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Conceptualizing and Measuring the Organizational Environment: A Multidimensional Approach

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Neither a single set of constructs nor a single set of measures of the organizational environment is widely accepted, making it difficult to build a comprehensive literature on the impact of the environment on the firm. In this article we review three constructs — complexity, instability, and resource availability — common to most environmental research. We identify theoretical omissions in Dess and Beard's (1984) measurement of these constructs, and present a revised set of constructs designed to build on their research. The new measures' construct validity is assessed using perceptual data from senior managers. We investigate the predictive validity of both our measures and Dess and Beard's by using them to predict industry performance. We also use our measures to predict two firm-level structural variables. We argue that the revised measures more accurately reflect our theoretical understanding of environmental dimensions.

Theoretical approaches to understanding the environment's effect on organizations include task/decision uncertainty (Duncan, 1972; Lawrence & Lorsch, 1967; Leblebici & Salancik, 1981), environmental conditions and perceived uncertainty (Downey, Hellreigel, & Slocum, 1975; Duncan, 1972; Tosi, Aldag, & Storey, 1973), the environment as a source of resources (Pfeffer & Salancik, 1978; Thompson, 1967; Yuchtman & Seashore, 1967), and as a source of variation in organizational forms (Aldrich, 1979; Hannan and Freeman, 1977). Only a few researchers (Aldrich, 1979; Dess & Beard, 1984; Tung, 1979) have attempted to synthesize these various and to some extent competing approaches.

Because neither a single approach to conceptualizing the environment nor to measuring it has received widespread acceptance, we have been unable to build a comprehensive, coherent literature about the environment and its impact on the

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firm. Authors use a variety of concepts and measures, making it difficult to compare results across studies. In this article we present a set of constructs — synthesized from existing theory — that we believe best conceptualizes the organizational environment. We operationalize these constructs and present data on the validity of our measures. Following suggestions by Schwab (1980), we address nomological (theoretical), vertical (construct) and horizontal (predictive) validity.

Approaches to Conceptualizing and Measuring the Environment

Perceptions versus Objective Reality

A debate in the environmental literature centers on whether the environment should be treated as an objective reality or a perceptual phenomenon. At one extreme, Weick (1969) suggests that there is no such thing as an objective environment. Rather, the environment is those parts of the external information flow that the firm "enacts" through attention and belief. Other early writers (e.g., Duncan, 1972; Lawrence & Lorsch, 1967) were not particularly concerned about the objective environment's existence, but argued that managerial perceptions — particularly concerning uncertainty — shaped managerial choice. Recently, there has been a resurgence of interest in enactment and managerial sensemaking about the environment (Dutton & Jackson, 1987; Gioia & Ford, in press; Smirchich & Stubbart, 1985). Following earlier work, these researchers believe that perceptions shape behavior, and their research focuses on how such perceptions are formed.

Researchers have questioned for some time the relationship between managerial perceptions and more "objective" environmental indicators. Several writers (e.g., Downey, Hellreigel, & Slocum, 1975; Tosi, Aldag, & Story, 1973) criticized earlier work for its failure to compare managerial perceptions to objective criteria. These studies found perceptual and objective measures to be unrelated, suggesting several potential explanations. For example, managers' perceptions may be too limited, attending to only those environmental sectors that specifically affect their functional area (Aldrich, 1979). Alternatively, recent environmental events may cause managers to overgeneralize from these events to the overall state of the environment, thus biasing their perceptions.

Although some researchers (e.g., Tung, 1979) attempted to integrate perceptual and objective perspectives into a single framework, Aldrich's (1979) typology of environmental dimensions led the field away from perceptual measures. His typology assumed the existence of an objective environment and made predictions about its impact on the firm. It was the theoretical basis for Dess and Beard's (1984) development of measures of the objective environment, which in turn became the basis for more recent work examining the relationship of the firm to its environment (e.g., Keats & Hitt, 1988; Lawless & Finch, 1989).

Where do we stand? There can be little doubt that managers' perceptions play an important role in shaping their response to the environment. But it also appears clear that there are differences between environments that are objective (i.e., observable through "scientifically rigorous measurement procedures" [Dess & Beard, 1984:53]) as well as intersubjective (i.e., perceived similarly by most observers). Our intent in this article is to develop a set of conceptualizations and ob-

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Table 1
Conceptualizations of the Environment

Major Works on Environments	Complexity	Dynamism and Stability	Resource Availability
March and Simon (1958)			Munificence
Emery and Trist (1965)	Complexity Routineity	Instability	
Thompson (1967)	Heterogeneity	Dynamism	
Child (1972)	Complexity	Variability	Illiberality
Mintzberg (1979)	Complexity Diversity	Stability	Hostility
Aldrich (1979)	Concentration Heterogeneity	Stability Turbulence	Capacity Consensus
Tung (1979)	Complexity Routineity	Instability	
Dess and Beard (1984)	Complexity	Dynamism	Munificence

jective measures of the environment that are consistent with existing theory as well as with managerial perceptions.

Three Environmental Dimensions

The various terms that have been used to describe the environment fall generally into three categories: complexity (the level of complex knowledge that understanding the environment requires), instability or dynamism (the rate of unpredictable environmental change) and resource availability (the level of resources available to firms from the environment). The terms used in the stream of environmental research from March and Simon (1958) to Dess and Beard (1984) are summarized in Table 1.

