What are our response options? Which response options fit our current capabilities? What resources are required to build any new capabilities? Can we readily acquire the resources to build new capabilities? How will our partners react to the various options? Where could resistance to change originate? Do the potential benefits of preferred options outweigh their probable costs in the long run?

In the face of such complexity, an extensive decision process helps to ensure that most or all important decision variables are considered, resulting in better decisions and better outcomes. Dean and Sharfman (1996) put it this way, ''executives who collect extensive information before making decisions will have more accurate perceptions... which has been shown to relate to firm performance...'' (p. 374).

Second, comprehensive processes help decision makers reduce some of the effects of cognitive biases. Beyond the general difficulties inherent in understanding a complex situation, these biases often cause decision makers to search in the wrong places, emphasize the wrong information, and ignore some important information. For example, the confirmation bias is a factor. This bias can cause decision makers to search only for information consistent with pre-conceived or favorite ideas (e.g., Ben-Shakher, Bar-Hillel, Bilu, & Shefler, 1998). Sunk cost bias can cause decision makers to resist changing the general trajectory of the firm (e.g., Arkes & Hutzel, 2000). Focusing bias can cause decision makers to consider only what is readily accessible in their existing mental models (Tor & Bazerman, 2003).

With such biases potentially having substantial effects, an extensive decision process likely improves the chances of reasonable information gathering and processing. With an extensive process, various types of information and various perspectives are used. Generating such information and promoting multiple perspectives would seem to work against unconscious biases that involve limited information gathering and consideration of limited options. Although cognitive biases are notoriously difficult to overcome (Bazerman, 2006), some recent evidence suggests that it is possible to reduce their effects. Idson, Chugh, Bereby-Meyer, Moran, Grosskopf, and Bazerman (2004), for example, used the ''Acquiring a Company Problem'' to provide evidence for the benefits of widening decision-making scope through comparative and analogical reasoning.

Third, comprehensive decision processes enhance implementation motivation among decision makers and those around them. Having invested a great deal in the decision process, decision makers are often more committed to implementation. Bagozzi, Dholakia, and Basuroy (2003) have examined this effect as part of the ''motivation-mustering potential'' of decision processes (also see Dholakia & Bagozzi, 2002). A sense of procedural justice may be a part of the causal explanation. Perceptions of procedural justice are influenced by the extensiveness of decision processes (e.g., Kim & Mauborgne, 1998).

[1]Most researchers have provided formal constitutive definitions corresponding to simple amount of investigatory activity. Dean and Sharfman (1996), for example, defined their variable as ''the extent to which the decision process involves the collection of information relevant to the decision and the reliance upon analysis of this information in making the choice'' (p. 373). Some researchers, however, have provided constitutive definitions focused on true completeness. Fredrickson and Mitchell (1984), for example, defined their variable as ''the extent to which an organization attempts to be exhaustive or inclusive in making and integrating strategic decisions'' (p. 402). Despite the variation in constitutive definitions, all researchers empirically investigating comprehensiveness have adopted operational definitions corresponding to simple amount of investigatory activity. Measuring true completeness would involve calculating the ratio of actual activity to total potential investigatory activity, and this has not been done.

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As indicated in the opening paragraphs of this essay, organizational analysts investigating comprehensiveness generally make a distinction between firms in nonturbulent environments and firms in turbulent environments. In the paragraphs that follow, this distinction is addressed. Nonturbulent environments, those characterized by limited change, present different demands relative to turbulent environments, those characterized by unpredictable change (for consistent definitions of turbulence see, for example, Glick et al., 1993, Huber, 1984, and Priem et al., 1995).

Comprehensiveness and performance in nonturbulent environments

As shown in the research summary contained in Table 1, comprehensiveness seems to have little effect on financial performance for firms facing limited change in their industries (see the sample-size weighted mean correlations for nonturbulent environments). The absence of positive effects is surprising. Beyond the forces and factors discussed above, two features of nonturbulent industries seem to indicate fertile ground for comprehensive approaches. First, nonturbulent environments present the gift of time. With consumer requirements, available technologies, and other aspects of the environment changing relatively slowly, a firm is faced with fewer strategic decisions per unit of time. With fewer decisions to make, each decision can be more carefully considered without risking the neglect of other crucial situations (see Glick et al., 1993). In the language of decision theory, scarcity of managerial attention, which could make attempts at higher comprehensiveness dysfunctional, is less problematic.

Second, nonturbulent environments create less ambiguity, where ambiguity is defined as an inability for decision makers to know what their preferences will be in the future (see March, 1997; March & Weissinger-Baylon, 1986). With relatively little change in consumer requirements and available technologies, a stable core of norms, expectations, and routines permeates an industry. In such an environment, it should be relatively straightforward to develop well-defined preferences and to have faith in the idea that organizational preferences held today will be similar to those held tomorrow (see Fredrickson, 1984; Glick et al., 1993). From the standpoint of decision theory, difficulty in developing such faith is generally taken to be a basic roadblock for future-oriented, consequence-driven decision-making (March, 1997). With this basic difficulty in playing a reduced role, nonturbulent industries would seem to be friendly territory for more comprehensive approaches.[2]

What, then, explains existing empirical results? Why has research failed to reveal positive effects for comprehensiveness in nonturbulent environments? There are at least two possible explanations. One explanation is that past learning makes extensive investigation of today's strategic issues unnecessary—not particularly helpful or harmful. Whether the specific mechanism is experiential learning that has occurred over the years (see, for example, Levitt & March, 1988), rule-based decision-making that has evolved from sense-making (see, for example, Shapira, 1998), or automated expertise that has developed through past analysis (see, for example, Simon, 1987), decision makers are guided by the lessons of history in an environment where those lessons still largely apply. The past, of course, is never a perfect predictor of the future, but in stable environments the value of past learning is substantial (Levitt & March, 1988), which may mute the impact of any new investigatory activity.

Although the above explanation for the puzzling null results has merit, there is a compelling alternative explanation. The alternative is that comprehensiveness is related to performance but through an inverted

[2]The definition of ambiguity used in this research highlights two aspects of future-oriented consequence driven decision-making: (1) probabilities of expected future events can be more or less difficult to estimate and (2) the possibility of unexpected and indeed unknowable future events can be perceived as high or low. In situations where probabilities of expected future events are less difficult to estimate and the possibility of unknowable events is perceived as low, ambiguity is low (i.e., individuals can more easily develop well-defined preferences for various strategies/tactics and have faith that preferences held today will also hold tomorrow). In the language of Knight (1921), such situations are characterized more by risk than uncertainty.