Thompson (1967) used two dimensions to describe the environment: *heterogeneity/homogeneity* and *stability/dynamism*. The former dimension describes whether the elements in the environment are similar to or different from one another. The latter deals with whether the elements are changing unpredictably or are stable. Child (1972) used similar dimensions in his research, labeling them *complexity* and *variability*. Child added a third dimension, *illiberality*, which reflects the availability of resources in the environment, and is similar to *munificence* (March & Simon, 1958).

Mintzberg (1979) described three dimensions of the environment similar to those proposed by Child, but added new facets for each. He introduced the term *market diversity* to reflect what Thompson meant by *heterogeneity* and Child by *complexity*, while reserving the term *complexity* for the degree of sophisticated knowledge necessary to operate in a given environment of a technical or scientific nature. Market diversity and the degree of sophisticated knowledge required appear to be distinct aspects of complexity, representing perhaps the breadth and depth of knowledge needed. Mintzberg's concept of stability included both market and technological stability, recognizing that firms must keep abreast of developments in both areas. Finally, he discussed *environmental hostility* in terms of

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both *availability of resources* (Child's illiberality) and *competition for resources*. Aldrich (1979), drawing from both the sources we have discussed and the ecology literature, also attempted to enumerate the dimensions of the environment. In his synthesis of the two literatures, Aldrich proposed that six environmental dimensions subsume all others: *geographic concentration* and *heterogeneity*, *stability* and *turbulence* (unpredictability based on environmental interconnection), and *domain consensus* (similar to competition) and *capacity*. These three pairs of constructs roughly correspond to and expand the meaning of each of the three dimensions proposed by Child (1972).

As we have suggested, the most consistent feature of the environmental literature is the presence of the three concepts whose evolution is traced in Table 1. Throughout this literature we have found discussion of (a) the degree to which the number and sophistication of elements in the environment make understanding it more difficult, (b) the stability/predictability of an environment, and (c) the level of resources available in an environment, relative to the number of firms competing for those resources.

The Dess and Beard Approach

Although Aldrich advanced the field theoretically, he devoted little attention to how these dimensions might actually be measured. Dess and Beard (1984) operationalized his dimensions, using a variety of archival data. These authors made an important advance by their use of industry-level data (using Standard Industrial Classifications, or SICs) to operationalize Alrich's environmental constructs.

Using factor analysis, Dess and Beard reduced Alrich's six dimensions to three — *complexity*, *dynamism*, and *munificence* — which roughly correspond to Child's three dimensions and to the three columns in Table 1. There has been some limited use of these or similar measures in the literature. Keats and Hitt (1988), using very similar measures, found significant relationships between the environmental dimensions and organizational strategy, structure, and performance. Lawless and Finch (1989) used the Dess and Beard data to operationalize the environmental dimensions and industry types identified by Hrebiniak and Joyce (1985).

Dess and Beard substantially advanced the study of the organizational environment, especially in the area of measurement. However, a number of theoretical issues raised by their work warrant investigation. One problem is their conceptualization of *complexity*. Although they originally predicted that a variety of measures would intercorrelate sufficiently to create this factor, the variables that loaded on complexity only reflected geographic concentration. Concentration is an important part of complexity, but Aldrich (1979), Mintzberg (1979), and others identify other components, notably market diversity and the sophistication of knowledge and information processing required.

Dess and Beard included such variables in their original conception of complexity, but ultimately did not include them in their complexity factor because they did not load with geographic concentration in their factor analysis. This decision is methodologically justified only if one assumes undimensionality in these environmental constructs a priori.

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We argue, however, that this approach leads to an unnecessarily narrow conceptual framework. There is no reason to believe that the subdimensions of any environmental construct are intercorrelated to the degree required by factor analysis. In particular, there is no reason to believe that the other aspects of complexity we have noted above are correlated with the degree to which similar firms are geographically concentrated. The significance of complexity is in its implications for the comprehensibility of the work to be performed in an organization (Mintzberg, 1979). It is clear that both the degree of sophisticated knowledge required and the diversity of environmental elements will have an impact on comprehensibility. Thus we conclude that Dess and Beard's complexity construct is incomplete. This problem is evident to some degree in each of the Dess and Beard constructs.

A second theoretical problem concerns Dess and Beard's dynamism factor, which relates to the difficulty in predicting the future of a given environment. Difficulty in prediction can stem from changes in either market patterns or technology. Dess and Beard's dynamism dimension reflects only market changes, neglecting the substantial impact created by that technological change. In fast-moving sectors where technology changes rapidly (e.g., biotechnology), product lifecycles rarely follow prescribed patterns, and radical technological advances (e.g., the invention of the transistor) can completely alter an industry. Extreme technological changes can limit or even stifle organizational adaptation (Hannan & Freeman, 1977). Dess and Beard considered including indicators of technological change in their complexity index, but omitted them when they did not load with market-oriented changes.

A third issue concerns *munificence*, which is generally seen as the extent to which an environment can provide sufficient resources for the firms present in it (Aldrich, 1979; Starbuck, 1976). Dess and Beard's construct is consistent with this definition, but lacks one critical aspect — competition for resources. It is important to understand the degree to which firms must contend with each other for environmental resources. Alrich's (1979) framework indirectly included competition in terms of domain consensus, whereas Mintzberg (1979) included it as part of his hostility construct.