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Table 1. Summary of comprehensiveness–performance research[a,b,c]

	Nonturbulent environments		Mixed environments		Turbulent environments	
	Profitability	Other	Profitability	Other	Profitability	Other
Elbanna and Child (2007b)				+		
Forbes (2005)[d]						+
Walters and Bhuian (2004)		ns				+
Morgan and Strong (2003)[e]						+
Reeves, Duncan, and Ginter (2003)				+		
Covin, Slevin, and Heeley (2001)[f]	ns	ns			ns	ns
Flynn and Forman (2001)				+		
Simons et al. (1999)				+		
Nutt (1998)				+		
Papadakis (1998)			+	+		
Dean and Sharfman (1996)		+				+
Priem et al. (1995)	ns	ns			+	+
Priem (1994)			+	+		
Glick et al. (1993)	ns	ns			+	ns
Bourgeois and Eisenhardt (1988)					+	+
Smith et al. (1988)			+	ns		
Miller and Toulouse (1986)	ns	ns			ns	ns
Fredrickson (1984)	+	ns				
Fredrickson and Mitchell (1984)[g]	−	−				
Sample-size weighted mean correlation[h]	.05	−.05	.23**	.39***	.43***	.25***
Overall sample-size weighted mean correlation	.00		.31***		.34***	

[a]The main entries in the table are summaries of the studies' findings: + for a positive relationship, − for a negative relationship, and ns for a nonsignificant relationship. If multiple comprehensiveness–profitability relationships were examined in a study (e.g., ROA and ROS), an average was taken. If multiple relationships involving comprehensiveness and other performance variables were examined, an average was taken.
[b]Comparative field research representing general strategic decision-making is summarized in the body of the table. Other types of studies have been conducted but are not incorporated here. George (1980) and Janis (1982) conducted more clinically oriented field studies and found support for comprehensive approaches in complex, fluid settings. Hough and White (2003) conducted a simulation using fictional organizations.
[c]Several comparative field studies were not included in the table. Atuahene-Gima and Li (2004) and Atuahene-Gima and Murray (2004) focused on project teams and project outcomes in a single functional area. Segars, Grover, and Teng (1998), Segars and Grover (1999), and Grover and Segars (2005) focused on a single functional area and intermediate outcome variables tied to that area. Papke-Shields, Malhotra, and Grover (2006) focused on a single functional area. These six studies do not assess general strategic decision-making. Nutt (2000a, 2000b, 2001, 2002, 2005) used the same data as Nutt (1998). Love, Priem, and Lumpkin (2002) used the same data as Priem et al. (1995). Fredrickson and Iaquinto (1989) used data from the same firms as Fredrickson (1984) and Fredrickson and Mitchell (1984). Elbanna and Child (2007a) used the same data as Elbanna and Child (2007b). Goll and Rasheed (1997, 2005) used an operational definition focused mostly on long-range planning and participation in planning across management levels. Jones, Jacobs, and van't Spijker (1992) and Jones, Jones, and Deckro (1994) grounded their work theoretically in the Fredrickson comprehensiveness tradition but used an operational definition focused mostly on long-range planning. Mueller, Mone, and Barker (2007) focused narrowly on written analysis. Judge and Miller (1991) focused on the number of alternatives simultaneously considered in a strategic decision situation. Because executives in an organization might consider a large number of alternatives sequentially, the Judge and Miller measure was not deemed a sufficient proxy of overall comprehensiveness (note that they did not intend to study overall comprehensiveness, but they are often cited in this literature). Finally, Miller and Friesen (1983) focused on the effects of the external environment on strategic decision-making. They did not directly, empirically examine the connection between comprehensiveness and performance.
[d]Forbes (2005) studied new ventures operating in the internet space in New York's Silicon Alley during the late 1990s. Consistent with Bourgeois and Eisenhardt's (1988) characterization of the environment faced by firms in California's Silicon Valley, the environment faced by the Forbes sample was classified as turbulent.
[e]Morgan and Strong (2003) studied high-tech industries where firms were characterized by "rapid product innovation,. . . frequent new technologies in production processes, a high level of technical and scientific expertise. . . and R&D being a key driver underlying the future growth of the industry" (p. 168). Thus, their sample was classified as turbulent.
[f]Covin et al. (2001) provided evidence for a contingent relationship between comprehensiveness and performance that involved organizational structure (in both non-turbulent and turbulent environments).
[g]Fredrickson and Mitchell (1984) suggested that the industry their firms represented was turbulent, but subsequent work has indicated the industry in question (sawmills and planing) was not turbulent during the relevant time period. For further discussion of this issue, see Glick et al. (1993) and Priem et al. (1995).
[h]Correlations were available for a subset of studies. Published information was augmented by the respective authors in the following cases: Fredrickson (1984), Fredrickson and Mitchell (1984), Glick et al. (1993), and Priem et al. (1995).
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

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U-shaped function (see Figure 1a). Assuming some symmetry in the inverted U (i.e., the slope on one side of the inverted U is not substantially flatter than the slope on the other side), such a function would lead to null results in studies of linear effects. Previous studies have been limited to just such effects.

The argument for an inverted U-shaped function is not difficult to construct. It follows directly from economic theories of information, where information generation has real and significant costs (Hwang, 1993; Rotheli, 2001), and where investments in information have value up to the point where the marginal expected cost equals the marginal expected return (see March, 1994). The specifics of the information-cost argument, as it applies to strategic decision-making, appear in the following paragraphs.

As discussed earlier, decision makers in nonturbulent environments possess the luxury of time and tend not to be paralyzed by ambiguity. Thus, when faced with a strategic decision, they have the time and the wherewithal to engineer significant investigatory activity (Fredrickson, 1984; March, 1997). Further, because all strategic decisions have some degree of novelty and complexity (Mintzberg, Raisinghani, & Theoret,

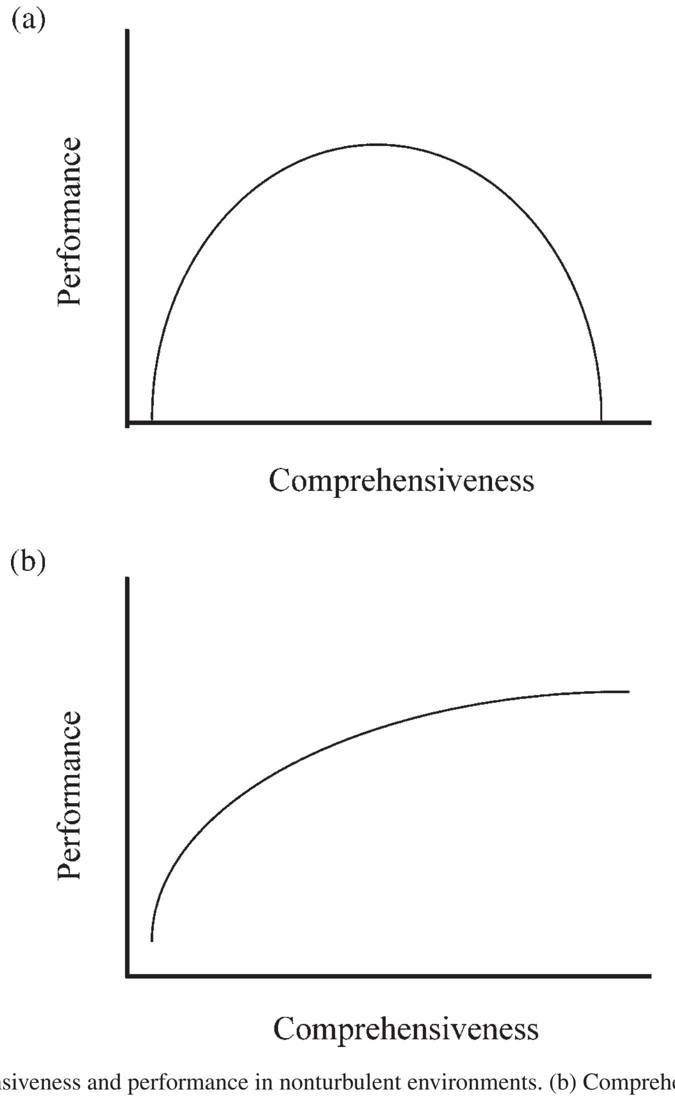

Figure 1. (a) Comprehensiveness and performance in nonturbulent environments. (b) Comprehensiveness and performance in turbulent environments

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1976; Schwenk, 1988), such investigatory activity would seem to be worthwhile. It would help to ensure proper understanding of the decision context. Thus, investigatory activity likely has positive effects, at least as it moves from low to moderate levels.

Decision makers and their firms may not benefit, however, from efforts to push investigatory activity from moderate levels to high levels. Decision makers do not need to expend additional resources to understand the decision context properly. Because past learning is relevant to today's decision in a direct and straightforward way, the decision context in a nonturbulent environment tends to be reasonably well understood at the outset of a strategic decision process (Miller & Friesen, 1983). The consequences of many possible choices will be known without investigation, and thus some alternatives will be screened immediately while others will be placed immediately in the set to be seriously considered. Also, developing an understanding of less familiar alternatives will be easier, as many pieces of the puzzle will be understood at the outset. With a great deal being known from the very start, investigatory activity ceases to produce new, useful information sooner than it otherwise would (Miller & Friesen, 1983). The result is a limit on the amount of useful, nonredundant investigatory activity that can be done. Going beyond this limit, wastes resources (see March, 1994) resulting in negative effects on firm performance as time and money are spent on unnecessary studies, consultants, and retreats rather than on more valuable developmental initiatives or improvement projects (see Rotheli, 2001).

Psychological theories of information processing also suggest problems when investigatory activity is unnecessarily pushed from moderate to high levels in well-understood environments. As unnecessary investigatory activity is carried out, redundant and trivial information is produced, by definition. Redundant information is potentially harmful as it can needlessly distract decision makers. Redundant reports and data, although perhaps valid, can cause decision makers to fail to fully exploit previously collected information while also failing to fully exploit the recent redundant information, as it seems familiar. Trivial information, which has little diagnostic or predictive validity, is potentially harmful as it can create a dilution effect. With dilution, the value of useful information is compromised as useless information enters mental processes in subtle, complex, and dysfunctional ways (Nisbett, Zukier, & Lemley, 1981). Available empirical evidence, although not focused on strategic decision-making in ongoing firms, provides some support for the distracting effects of redundant information (e.g., Davis, Lohse, & Kottemann, 1994; Hwang & Lin, 1999) and consistent support for the diluting effects of trivial information (e.g., Hoffman & Patton, 1997; Iselin, 1993; Whitecotton, Sanders, & Norris, 1998). These findings suggest that going too far with investigatory activity harms the quality of decision-making and, by implication, firm performance.

To summarize the discussion, a meaningful but limited amount of comprehensiveness seems to be appropriate in nonturbulent environments. High levels of comprehensiveness make little sense in these environments because so much is known about the decision context prior to addressing a particular strategic situation. Much of the information and insight required to make a sound choice are already on hand. Low levels of comprehensiveness also make little sense because some novelty is present in the decision context, meaning some new knowledge must be generated. In nonturbulent environments, it seems that both high and low levels of investigatory activity have significant drawbacks, while the midrange is more fruitful. If this is in fact the case, the puzzling null results found in previous studies would be explained. Following the arguments presented here, the formal hypothesis is as follows:

H_1: In nonturbulent environments, comprehensiveness and performance exhibit an inverted U-shaped relationship (see Figure 1a).

Comprehensiveness and performance in turbulent environments

As shown in Table 1, comprehensiveness has positive effects on performance for firms facing a significant amount of unpredictable change. From the standpoint of basic decision theory, this may seem surprising. First, turbulent environments place restrictions on how much time can be invested in a particular strategic decision. With consumer requirements, available technologies, and other aspects of the environment

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changing relatively rapidly, a firm is faced with more strategic decisions per unit of time. With more decisions to make, each decision can be considered for only so long without risking the neglect of other crucial situations (see Glick et al., 1993). In the language of decision theory, scarcity of managerial attention is a major issue.

Second, turbulent environments create more ambiguity for decision makers. With frequent, dynamic changes in consumer requirements and available technologies, a stable core of norms, expectations, and routines does not exist in an industry. In such an environment, it is more difficult to develop well-defined preferences and to have faith that organizational preferences held today will be similar to those held tomorrow (see Fredrickson & Mitchell, 1984; Glick et al., 1993). With these difficulties playing a major role, turbulent environments would seem to be hostile territory for deliberate decision-making.

Yet, the available empirical data are clear. Comprehensiveness has positive effects. Why? The key is probably a lack of previous learning relevant to today's decision context. Because the world is different today relative to yesterday, new knowledge creation takes on a critical role. And the difficulty of creating useful, future-oriented knowledge in a turbulent environment simply calls for greater effort across many people. In decision-tree terms, specifying what the outcome branches are for each alternative is difficult, and specifying the probability for each branch is difficult, and specifying the sub-branches for each branch is difficult, and so on, but this must be accomplished if only qualitatively to avoid a random pattern of success and failure. Miller and Friesen (1983) supported this line of reasoning in their empirical work and drew the following conclusion: ''A dynamic environment must be studied more carefully and diligently to afford executives an adequate degree of mastery'' (p. 223). Bourgeois and Eisenhardt (1988) argued that it may be impossible to proceed in a turbulent environment unless analyses are used to structure the situation, and to help executives cope psychologically with the chaos. In addition, Bourgeois and Eisenhardt (1988) found, as have others, that comprehensive decision processes can be completed in an intense, quick fashion, thereby negating one of the presumed drawbacks of high levels of comprehensiveness in turbulent settings.

Although it seems clear that comprehensiveness has positive effects on performance in turbulent environments, it is unlikely that the relationship is strictly linear. Even though the need for investigatory activity is quite high (much higher than in nonturbulent environments), efforts at continued investigation probably provide diminishing returns when substantial information is already in place and new information becomes more difficult to find. Relatedly, redundant information and its distraction effects probably become significant as investigatory activity reaches high levels. Although a large amount of nonredundant activity is possible (more so than in a nonturbulent environment), substantial redundancy cannot be avoided if search and analysis continue endlessly. Trivial information and its dilution effects also could become more pronounced at higher levels of investigatory activity but are likely to be problems from the very start of a decision process in a turbulent environment. In such a fluid, novel situation, missteps resulting in trivial information are probable.

In combination, the forces discussed above likely cause the positive effects of comprehensiveness to diminish as investigatory activity moves higher and higher. Because these forces collectively do not become as problematic in turbulent environments, the positive effects of comprehensiveness likely diminish in intensity rather than turn negative. In sum, the formal hypothesis is as follows:

H_2: In turbulent environments, comprehensiveness and performance exhibit a positive relationship that is concave downward based on diminishing returns (see Figure 1b).

RESEARCH METHODS

The hypotheses developed above were tested using a sample of 85 autonomous business units. Sample development, measures, and analytical techniques are described below.

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Sample

Five hundred and thirty-five candidates for the sample were identified through the Compustat industry-segment data file. These candidates were randomly selected from a variety of industries so as to ensure variance on two industry-level variables: turbulence and munificence (see Glick et al., 1993, for details on industry selection). Because not all entries in the industry-segment file correspond to autonomous business units, telephone calls to public relations officers were used as a screen. After deleting 78 candidates that were found not to be autonomous business units, after deleting 31 candidates that were autonomous business units but that had fewer than two levels of management (two levels of management were deemed necessary for significant operations), and after deleting 30 candidates where appropriate contact information could not be found, 396 strategic business units remained.