A market that has little growth may be extremely munificent if it contains few competitors. Alternatively, a rapidly growing market may have little capacity for a given firm if there are many competitors (Bain & Qualls, 1987). Most industries operate under monopolistic competition (cf. Lipsey & Steiner, 1978) where products or services are differentiated. In these industries, we suggest that market growth and the amount of competition for that growth are positively related.

When few firms compete in an industry, products are differentiated, and markets are growing, it is likely that firms will make above-average profits (Bain, 1951; Datta & Narayanan, 1989). In the absence of substantial barriers to entry, such profits will attract new competitors. Unless the market grows faster than the rate at which these new firms enter, resources will become scarce and individual firm performance may suffer. Therefore, high growth alone does not ensure munificence. For the construct to be complete, competition should be factored into Dess and Beard's conceptualization of munificence.

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An Alternative Approach to Measuring the Environment

Dess and Beard have developed very useful indicators of aspects of each dimension. We see their measures as more incomplete than incorrect and wish to build on their value. Each of our constructs has a component calculated (using updated data) in a manner identical to theirs. However, the differences between the approaches are significant and deserve attention. By using factor analysis, Dess and Beard had to assume the constructs used to conceptualize the environment would be unidimensional. We do not make this assumption. Rather, consistent with the literature discussed above, we conceive these constructs to be multidimensional and constructed measures to reflect this conceptualization. (The Appendix describes our data sources and the calculation of each variable).

Revised Complexity Measure

Of all the complexity measures Dess and Beard investigated, only the geographical concentration items correlated well enough to be considered a factor. We retained these measures in our complexity construct. It is difficult to tell, however, whether Dess and Beard considered concentration as an indication of high or low complexity, because they cite plausible arguments for both. Concentration could be seen as an indication of high complexity because it means that managers would need to take a great number of organizations in their region into account when making decisions (Duncan, 1971). Alternatively, greater concentration could indicate low complexity because greater proximity of firms facilitates interfirm communication, rendering information processing easier. We find the second argument more convincing: because most product markets are national or even international, firms will have to take one another into account regardless of their location. Thus we consider concentration to represent low complexity. But complexity can also result from product diversity (Thompson, 1967) or technical intricacy (Mintzberg, 1979). The more products offered by firms in an industry, the wider the variety of production processes, markets, and inputs that firms in the industry must understand. Consistent with previous definitions, a higher number of products would increase the level of knowledge necessary to understand the industry.

A third aspect of complexity is technical intricacy. Our third indicator — intended to capture this aspect — is the percentage of scientists and engineers employed in the industry. (This measure was originally used by Dess and Beard to measure technical instability, but not included in the final construct.) We propose that the higher this percentage, the greater the degree of sophisticated knowledge required for participation in the industry (i.e., the higher its degree of technical complexity).

Indicators of both product complexity (number of distinct product categories within the SIC code) and technical complexity (percentage of scientists and engineers in the work force) were added to Dess and Beard's geographical concentration value to form our complexity index. Thus our measure indicates that the more scientists and engineers and the more product categories there are in a given industry, and the less it is geographically concentrated, the more complex (harder to understand) the industry will be.

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Revised Dynamism Measure

We have argued that dynamism/instability in an industry encompasses both *market and technological instability*, and our revised dynamism measure includes and operationalizes both of these subdimensions. Our market instability indicator is the same as Dess and Beard's (with updated data). We regressed volume of shipments and numbers of employees for the period 1973-1982 on a variable representing the time period. The market instability measure is a function of the standard errors of the resulting regression slopes divided by their respective means. This is a standardized way of indicating variability in the market indicators (number of employees and value of shipments) over time.

An indicator of technological instability — the average number of patents in an industry over time — was added to the market instability indicators, in order to more completely assess environmental dynamism. We argue that the more patents produced in an industry, the faster the technology in that industry is changing. We argue that when high levels of patents are granted in an industry, the technology of that industry is unstable. Rapidly changing technology can just as easily make an environment unstable as swings in sales and employment.

Competitive Threat Measure

Based on our contention that assessing the growth of an industry is insufficient to capture munificence, we expanded this dimension to include competition. The first part of our measure uses the eight-firm concentration ratio, which is the most commonly used measure of industry concentration (Bain & Qualls, 1987). Klein (1977) showed that substantial changes in market share indicate high levels of competition. Major changes in market shares would cause firms to move on and off the eight-firm list. Firms would only engage in competitive behavior if it accomplished the goal of increases in market share. It is hard to imagine a market where high levels of competition did not result in any change. Thus we propose that the higher total number of companies found on this list over a given time period, and the more that the market shares of the firms that remain on the list change over time, the higher the level of competition in an industry.

Constant change in the set of dominant firms indicates that competitive positions within the industry have not been established. Further, wide swings in market shares suggest high inter-firm rivalry and low customer loyalty. Alternatively, if neither the dominant players in an industry nor their market shares are changing, it is unlikely that much competition exists in the industry. The firms in such a market have claimed their niches and are able to defend them. We argue that these two dimensions — eight-firm changes and market share changes — represent the level of competition in an industry. The competition indicator for each SIC code is composed of the average market share changes for each firm that had appeared in the eight-firm concentration ratio in both 1976 and 1983 (see the Appendix) multiplied by the total number of firms making up the eight-firm concentration ratio across those sample years and 1979. This indicator of competition should give us a good representation of the fight for resources in a given industry.