The chief executives of the 396 business units were contacted by phone and asked to participate in this study along with their upper-echelon executive teams. Seventy-nine agreed to participate. After the chief executive had committed to participate in the study, participation by individual members of the upper-echelon team was exceptionally high, with 82% of mailed surveys being completed and returned in the typical business unit. Data were also collected from six business units during a pilot test of the questionnaire used in this study. The final questionnaire was identical to the pilot-tested version, so the six business units were included in the analyses, yielding a total sample of 85.

With 85 business units being usable in the study, the participation rate was 21% [85/(396 + 6)]. For research of the type discussed here, where information is sought from multiple upper-echelon informants within a given business unit, 21% is a reasonable figure. Gilley and Rasheed (2000), for example, reported a 17% participation rate. Simons et al. (1999) reported a 6% participation rate. West and Schwenk (1996) reported an 11% participation rate. These lower response rates tend to occur in macro-organizational and strategy research when multiple informants are used as a means to enhance measurement validity. Importantly, any sample bias resulting from lower response rates is unlikely to pose a serious threat to studies of complex relationships, such as moderated relationships involving three variables (Simons et al., 1999). The joint probability of an investigator hypothesizing a complex relationship that does not exist in the population and then drawing a sample in just such a way that the very same complex relationship appears in the data is low (see Simons et al., 1999). Also, this study's empirical results for turbulent industries are consistent with the results of previous studies, suggesting that the sample is not biased in any substantial fashion (results for stable industries are not consistent with prior studies, but those results are driven by novel empirical tests).

For the 85 business units in the sample, there were on average 3075 employees (range of 6–36 000). Sixty-three had parent companies, while 22 operated as stand-alone units. Forty-six were drawn from manufacturing industries (e.g., coated paper bags, metal cans, semiconductors, and related devices), 26 were drawn from the services (e.g., life insurance, advertising, day care), and 13 were drawn from extraction industries (e.g., mining gold and silver ores; mining potash, soda, and borate; drilling oil and gas wells). No industry accounted for more than five business units (47 industries in total were represented). For the 468 individual informants, the average tenure in the business unit was 10.9 years and the average tenure as an upper-echelon manager was 5.3 years. With this level of experience, the informants were likely to have been knowledgeable about organizational issues.

Data and measures

Comprehensiveness

To ensure adequate measurement, comprehensiveness was assessed with a measure successfully deployed by Fredrickson (Fredrickson, 1984; Fredrickson & Iaquinto, 1989; Fredrickson & Mitchell, 1984). The measure contained three items. Each item presented rich descriptors of a highly comprehensive decision process and asked informants to rate on a one-to-seven scale the extent to which the descriptors are applied to the typical strategic decision in the business unit. The first item focused on comprehensiveness in situation diagnosis, the

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second focused on comprehensiveness in generating alternatives, and the third focused on comprehensiveness in selecting an alternative (see Appendix A).

Available data suggests the measure is sound. In Fredrickson's work, the items were used in validity analyses and the validity coefficients were very respectable (ranging from .74 to .82). Interitem reliability coefficients were not calculated by Fredrickson, but were found to be strong in two studies reported by Miller et al. (1998) (.84 and .85, respectively).[3]

Performance

Profitability, the most popular aspect of performance in studies of comprehensiveness, was assessed with a questionnaire measure developed by Glick et al. (1990). The measure provided a subjective evaluation of after-tax return on assets in comparison with other organizations in the primary industry. Papadakis (1998), Priem (1994), Smith et al. (1988), and others also used an ROA definition of profitability in their studies of comprehensiveness. More generally, Combs and Ketchen (1999), Hill, Hitt, and Hoskisson (1992), Lee and Miller (1999), and others have highlighted the importance and general usefulness of return on assets as a measure of performance in strategic management. Hill et al. (1992), for example, argued that ROA provides superior year-to-year stability relative to other measures. Lee and Miller (1999) highlighted ROA's attractiveness in terms of comparable data across many different types of industries.

As in the present research, several previous contributors to the comprehensiveness-performance area have used a subjective assessment of profitability (e.g., Priem et al., 1995; Smith et al., 1988), and many contributors to other areas of strategic management have done the same (e.g., Gilley & Rasheed, 2000; Luo & Park, 2001; Slater & Olson, 2000). Although subjective assessments of profitability can be questioned, comparisons of subjective and accounting data tend to produce substantial correlations (e.g., Smith et al., 1988). Further, subjective assessments made confidentially may be more accurate owing to the public relations, tax, and other extraneous considerations that impact accounting data (Miller & Cardinal, 1994). Finally, in the case of this research, archival profitability data were not collected during the original study period, and these data were available for only a subset of firms at a later point in time.

Performance is multidimensional. Although important strategic-management variables (e.g., diversification) often have reasonably consistent relationships with various performance dimensions (see, for example, Palich, Cardinal, & Miller, 2000), the use of multiple dimensions seems prudent and is standard. Thus, following Glick et al. (1993), open-systems effectiveness was included in the study as a second key indicator of performance. This dimension, representing the ease with which an organization can acquire financial resources, seems appropriate for studies of strategy and strategic decision-making as it captures the degree to which an organization is in alignment with its environment. Organizations that satisfy the demands of their environments have greater support from those environments (Quinn & Rohrbaugh, 1983; Scott, 1987; Yuchtman & Seashore, 1967). The specific measure used here was originally developed by Glick and colleagues (1990), and it provided information on the accuracy of two statements: The organization has "difficulty in obtaining sufficient funds to produce its products/services" (reverse scored) and the organization can "easily acquire resources for growth and expansion."

Turbulence

Turbulence was assessed archivally through the Compustat industry-segment data file. For each industry represented in our sample, the two components of turbulence—instability and unpredictability—were

[3]Miller et al. (1998) also reported a third study in which a different measure was used. The measure selected for the present research was also available to them for their third study but it was not utilized. Follow-up analyses revealed that it would have produced results similar to those reported in their published work. Thus, there is some evidence of a form of convergent validity.

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measured based on the popular time-series operational definitions of Dess and Beard (1984) and Wholey and Brittain (1989). In essence, instability corresponded to year over year variation in such variables as sales and assets in the industry. Unpredictability corresponded to lack of regularity in the pattern of variation. When variables such as sales and assets exhibit unpredictable change over an extended period, the industry typically faces dynamic conditions in technologies and/or customer preferences. Instability and unpredictability were combined to yield an industry-level measure of turbulence. Industry scores were assigned to the business units based on industry membership. Appendix B contains additional details.

Informant bias

Because both comprehensiveness and performance were assessed with questionnaire-based measures, informant bias was a consideration. Informants may have held beliefs about how comprehensiveness and performance were related, and may have provided data consistent with their beliefs rather than data that accurately represented the business unit (Dean & Sharfman, 1996). An informant, for example, may have thought that "the business unit is performing well so we must be carefully considering key decisions." Alternatively, an informant could have thought that "the business unit is not performing well so we must be neglecting key decisions."