Munificence is the second component of our measure. Munificence scores were created in the same manner as Dess and Beard's, by adding the standardized

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regression slopes of value of shipments and the number of employees in the period 1973-1982. This measure provides an idea of the extent of growth in the industry; the steeper the regression slope, the higher the level of growth.

Our new measure *competitive threat* was created by dividing our competition measure by our munificence measure. Thus, our indicator of competitive threat can be increased by either increases in competition or decreases in growth. This new measure is conceptually similar to Child's illiberality and Mintzberg's hostility. (We made corrections to both the numerator [taking the square root] and the denominator [adding a constant] to ensure both similarity in magnitude between them and a positive number as a result — see the Appendix.)

We have tried to demonstrate in this section that our measures of environmental dimensions and the conceptualizations on which they are based are theoretically consistent. We have incorporated in each construct subdimensions expected to have similar impacts on the firms in an environment. Thus the dimensions of our competitive threat construct indicate competition for resources: the dynamism dimensions indicate unpredictability, and the complexity dimensions difficulty of understanding. This approach has also allowed us to better incorporate into our conceptualization factors suggested by a variety of authors over several decades. Virtually all of the environmental dimensions that have been proposed relate to competition, predictability, or understanding.

Validation of the New Measures

Nomological Validity

We followed Schwab's (1980) approach to validation, which involves establishing three types of validity. The first, which he called nomological validity, could be considered theoretical validity. To develop nomological validity, one places one's constructs within a nomological (theoretical) net with other established constructs. We believe the previous sections of this article have established such links for our constructs. We described how our measures relate theoretically to the terms used in the literature.

Vertical Validity

Schwab's (1980) second type of validity, which he calls vertical validity, describes the extent to which a scale measures what it is supposed to measure, that is, effectively represents its latent construct. The conventional approach to construct validation is based on convergent validity among items (cf. Campbell & Fiske, 1959), often measured by Cronbach's (1951) alpha statistic. Although often identified as a measure of reliability, the alpha statistic actually measures the convergent validity (internal consistency) of a set of items based on their intercorrelation (Kerlinger, 1986). This method is appropriate when theory suggests that a construct is unidimensional, or that its subdimensions are intercorrelated. (Hence Dess & Beard's use of Cronbach's alpha for their unidimensional constructs.) It is not appropriate where theory suggests a multidimensional construct, and no a priori assumption of intercorrelation among subdimensions is made.

An example may help clarify this point. The mathematical construct "area of a triangle" is a function of its two subdimensions, "base" and "height." The subdi-

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mensions are included in the construct because they each can influence the area of the triangle; there is no need to assume that the base and height of any given sample of triangles are correlated. If the bases and heights of any such sample were found to be uncorrelated, this finding would not invalidate their connection to the concept of area, which can be shown through mathematical proof. Although such proofs are seldom if ever available for organizational theory constructs, this example serves to demonstrate that a construct may comprise subdimensions that are included based on the similarity of their effects, rather than on their intercorrelation.

Because the convergent validity approach was not appropriate for our multidimensional scales, we have turned to another approach suggested by Schwab to demonstrate vertical (construct) validity — a concurrent validity study (Best, 1977). In this approach, the investigator compares new measures against more established measures of the same phenomena. Given the extensive use of managerial perceptions to measure the environment (Duncan, 1972; Downey, Hellreigel & Slocum, 1975; Hansen & Wernerfelt, 1987; Lawrence & Lorsch, 1967; Leblebici & Salancik, 1981), this was the logical approach for us to choose in assessing the concurrent validity of our measures.

There are, however, potential level-of-analysis problems in the comparison of industry level measures with individual perceptions (or organizational phenomena; see predictive section below). We based our analyses on Rousseau's (1985) recommendations for cross-level research. Rousseau cautions that in order to reduce aggregation errors, any cross-level analysis should be cast at the level of the dependent variable. Towards that end, we examined dependent variables at the individual, organizational and industry levels because the environment has effects at each of these levels of analysis.

Method. To investigate the relationships between our new measures and managerial perceptions, we used interview data from 104 senior managers of 25 companies representing 16 different SIC codes. These data were collected using a structured interview protocol where the interviewees were asked a series of closed choice questions and the researcher recorded their responses. The questions included Likert style and "agree/disagree" items. These managers were senior both in terms of their position (75% were department directors or above) and in their length of time in the company (on average 4.5 years in their positions and 13.3 years in the company). The industries were selected to maximize variance across our environmental dimensions. To assess managers' perceptions of competitive threat, we asked them how difficult it is to be profitable in their industry. Concerning complexity, we asked how difficult it was to understand what was going on in their industry regarding products, technology, and so forth. To assess dynamism, we asked about the extent to which their industry was stable or dynamic. Each of these items were 7-point Likert scales. We then correlated the responses to these items with our environmental measures.

Results. We present the results of this correlation analysis in Table 2. In general, the correlations were significant and in the proper direction. We see the strongest relationship between the competitive threat measure and its perceptual item. The relationship between the dynamism scale and its perceptual item also

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was strongly significant and in the predicted direction. (This item was reverse-scaled so that a high score indicated stability and a low score indicated dynamism.)