The likelihood of the above bias occurring, however, was mitigated by three characteristics of the research design. First, the research project of which the current study was a part was not labeled an examination of comprehensiveness and performance (the larger project had multiple foci and general labels were used on questionnaires, etc.). Thus, attention was not drawn to the key relationship of the current study. Second, the comprehensiveness and performance measures were located in different places in the lengthy version of the questionnaire completed by chief executives. Thus, the opportunity for these informants to mentally connect the two constructs was relatively weak. Third, the comprehensiveness and performance measures were included in different versions of the abbreviated questionnaire completed by executives/managers below the chief-executive level. Half the informants below the chief-executive level responded to Version 1 of the abbreviated questionnaire, which contained the comprehensiveness measure, and half responded to Version 2, which contained the performance measures. Thus, the opportunity for these informants to mentally connect the two constructs was not strong. In sum, with comprehensiveness data coming from one set of informants within a business unit and performance data coming from another set of informants (with the chief executive being the only individual to provide data on both), the informant bias discussed above probably did not play a major role in the study.

A secondary measure of comprehensiveness was available but was not used in this study because of elevated potential for informant bias. The measure was part of the abbreviated version of the questionnaire that contained the performance measures. Informants possibly could have mentally connected the two variables and provided assessments of comprehensiveness that were influenced by how well the business unit was doing. The measure also was not used because it exhibited a restriction of range problem. The lowest score for a business unit was well above the theoretical minimum of the scale (minimum observed score = 13 on a scale that runs from 5 to 35).

Analysis

A standard approach for exploring curvilinear effects was employed here. This approach, detailed by Aiken and West (1991), calls for (1) variables to be centered at their means and (2) higher order terms to be created to represent curvilinear effects. To investigate the two hypotheses, the following equation was used:

$$\hat{Y} = b_0 + b_1 C + b_2 C^2 + b_3 T + b_4 CT + b_5 C^2 T,$$

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where $\hat{Y}$ equals predicted performance, C equals comprehensiveness, and T equals turbulence. The key term in the equation is b_5C^2T. This term tracks curvilinear effects of comprehensiveness at different levels of environmental turbulence. If H_1 and H_2 are valid, comprehensiveness has different types of curvilinear effects across the range of turbulence: a function that exhibits an inverted U at low levels of turbulence and a function that increases at a decreasing rate at high levels of turbulence. To provide the proper statistical context for interpreting C^2T, its component terms (i.e., the lower order terms) were also included (see, for example, Pedhazur, 1982).

RESULTS

Measurement

On average, three executives/managers assessed comprehensiveness in each business unit. An ANOVA-based ICC interrater reliability analysis (Shrout & Fleiss, 1979) produced acceptable results, indicating that executives/managers agreed on their unit's comprehensiveness to an adequate degree (ICC 1, $k = .53$, $p < .001$). Thus, it was reasonable to average responses within business units to arrive at aggregate comprehensiveness data. The interitem reliability estimate based on the aggregate data was strong, $\alpha = .86$.

Similar to comprehensiveness, on average three executives/managers assessed performance in each business unit. The ANOVA-based ICC interrater reliability analyses produced sound results, indicating that executives/managers agreed to a substantial degree on how their business units were performing (ICC 1, $k = .77$ for both performance variables, $p < .001$). Thus, it was reasonable to average responses within business units to arrive at aggregate performance data. Based on the aggregate data, the interitem reliability estimate for open-systems effectiveness was a respectable .79. Because profitability was assessed with a single question, no interitem reliability estimate was necessary. Convergent validity, however, was estimated for profitability using data from the Compustat industry-segment file. For the subset of business units for which archival ROA data were available, convergent validity between profitability measured subjectively and profitability measured through archival means was a reasonable .51.

Profitability and open-systems effectiveness exhibited a correlation of .40. With 16% shared variance, combining the two into one overall performance variable was a possibility that could have been explored but was not. Because profitability is commonly used as a stand alone variable in strategy research, it was desirable to maintain it as a separate outcome variable in this study in order to enhance comparisons to other studies, past and future, and to facilitate future meta-analytic work. Moreover, profitability is conceptually distinct from open-systems effectiveness. In the oft-cited competing values model of organizational effectiveness, profitability is conceptualized in terms of an external focus coupled with a control orientation while open-systems effectiveness is conceptualized in terms of an external focus coupled with a flexibility orientation (Quinn & Rohrbaugh, 1983).

Turbulence was assessed by using archival methods. Thus, no interrater reliability analysis was necessary. The interitem reliability estimate for turbulence was .71, based on the combination of two indicators—one for instability and one for unpredictability.

Hypothesis tests

The correlation between comprehensiveness and profitability was weak (.16, n.s.). The correlation between comprehensiveness and open-systems effectiveness was close to zero (.01, n.s.). These correlations suggest the absence of simple linear effects.

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In the regression analyses, performance was regressed onto comprehensiveness, turbulence, and the higher order terms. For profitability, the resulting model had the following characteristics:

$$\hat{Y} = .1673 + .1266C + .0003C^2 + (-.0790T) + .0236CT + .0124C^2T,$$

where $\hat{Y}$ = predicted profitability, C = comprehensiveness, and T = turbulence. As shown in Table 2, the model provides significant explanatory power ($p < .01$) and the term for curvilinear comprehensiveness effects at different levels of turbulence is statistically significant ($.0124C^2T$, $p < .01$) (see Model 1). In models to be discussed in conjunction with robustness analyses (Models 2 and 3), the term for curvilinear effects at different levels of turbulence is also statistically significant. For open-systems effectiveness, the model had the following characteristics:

$$\hat{Y} = .7694 + .1617C + (-.0577C^2) + (-.0738T) + .0669CT + .0141C^2T,$$

where $\hat{Y}$ = predicted open-systems effectiveness, C = comprehensiveness, and T = turbulence. As shown in Table 2, the model provides significant explanatory power ($p < .01$) and the term for curvilinear comprehensiveness effects at different levels of turbulence is marginally significant ($.0141C^2T$, $p < .10$) (see Model 4). In models to be discussed in conjunction with robustness analyses (Models 5 and 6), the term for curvilinear effects at different levels of turbulence is significant at $p < .01$.

To better understand the nature of the curvilinearity reported above, the fundamental regression equation was re-expressed to segregate linear and curvilinear effects at various levels of turbulence. The re-expressed equation took the following form:

$$\hat{Y} = (b_1 + b_4T)C + (b_2 + b_5T)C^2 + (b_3T + b_0).$$

The first coefficient ($b_1 + b_4T$) represents the linear effects of comprehensiveness at a given level of turbulence. The second coefficient ($b_2 + b_5T$) represents curvilinear effects at a given level of turbulence.

Table 2. Performance regressed onto comprehensiveness, turbulence, and higher order terms[a,b]

	Profitability			OS effectiveness		
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Comprehensiveness	$.1266^{*}$	$.0880^{\dagger}$	$.0895^{*}$	.1617	.1193	.0540
	(.0493)	(.0466)	(.0448)	(.1039)	(.0884)	(.0852)
Comprehensiveness squared	.0003	−.0077	−.0093	$-.0577^{*}$	$-.0654^{**}$	$-.0623^{**}$
	(.0125)	(.0109)	(.0102)	(.0263)	(.0206)	(.0193)
Turbulence	$-.0790^{*}$	$-.0884^{*}$	$-.0933^{*}$	−.0738	−.1122	$-.1271^{\dagger}$
	(.0342)	(.0379)	(.0397)	(.0720)	(.0719)	(.0755)
Comprehensiveness × turbulence	$.0236^{\dagger}$	$.0211^{\dagger}$	.0143	$.0669^{*}$	$.0689^{**}$	$.0459^{*}$
	(.0122)	(.0114)	(.0103)	(.0257)	(.0216)	(.0195)
Comprehensiveness squared × turbulence	$.0124^{**}$	$.0104^{***}$	$.0093^{***}$	$.0141^{\dagger}$	$.0164^{**}$	$.0143^{**}$
	(.0038)	(.0030)	(.0026)	(.0079)	(.0058)	(.0050)
Intercept	.1673	.2240	.2342	.7694	1.0073	1.0265
Multiple R	$.44^{**}$	$.40^{*}$	$.41^{*}$	$.43^{**}$	$.50^{***}$	$.48^{***}$
Adjusted R^2	$.14^{**}$	$.11^{*}$	$.12^{*}$	$.14^{**}$	$.20^{***}$	$.18^{***}$

[a]Table entries are unstandardized regression coefficients; standard errors are in parentheses.
[b]Models 1 and 4 are based on arithmetic means for aggregating data to the level of the business unit. Models 2 and 5 are based on medians. Models 3 and 6 are based on means with the most discrepant within-unit scores dropped.
$N = 85$.
Note: $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$; $^{\dagger}p < .10$.

For low turbulence (defined as one standard deviation below the turbulence mean), the two comprehensiveness–performance relationships exhibit no significant linearity ($p > .10$) but substantial curvilinearity ($p < .01$ for both profitability and open-systems effectiveness). For each relationship, the negative sign of the curvilinear coefficient suggests a curve that is concave downward. Simple slope analyses (see, for example, Aiken & West, 1991) reveal significantly positive slopes at low to moderate levels of comprehensiveness and significantly negative slopes at moderate to high levels of comprehensiveness. Overall, the relationships appear to increase at a decreasing rate up to a point and then decrease at an increasing rate. Taken as a whole, these results clearly show the classic inverted U, in support of H_1.

For high turbulence (defined as one standard deviation above the mean), the comprehensiveness-profitability relationship exhibits both significant linearity ($p < .01$) and significant curvilinearity ($p < .05$). Both the linear and curvilinear coefficients are positive, suggesting a positive relationship that has a concave upward component. Simple slope analyses highlight an interesting pattern: a negligible relationship as comprehensiveness moves from non-existent through low levels, followed by a significant relationship at moderate and high levels of comprehensive, where the relationship increases at an increasing rate. Thus, comprehensiveness appears to provide increasing benefit as more and more is done in turbulent environments, which is not quite consistent with H_2.

The relationship between comprehensiveness and open-systems effectiveness exhibits significant linearity ($p < .01$) but nonsignificant curvilinearity ($p > .10$) when turbulence is high. The linear coefficient is positive, indicating a positive relationship. Simple slope analyses suggest no significant relationship as comprehensiveness moves from nonexistent through low levels, followed by a significant, positive relationship at moderate and high levels of comprehensiveness, with some weakening of the positive linear relationship at the highest levels of comprehensiveness. Overall, the results suggest that comprehensiveness has no impact until a critical level is reached and then the impact is positive. This pattern is reasonably consistent with H_2.

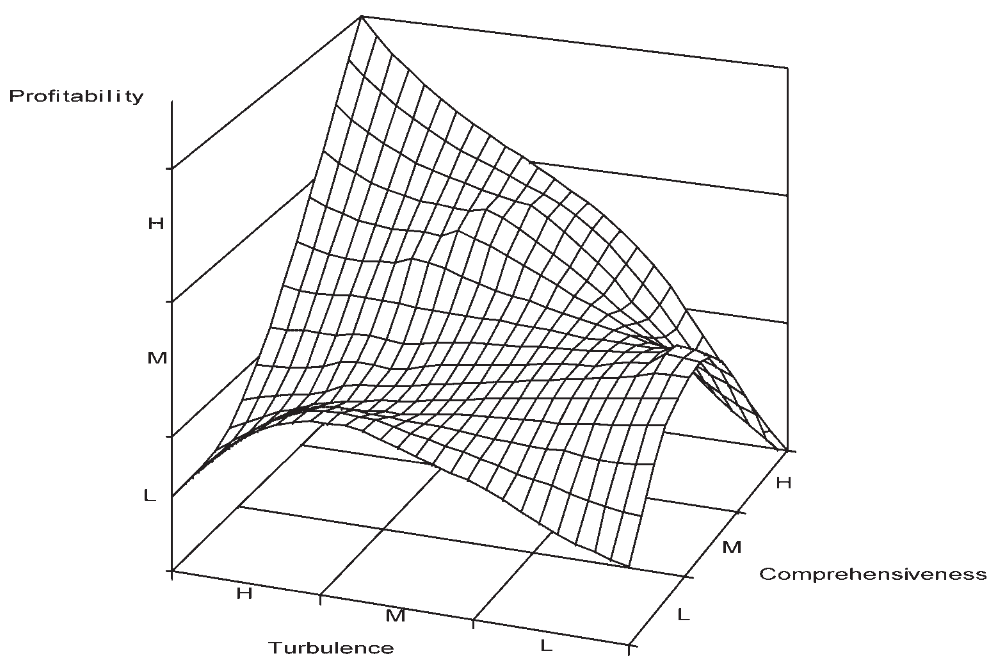

Figure 2. Profitability at various levels of comprehensiveness and turbulence, $\hat{Y} = (.1266 + .0236T)C + (.0003 + .0124T)C^2 + (-.0790T + .1673)$, where $\hat{Y}$ = predicted profitability, C = comprehensiveness, and T = turbulence

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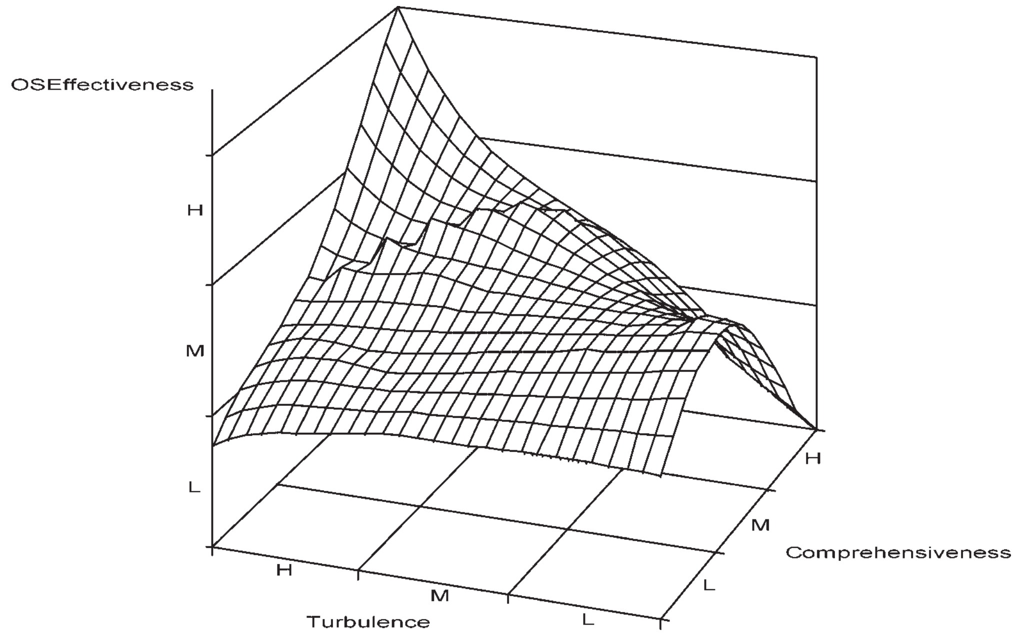

Figure 3. Open-systems effectiveness at various levels of comprehensiveness and turbulence, $\hat{Y} = (.1617 + .0669T)C + (-.0577 + .0141T)C^2 + (-.0738\mathrm{T} + .7694)$, where $\hat{Y}$ = predicted open-systems effectiveness, C = comprehensiveness, and T = turbulence

To bring the results into sharp relief, three dimensional plots were created. The predicted performance values from the re-expressed equations were plotted against the comprehensiveness and turbulence data (extrapolation and smoothing were used to enhance the presentation). The plots provide visual support for the analyses presented above (see Figures 2 and 3).