The correlation between the complexity scale and its perceptual item was not significant. Perhaps asking managers if their markets were hard to understand was tantamount to asking them if they did not understand their jobs. Because few managers would admit to not understanding their jobs even if it were true, we looked for less obtrusive measures of complexity.

We had also asked these managers five questions about the uncertainty of the decisions they were currently facing. These questions included items on how complex were the issues involved in the particular decision, how much additional information the respondent would have like to have had, and so on. We summed these items to create an uncertainty scale (alpha = .59), which we correlated with our complexity scale. The two variables were correlated at .21 (p = .014). This correlation indicates that even though managers in more complex industries may have been unwilling to admit that their industries were hard to understand, they did describe the decisions they faced as more uncertain.

Predictive Validity

To establish predictive (horizontal) validity — Schwab's third type — one uses the new scale to predict a dependent variable that theoretically should be related. To meet this criterion, we used our dimensions (as well as Dess & Beard's) to predict industry-level performance. Because a major tenet of organizational theory is the impact of environment on performance, variables that differentiate industry environments should be able to predict industry performance.

There has been surprisingly little empirical research on industry-level performance (Bain & Qualls, 1987). The research on industry structure and performance primarily describes the effects of industry concentration (e.g., Bain, 1956; Datta & Narayanan, 1989). These findings suggest that the more that an industry is concentrated (resembles an oligopoly), the higher the average performance (Datta & Narayanan, 1989), due to decreased price competition. These findings suggest that a prediction of better industry performance could be made in environments low on competitive threat.

Consistent with these findings, the theoretical position to be tested in this analysis is quite simple. Firms, on average, should perform better in "friendly" environments, which are simple, stable, and offer substantial resources. Firms in a simple environment will have lower information processing costs (e.g., Galbraith, 1973) and an easier time understanding what is required by the marketplace (cf.

Table 2
Correlations Between the Revised Environmental Measures and Managerial Perceptions of the Environment

	Perceptions of Stability	Difficulty of Profits	Hard to Understand
Competitive Threat	−.15	.41***	−.10
Revised Dynamism	.27***	−.29***	.07
Revised Complexity	.15	−.21**	.11

*p < .1. **p < .05. ***p < .01. ****p < .001.

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Table 3
Descriptive Statistics and Correlations

Dess and Beard's Environmental Measures and 73-77 Dependent Variables

Variable	*M*	*SD*
Munificence	0.43	0.86
Dynamism	−0.34	0.77
Complexity	−0.23	0.69
Avg. Quick Ratio	0.92	0.16
% Before Tax Profit	5.47	1.52
BTP/Total Assets	9.07	1.46

	Munificence	Dynamism
Dynamism	0.29	
Complexity	−0.21	−0.11

Revised Environmental Variables and 78-82 Dependent Variables

Variable	*M*	*SD*
Revised Dynamism	9.46	7.37
Competitive Threat	9.68	0.62
Revised Complexity	10.11	2.26
Avg. Quick Ratio	0.89	0.15
% Before Tax Profit	4.55	1.26
BTP/Total Assets	8.47	1.84

	Revised	Competitive
Competitive Threat	−0.19	−0.08
Revised Complexity	0.16	

*$p < .1$. **$p < .05$. ***$p < .01$. ****$p < .001$.

Child, 1972). Firms in a stable environment do not have to respond to changes and can spend their energies increasing efficiencies (Porter, 1985). Firms in simple and stable environments also seem less likely to squander resources on incorrect decisions. Finally, if there are numerous resources and few competitors, firms may be able to charge monopolistic (or at least oligopolistic) prices, thus reaping substantial returns.

Method. The most direct test of this theoretical position would have been to collect data for both sets of measures from the same industries and time periods and compare their predictive power. Unfortunately, this was not possible; the data necessary for our competition measures were unavailable for the period for which the Dess and Beard measures were constructed. Given this limitation, recent data from one sample of industries were analyzed, as well as data from a sample of Dess and Beard's original industries. Each sample was selected using the criterion that the industry be listed in the Robert Morris Associate's (RMA) *Annual Statement Studies*, which we believe to be the best source of industry performance data. This criterion yielded a sample of 45 industries, 23 of which were studied by Dess and Beard. Descriptive statistics and intercorrelations for each sample are presented in Table 3.

Measuring aggregate industry performance involves several conceptual and empirical difficulties. Bain and Qualls (1987) suggest that any approach must average data over several years to ensure the accurate analysis of long-run trends, and the organizational performance literature (e.g., Kirchoff, 1977) suggests that

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Table 4A
Dess and Beard's Measures and the 1973-1977 Industry Performance Measures

	BTP	BTP/Total Assets	Quick Ratio	Performance Scale
Munificence	.02	.13	.05	.08
Dynamism	.12	–.17	–.11	–.06
Complexity	.19	–.03	–.20	–.02

$N = 23$
$^{*}p < .1$. $^{**}p < .05$. $^{***}p < .01$. $^{****}p < .001$.

no single measure can capture all of this concept's intricacies. We selected the average industry performance approach to address both concerns.