Robustness analyses

As noted earlier, the interrater reliability estimates were acceptable for comprehensiveness and very reasonable for the two performance variables. Even so, to ensure that discrepant responses within business units did not have undue influence on the empirical results, alternative regression analyses were completed by using (1) data aggregated within-unit based on medians and (2) data aggregated within-unit based on means but without using the most discrepant informant score for a given variable (discrepant scores were removed only for those units with three or more informants for a given variable). Medians are less sensitive to outlying data than are arithmetic means and means with outliers removed are also less sensitive to outlying data. The results of the alternative analyses were very similar to the main results (in Table 2, see Models 2 and 5 for the median-based results and see Models 3 and 6 for results based on removing the most discrepant within-unit score).

To ensure that omission of potentially important variables did not alter the regression results, several control variables were incorporated into the primary models, including organizational size, existence of a parent organization, type of industry (mining, manufacturing, service), average tenure of upper-echelon managers, and industry munificence. Initially, profitability was regressed onto the control variables. Explanatory power was low, and the overall R^2 was statistically nonsignificant. When the comprehensiveness and turbulence variables were added, explanatory power increased substantially (adjusted R^2 increased from .02 to .17, with overall model significance at $p < .01$). Moreover, the key term tracking curvilinear comprehensiveness effects at different levels

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of turbulence exhibited strong statistical significance ($p < .001$). Next, open-systems effectiveness was regressed onto the control variables. Explanatory power was significant ($p < .05$). When comprehensiveness and turbulence variables were added, explanatory power increased substantially (adjusted R^2 increased from .11 to .28, with overall model significance at $p < .001$). Importantly, the key term tracking curvilinear effects of comprehensiveness at different levels of turbulence exhibited significance ($p < .051$).

To provide an alternative to the regression results, an ANOVA approach was also applied. The ANOVA approach offers specific contrasts between particular groups representing different conditions under investigation. Groups were created by (1) trichotomizing the sample into roughly equal thirds based on low, moderate, and high values of comprehensiveness and (2) dichotomizing the sample into two roughly equal halves based on low versus high turbulence (i.e., a median split). Although other methods of group creation could have been used, creating groups in this way ensured a reasonably objective process. The results of the 3×2 analyses of variance were generally supportive of the study's theoretical expectations.

For profitability, the key interaction term in the overall ANOVA (comprehensiveness $\times$ turbulence) was marginally significant ($p < .07$), but the model itself was just above marginal significance at the .10 level. Simple main-effect analyses, which should be viewed cautiously given the lack of significance for the overall model, provided support for significant effects in low turbulence environments. Cell means in that context followed the expected inverted-U pattern: mean profitability for moderate comprehensiveness was significantly higher than mean profitability associated with low and high comprehensiveness, while the means for low and high comprehensiveness were not significantly different from one another. Simple main-effect analyses suggested no significant effects in high turbulence environments, although the profitability means did exhibit the expected ordering.

For open-systems effectiveness, the key interaction term in the overall ANOVA (comprehensiveness $\times$ turbulence) was statistically significant ($p < .05$) and the model itself was significant ($p < .01$). Simple main-effect analyses suggested important effects for low turbulence environments. Cell means in that context followed the expected inverted-U pattern: mean effectiveness associated with moderate comprehensiveness was significantly higher than mean effectiveness associated with low and high comprehensiveness, whereas the means for low and high comprehensiveness were not significantly different from one another. Simple main-effect analyses also suggested effects for high turbulence environments. In that context, mean effectiveness associated with high comprehensiveness was significantly higher than mean effectiveness associated with low comprehensiveness.[4]

Overall, simple main-effect analyses supported theoretical expectations in three of four cases: low turbulence samples coupled with profitability as the performance variable, low turbulence samples coupled with open-systems effectiveness as the performance variable, and high turbulence samples coupled with open-systems effectiveness as the performance variable. Given the focus in this study on a puzzle associated with low turbulence environments, the support in both low-turbulence cases was useful.

DISCUSSION

Empirical work related to comprehensiveness has produced a puzzling set of findings for decision makers facing nonturbulent conditions. These findings, suggesting that degree of comprehensiveness does not matter,

[4]For the simple main-effect analyses, least-square means and slicing results from the overall models were initially evaluated. Next, a follow-up analysis was carried out for the low turbulence sample. Finally, a follow-up analysis was carried out for the high turbulence sample. Means were compared using Duncan tests (alpha set at .05), with Newman-Keuls and Tukey tests also being consulted (results were similar using these more conservative tests, but with some mean comparisons becoming marginally significant). Cell sizes were 14, 9, and 19 for low, moderate, and high comprehensiveness in the low turbulence sample. Cell sizes were 14, 20, and 9 for low, moderate, and high comprehensiveness in the high turbulence sample.

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run counter to some basic ideas about decision-making. The present research provides an explanation for the puzzle: comprehensiveness and performance are connected through an inverted U-shaped function in nonturbulent environments. Previous studies have been focused on linear effects and have not had the opportunity to observe an inverted U.

Beyond offering a solution to the puzzle in less turbulent settings, this research provides insights related to strategic decision-making in turbulent conditions. As in previous studies, the current research indicates that comprehensiveness is positive for performance under conditions of unpredictable change. Unlike previous studies, it suggests that there may be some minor curvilinearity in the relationship. Also unlike previous studies, it suggests that positive effects do not begin at lower levels of comprehensiveness. The regression results suggest no relationship between comprehensiveness and performance at the lower end of the comprehensiveness scale. Organizations may need to move to at least a moderate level of comprehensiveness before experiencing any benefit.

Implications for theory and research

The findings of this study reinforce several existing ideas related to decision-making while qualifying or calling into question others.

In an interesting stream of research, redundant and trivial information have been studied for their effects on quality of judgments and choices (e.g., Kemmelmeier, 2004). In theory, such information can distract decision makers and dilute the value of useful information, causing low quality decisions to emerge. Empirical research has provided evidence in supportive of these effects but existing studies have been restricted to experimental settings (e.g., Nisbett et al., 1981; Davis et al., 1994). The experimental approach is very powerful but evidence from natural settings also would be useful. In the current study, indirect evidence was generated by using strategic decision makers responsible for business units. Specifically, for the business units and decision makers embedded in nonturbulent environments, redundant and trivial information probably entered the process when high levels of comprehensiveness were employed, and high levels of comprehensiveness produced poor outcomes.