Three measures of performance — profit, activity and liquidity — were averaged over the appropriate period to create the dependent variables used in our analysis. These variables, whose names were taken from the *RMA Annual Statement Studies*, are commonly accepted as regular parts of a financial analysis (Thompson & Strictland, 1987). The percentage of before-tax profit (BTP), also known as before-tax Return on Sales, was our profit-oriented measure. To measure performance in terms of activity, a capacity utilization measure (BTP/Total Assets, also known as before tax Return on Assets) was employed. This ratio tells how efficiently assets are being used to generate profits. The third area of performance measurement was liquidity, specifically the quick ratio. This value describes how well on average firms can meet their current cash flow needs without having to sell inventory.

For each performance measure, industry-level averages were collected for the relevant periods. Most of the data from the Dess and Beard measures were from the period 1973-1977; for our measures, the relevant time period was 1978-1982. Five-year averages for each of the industry-level performance measures were calculated to gain a clearer idea about trends in the environment. Using average data reduces the impact of specific year-to-year aberrations. We used these values as the dependent variables and the two sets of environmental measures as the independent variables in our analysis.

Two analyses were done using each set of independent variables. In the first analysis, we used bivariate correlations: each of the three environmental measures was correlated with the three corresponding performance measures (See Tables 4A & 4B). Because the performance measures we selected were highly intercorrelated, we also created a performance scale by adding together *Z*-score transformations of each of the measures. The *Z*-scores were used because the dependent

Table 4B
The Revised Environmental Measures and the 1978-1982 Industry Performance Measures

	BTP	BTP/Total Assets	Quick Ratio	Performance Scale
Competitive Threat	–.19	–.15	–.07	–.16
Revised Dynamism	.46**	.47**	.44**	.56***
Revised Complexity	.42*	.34	.13	.36*

$N = 22$
$^{*}p < .1$. $^{**}p < .05$. $^{***}p < .01$. $^{****}p < .001$.

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Table 5A
Regression Results Using the Dess and Beard Environmental Measures and the 1973-1977 Performance Scale

Variables	*B*	*SE (B)*	*Beta*	*T*	*SIG (T)*
Munificence	–.019	.744	–.006	–.026	.98
Dynamism	–.274	.683	–.096	–.401	.69
Complexity	.277	.623	.108	.445	.66

F (3,19) = .096 *SIF (F)* .96 R^2 .01

measures were on quite different metrics. For the 1978-1982 data, this yielded a scale with an alpha of .78; for the 1973-1977 data, the alpha is .66.

As one can see from the Table, none of the Dess and Beard measures were significantly related to the dependent variables. The lack of significant relationships might be a function of the small sample size (23) employed in the analysis. With a larger sample, a different picture might have emerged.

We do, however, see several significant relationships in Table 4B. Both our complexity and dynamism measures are strongly related to the individual performance measures. However, the direction of these relationships is the opposite of our prediction: the more dynamic and complex the environment, the better the industry performed. Only the correlations with the competitive threat measure were in the predicted direction, but these correlations were not significant. Again, given the fact that the significance tests of bivariate correlations are sensitive to sample size (22), caution must be exercised in interpreting these results.

Next we performed a multiple regression for each set of measures, using the performance scale as the dependent variable and the environmental measures as independent variables. This allowed us to further investigate the proposed relationships, as well as any joint effects among the environmental and industry-level performance measures. The results of these analyses are presented in Tables 5A and 5B.

The results of this analysis confirm the results of the correlation analysis. The Dess and Beard environmental measures predict very little variance in their associated performance scale (Table 5A). However, a substantial portion (38%) of the variance in the 1978-1982 performance scale was explained by the equation constructed with our revised environmental measures (Table 5B). The vast majority of this explained variance (32%) comes from the revised dynamism measure. This analysis, confirming the correlational results, suggests that our revised envi-

Table 5B
Regression Results Using the Revised Environmental Measures and the 1978-1982 Performance Scale

Variable	*B*	*SE (B)*	*Beta*	*T*	*SIG (T)*
Competitive Threat	–.17	.70	–.05	–.25	.81
Revised Complexity	.28	.19	.27	1.47	.16
Revised Dynamism	.16	.06	.51	2.67	.02
(Constant)	–2.59	7.25		–.36	.72

F (3,18) = 3.82 *SIF (F)* .03 R^2 .38
$^*p < .1$. $^{**}p < .05$. $^{***}p < .01$. $^{****}p < .001$.

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ronmental measures better predict industry-level performance than the Dess and Beard factors.

Predicting organization-level phenomena. We have described above how the revised environmental measures are related to managers' perceptions of their environment and how our revised complexity measure is related to a decision uncertainty scale. To further demonstrate the predictive validity of our measures, we looked at two other organizational phenomena, formalization and environmental information gathering. Formalization was selected for its potential relationship to competitive threat, and environmental information gathering as a response to the information processing demands presented by complexity and dynamism.

Our prediction about the relationship between formalization and our environmental measures was that firms, recognizing the need to be flexible, would have and use fewer rules in times of competitive threat or instability and in complex markets. To investigate the relationship between our measures and organizational formalization, we used some additional interview data from our managerial informants. We adopted the Aston (cf. Pugh, Hickson, Hinings, & Turner, 1968) definition of formalization as the presence of written rules and procedures.