In another interesting stream of research, effort put forth in making decisions has been studied for its effects on (1) commitment to decision implementation and (2) goal realization (e.g., Dholakia & Bagozzi, 2002). In theory, more effort in decision-making enhances commitment to implement the resulting decision and therefore enhances goal realization, independent of the importance originally attached to the decision process. As might be expected, such commitment is seen as more important in situations where implementation is difficult. Empirical evidence is supportive of these general ideas but again is largely based on experiments (e.g., Bagozzi et al., 2003). In the natural field setting represented in the current research, complementary evidence is generated that indirectly supports the above ideas, as described below.

In turbulent environments, decision implementation is particularly difficult because delays can occur, temptations to endlessly revise a decision abound, protocols for implementing strategic decisions may need to be modified in real time, and so on. Strong commitment to implementation is critical in such a setting, and it follows that factors such as decision effort which enhance commitment would have strong positive effects. The current study supports this causal process by showing that decision effort at the strategic level is positively related to firm performance in turbulent settings. It is likely that decision-making effort (i.e., high levels of comprehensiveness) produced not only high quality decisions in the business units studied here but also enhanced implementation commitment (also see Nutt, 1998) thereby serving the underlying goals of effective strategy and strong financial performance.

In nonturbulent environments, decision implementation is complex but less so than in fast-changing, unpredictable environments. This suggests that high levels of decision effort are somewhat less important in terms of creating implementation commitment. As discussed earlier, high levels of decision effort also seem to be harmful for decision quality in this context. These ideas taken together highlight the efficacy of

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moderate levels of decision effort in nonturbulent environments. Moreover, these ideas suggest that high levels of effort create poor quality decisions which upper-echelon managers are then committed to implement.

Taking into account (1) the risks of redundant and trivial information, (2) the overall costs of information, (3) the objective need for new information in strategic situations, (4) the motivating potential of deep investigation, and (5) the heightened risks of cognitive biases when structured analysis is minimal, high levels of investigatory activity seem crucial for strategic decision-making in turbulent environments, whereas moderate levels appear to be ideal in less turbulent environments. Low levels of investigation do not appear to be valuable in any context. This interpretation of available evidence is new to the field of strategic management and offers new applications and insights for the field of behavioral decision-making.

Cautionary notes

Well-traveled measures, multiple informants from each business unit, archival assessments of environmental characteristics, and a sample size that is above average for this type of work are among the features that contribute to a sound research design. As with all research, however, this work has limitations. First, it presents a single study, and its results are therefore subject to sampling error. Its findings, especially for less turbulent environments, must be confirmed in future work. Second, the study is cross-sectional in nature, making causal direction an issue. It was assumed that comprehensiveness influences performance, but it could be that performance influences comprehensiveness. The complex pattern of findings in this study, however, makes it very difficult to construct an explanation with performance as the independent variable. Further, available data that are longitudinal (e.g., Bourgeois & Eisenhardt, 1988) suggest that comprehensiveness influences performance rather than the other way around. Third, the study relied upon questionnaire data for both comprehensiveness and performance, raising the possibility of informant bias. Beyond the mitigating factors discussed earlier for such bias, the complex curvilinear and interactive results involving an archival variable make it very unlikely that informant bias is an important issue.

Confirmation of the results of past studies is also an indicator of the validity of this study. In both regression models, comprehensiveness was basically found to have a positive impact on performance for organizations facing turbulent environments. These positive findings are consistent with the empirically based consensus that comprehensiveness is positive in turbulent conditions. Additionally, the positive findings are consistent with parallel results in the strategic planning literature, where a quantitative synthesis of decades of research showed extensiveness of long-range strategic planning to be positively related to performance in turbulent conditions (see Miller and Cardinal, 1994). Whether the current study's findings for less turbulent environments become part of a consistent set of empirical results awaits additional tests of an inverted U. At present, there are no empirical studies that are relevant for comparison.

CONCLUSION

Comprehensiveness affects performance. For more turbulent situations, the evidence for beneficial effects has become clear over the past decade or so. Important questions at this point would seem to be those focused on how to best achieve higher levels of comprehensiveness under conditions of unpredictable change. Which investigatory activities provide the best returns? Which activities most effectively reduce the chances of decision bias? How can various search activities be integrated most effectively? For less turbulent situations, the evidence for a curvilinear relationship is new and provocative. Important questions present themselves here as well. How can decision makers best structure staff units and their own discussions to ensure a halt to investigatory activity at the right time? Which cultural features are crucial in this process? Which personality types work best? Answers to these questions will help push forward both scholarship and practice.

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APPENDIX A: Measure of Comprehensiveness[a,b]

Some firms are very comprehensive when making important, non-routine decisions. Other firms are very non-comprehensive when making such decisions. Both approaches can be very effective. Please indicate how comprehensive your firm is by answering the following questions:

a. A firm that is very comprehensive in *determining the cause* of a major problem might form a special group of several members, make extensive use of outsiders, conduct extensive analyses, allow unlimited expenses, involve people with diverse backgrounds, and consider all possible causes. On the other hand, a very non-comprehensive firm might rely entirely on the ideas and experience of one or two employees. Which of the numbers to the right *best describes* YOUR FIRM's approach?	Very non-comprehensive 1 2 3 4 5 6 7 Very comprehensive
b. A firm that is very comprehensive in *generating alternatives* to solve an important problem might form a special group, use scheduled meetings, use brainstorming sessions, prepare lists of alternatives, and spend resources to involve outsiders who could help identify all possible alternatives. In a very non-comprehensive firm, one or two employees might simply rely on their experience to identify a satisfactory solution. Which of the numbers to the right *best describes* YOUR FIRM's approach?	Very non-comprehensive 1 2 3 4 5 6 7 Very comprehensive
c. A firm that is very comprehensive in *evaluating a particular action* might form a special group of employees and outsiders with diverse expertise, set specific criteria, state assumptions, make contingency plans, and conduct extensive analyses that directly compare several alternatives. In contrast, a very non-comprehensive firm might base a decision entirely on the experience and "feeling" of one or two employees. Which of the numbers to the right *best describes* YOUR FIRM's approach?	Very non-comprehensive 1 2 3 4 5 6 7 Very comprehensive

[a]The term "firm" rather than "autonomous business unit" appears in the questionnaire items. In the instructions that accompanied the questionnaire, informants were told to equate "firm" with their business unit, and to answer all questions with respect to the business unit rather than a parent company.
[b]Adapted from the work of Jim Fredrickson (Fredrickson, 1984; Fredrickson & Iaquinto, 1989; Fredrickson & Mitchell, 1984).

APPENDIX B: ASSESSMENT OF TURBULENCE

The time-series regressions required by the environmental assessment were focused on a 7-years period. Some have used longer time periods to capture industry characteristics in archival assessments (e.g., 10 years for Dean and Sharfman, 1996 and for Dess and Beard, 1984). Others have used shorter time periods (e.g., 5 years for Keats and Hitt, 1988). Use of 7 years seems reasonable in light of past practice and a desire to assess enduring features of the environment, but there is no established standard. As in past work, instability (the first component of turbulence) was assessed for several variables (e.g., sales, assets) using separate regressions. In each regression, instability was based on the standard error of the coefficient of the yearly time trend divided by the mean of the dependent variable (results from the separate regressions were averaged, following confirmatory factor analysis, to arrive at an overall instability measure). Unpredictability (the second component of turbulence) was assessed in each separate regression (e.g., one for sales, one for assets) in terms of the R^2 of the time trend (results from the separate regressions were averaged, following confirmatory factor analysis, to arrive at an overall unpredictability measure). For additional information on environmental dimensions and assessments, see Miller, Ogilvie, and Glick (2006).

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