The managers were asked two questions about formalization. The first concerned the extent to which the activities of their firm were governed by either written or unwritten rules. The second question asked whether the rules they followed were written or unwritten. The more rules there were and the more that the manager followed written rules, the more formalized was the firm. Surprisingly, the two items were insufficiently correlated to be combined in a scale. As a result, we assessed the correlation of each item with our environmental measures. The results of these analyses can be found in Table 6.

Our prediction was supported with both the dynamism and complexity variables, at least with the "use of written rules" item. The correlation between dynamism and the "presence of rules" item was also significant and in the predicted direction. The anomaly in the results came with the correlation between competitive threat and the "use of written rules" item. This correlation, contrary to prediction, was positive and highly significant. One possible explanation for this result is that in highly threatening environments, firms respond with the rigidity response described by Staw, Sandelands, and Dutton (1981) and Bourgeois, McAllister, and Mitchell (1978). The formalization of the firm through written rules, although not rational, may be comforting to managers in threatening times.

We also predicted that in complex, unstable, and threatening markets, firms would engage in more market information gathering so as to acquire as much in-

Table 6
Correlations Between the Revised Environmental Measures, Two Measures of Organizational Formalization and Two Measures of Environmental Information Gathering

	Presence of Rules	Use of Written Rules	Market Research
Competitive Threat	–.03	.35****	–0.30***
Revised Dynamism	–.25**	.17*	0.37****
Revised Complexity	–.13	–.33****	0.18*

*$p < .1$. **$p < .05$. ***$p < .01$. ****$p < .001$.

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telligence as was possible. To analyze the relationship between our environmental measures and information gathering, we used a scale made up of items that asked about the extent to which the company conducted or purchased market research (alpha = .67).

As one can see from Table 6, the environmental measures were significantly related to these formalized market research activities. The correlations followed a pattern similar to those of formalization and our environmental measures. They indicated an increase in market research activities in dynamic and complex markets (as predicted) and a decrease in competitively threatening ones. Again, this anomalous result for competitively threatening markets suggests that in those kinds of environments, a rigidity response may occur despite the irrational implications of this choice.

Discussion

Whenever small-sample analyses are done, researchers must be careful in interpreting the results. The sample sizes presented in some of these analyses limit the extent to which broad statements can be made about the relative predictive power of the two approaches. Small-sample analyses lead to a conservative estimation of any relationship. With this power caveat in mind, we now discuss our analysis in terms of the validity of our measures. Following Schwab's (1980) approach, rather than relying on a single validity technique, we used three approaches to triangulate our findings.

Nomological validity. First, we connected our measures to previous work in the field. Our review of the organizational theory literature revealed three environmental constructs: complexity, instability/dynamism, and resource availability. From these three constructs we developed a set of multidimensional measures based on the literature. By doing so, we have met Schwab's criterion of nomological validity. With the establishment of nomological validity for such measures, Schwab (1980) contended that two additional types of validity must be addressed: horizontal (predictive) and vertical (construct) validity.

Vertical validity. Because our constructs are theoretically derived, they include subdimensions for which no a priori assumption of intercorrelation is made. We are faced with the problem of demonstrating the validity of these measures without employing traditional construct validity techniques (e.g., alpha or factor analyses). In order to demonstrate construct validity, we chose a technique called concurrent validation (e.g., Best, 1977). In this approach, the validity of a measure is demonstrated by showing its relationship to accepted approaches of measuring the phenomena. In our case, we correlated managerial perceptions of their environment with our environmental measures. In general, the relationships were significant and in the correct direction.

When our measures indicated an environment was high in competitive threat, managers in these environments reported it was harder to be profitable. In dynamic environments, managers suggested that their markets were more unstable. In complex environments, managers described their decisions as more uncertain. These results suggest that our measures are both related to the previous literature and have tapped constructs that have meaning to senior managers. After demon-

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strating the construct validity of our measures, we turned to the issues of horizontal or predictive validity.

Horizontal validity. In order to demonstrate the horizontal validity of our measures, we predicted both industry-level performance and two different firm-level variables. We found a fairly strong relationship between the dynamism scale and industry-level performance, suggesting a different conception of environmental change. In industries that have a high level of change, more firms may be able to capitalize on such changes by adopting narrow, niche strategies (Carroll, 1984). Thus changes may represent opportunities, rather than something from which firms need to be protected.

The new dynamism measure captures both changes in sales/employment and changes in technology. In industries with rapidly changing technologies, firms can claim high value-added opportunities. Porter (1985) might have explained this result by saying that a high level of patents in an industry leads to higher barriers to entry and oligopolistic performance (Bain & Qualls, 1987). In fast moving industries such as computers, however, this may not be the case, because patented technology may be outdated by the time the patent is granted. Rather, as Schumpeter (1949) might have predicted, we believe that the high level of technological change, which is represented by a high level of patents, creates opportunities for growth.

The relationship underlying this dynamism-performance link may be explained by examining an industry's general stage in the life cycle. The technology in emergent and growth industries is changing, as are their market patterns. Value-added opportunities based on either market or technological moves are common. As industries enter mature stages, the frequency of these value-added opportunities declines because the industry flows toward equilibrium.

We also looked at the extent to which the firm's environment predicted its use of written rules and environmental information gathering. In both cases an interesting result occurred. In complex and unstable environments, managers suggested that their firms had fewer written rules and engaged in more market research, as we predicted. These firms seemed to be trying to reduce their uncertainty and increase their flexibility as would be appropriate in complex, unstable environments. In addition, they appear to be trying to increase their information-processing capability (e.g., Galbraith, 1973). However, in competitively threatening environments, the managers reported that their firms had more written rules and did less market research, the opposite of our prediction. The most plausible explanation is that in competitively threatening environments, firms engage in the rigidity response suggested by Staw, Sandelands, and Dutton (1981) and Bourgeois et al. (1978). Both a lower level of market research and a higher level of written rules indicate a rigid firm, sticking to its own ways regardless of any fit with the environment.

Advances in measuring the environment. Our approach for measuring the environment is quite different than Dess and Beard's (1984). In their work, they defined Aldrich's (1979) dimensions using a variety of measures, and they performed a factor analysis on that data. They defined the resulting factors as environmental dimensions. In their approach, the critical assumption is made that

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the environmental factors are unidimensional. Here, no assumption of unidimensionality was made. Rather, the validity of our measures was supported using three distinct approaches. First, the literature on the environment was reviewed and support was found for three constructs that subsume Dess and Beard's (1984) factors. These constructs are multidimensional and contain elements for which no a priori assumption can be made about their intercorrelations. Rather, arguments are presented that describe the effects that they have on organizations. These effects are then combined in formulae appropriate for each particular measure.

Second, when we compared the predictive power of these measures with those of Dess and Beard (1984) we found striking differences. No significant relationships were found between the Dess and Beard data and their appropriate set of dependent variables. With the revised measures, four of the relationships were significant. Along with strong bivariate relationships, a multiple regression showed that our revised measures accounted for approximately 38 percent of the variance in their set of industry performance variables. Further, the new measures also were significantly related to two sample organizational phenomena that were studied. Using correlation analyses, we were able to demonstrate that our measures were significantly related to the presence of formal rules and procedures and the use of market research for environmental information gathering.

We have demonstrated that our measures are consistent with the dominant themes of the literature. We also have been able to establish the construct and predictive validity of our measures. Specifically, we have shown that our measures capture many of the environmental pressures perceived by senior managers. Our measures were able to discriminate between industries on the basis of aggregate industry performance and between firms on the basis of formalization and environmental information gathering. By creating these measures and establishing their validity, we have advanced our understanding of the impact that the environment has on organizations and increased our ability to measure that impact.

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Appendix

Definition of the New Environmental Dimensions

Item	Name	Calculation	Data Source
1.	Revised Dynamism Measure		
1.A	Value of Shipments Instability (VSI)	Standard error of the regression slope of value of shipments over 1973-1982 divided by the mean of value of shipments.	U.S. Bureau of the Census, 1982 Census of Manufactures.
1.B	Number of Employees Instability (NEI)	Same procedure as 1.A using number of employees.	Same as 1.A
1.C	Technological Instability (TI)	Average number of patents granted in the industry from 1973-1982	Invention Summaries, U.S. Patent Office, 1984
New	Dynamism Measure (ND)	$ND = Z(VSI + NEI) + Z(TI) + 10$ (1) (2)	
2.	Competitive Threat		
2.A	Value of Shipments Munificence (VSM)	Regression slope of the value of shipments over 1973-1982 divided by the mean of value of shipments.	Same as 1.A
2.B	Number of Employees Munificence (NEM)	Same procedure as 2.A using the total number of employees.	Same as 1.A
2.C	Number of Firms in the Eight Firm Concentration Ratio (NF)	Total number of different firms appearing in the top eight market share holders in the data sets from 1976, 1979 and 1983.	Trinet Corp. Large Business File Tape
2.D	Average Market Share Change (MSC)	Each firm that appeared in both 1976 and 1983 top eight was selected for analysis. Each firm's market share was compared across the time periods and the absolute value of the change was calculated. The average of these absolute values was then used as average market share change.	Same as 2.C

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Appendix continued

Competitive Threat Measure (CT)	$CT = Z\left(\frac{\sqrt{NF * MSC}}{(10.05 + MUN)}\right)$ where $MUN = VSM + NEM$ (2)		
3.	Revised Complexity Measure		
3.A	Geographic Concentration of Firms (GCNF)	Sum of the total number of the firms in a census division squared divided by the total number of firms in that census division — quantity squared (see Dess and Beard 1984 for a discussion of the procedure).	U.S. Bureau of Census, Census of Manufactures, General Statistics by Geographic Area 1982.
3.B	Geographic Concentration of the Number of Employees (GCNE)	Same procedure as 3.A using total number of employees.	Same as 3.A
3.C	Percentage of Scientists and Engineers (SE)	Estimated employee levels of all scientists and engineers as a percentage of the total workforce in an industry.	Employment Patterns in U.S. Industry, Bureau of Labor Statistics, 1983.
3.D	Number of seven Digit (product level) SIC codes (SDC)	Total number of product categories in each identified industry.	Same as 1.A
New Complexity Measure	$Z(SDC) + Z(SE) - Z(GCNF + GCNE) + 10$ (2)		

(1) *Z* scores were used to insure that all scale values were on the same metric.

(2) The various linear transformations that have been used were done to prevent the calculation from creating non-meaningful numbers. It was assumed that an environmental dimension could only be non-existent and not negative. Therefore the limits of all three dimensions are 0 and positive infinity.

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