MEASURING ENVIRONMENTAL UNCERTAINTY

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Abstract

The goal of this paper is to report the development of a multi-item measure of environmental uncertainty to be used in a variety of marketing contexts. This measure evaluates the uncertainty within six critical environmental sectors or components: supply environment, competitive environment, demand environment, financial/capital environment, labor environment and regulatory environment. Evidence for the reliability and validity of this operationalization of environmental uncertainty was provided by an empirical test conducted in the US lodging industry.

Keywords: Environmental uncertainty, competition, marketing strategy.

Introduction

The rapid changes facing organizations in today's global business environment make it imperative to develop marketing strategies that incorporate environmental uncertainty as a key variable (Ansoff 1991). As a result, the manner in which this construct is conceptualized, operationalized and measured becomes critical. While marketing serves a boundary function between the firm and its customer, channel and competitor environments (Day 1992), environmental management, as a marketing imperative, has only recently attained prominence in the marketing literature (Zeithaml and Zeithaml 1984).

A recent article on agency and related theories in the *Journal of Marketing* identified shortcomings in the operationalization of commonly used strategic marketing constructs such as environmental uncertainty (Bergen, Dutta and Walker 1992). After summarizing a number of studies that have utilized a variety of operational definitions of the 'uncertainty' construct in agency theory-related research, the authors conclude:

> Aggregate measures of 'environmental uncertainty', such as historical variance in a firm's performance, may not adequately capture the psychological dimensions of the construct from an individual agent's perspective. (Bergen, Dutta and Walker 1992: 20)

The primary purpose of this paper is to propose a measure of environmental uncertainty that addresses some of the shortcomings identified by marketing scholars (Bergen, Dutta and Walker 1992; Oliver and Weitz 1991). First, we describe the environmental uncertainty construct, examining its conceptualization from the perspective of different academic disciplines, briefly outlining the alternative measurement approaches used and presenting evidence of what works and why. Though space limitations preclude an exhaustive review of the environmental uncertainty literature (for an extensive review, see Jauch and Kraft 1986), we do incorporate findings from other disciplines - particularly organization theory - that are germane to marketing issues. Next, we review the marketing literature that has used environmental uncertainty as an exogenous variable. While this review is brief (for an extensive review, see Achrol 1992), we attempt to highlight the strengths, identify weaknesses and propose

suggestions for the improved conceptualization and measurement of this construct. Finally, we offer a potentially useful measure of environmental uncertainty, assess its validity, reliability and unidimensionality, examine its limitations and suggest some areas in which this construct may be used in marketing research.

Conceptual background

The preoccupation with the contingent nature of the organization-environment interface and its implications for marketing can be traced back to the recognition of organizations as open systems (Thompson 1967). Over the last twenty-five years, the literature on the environment of organizations has offered a number of different, sometimes competing, conceptual positions. These positions fall into three broad 'issues': dimensions of environmental uncertainty, components of the environment and alternative measurement approaches. In the following sections, we present the essential elements of each issue, briefly analyze competing positions and develop a rationale for our study.

Dimensions of environmental uncertainty

A primary issue that has defied consensus in the environmental uncertainty literature is the multidimensionality of the environmental uncertainty construct. Burns and Stalker (1961), in viewing organizations as open systems, proposed the notion of contingent organization adaptation by classifying organization environments as stable and volatile. Building on this, Emery and Trist (1965) develop a typology of four environmental states based on the rate of change in the environment: placid- randomized, placid-clustered, disturbed-reactive and turbulent field. These environmental states, arranged in ascending order of change and uncertainty, each require a different type of strategy and structure.

In organization theory, a great deal of attention has been focused on attempting to establish the nature and scope of organizational environments. Thompson (1967) stressed that co-alignment of the organization with its environment should be a basic function of administration. Duncan (1972) defined the environment of a firm as 'the totality of physical and social factors that are taken directly into account in the decision making behavior of individuals in the organization'. Up to this point, environmental uncertainty

was viewed as a unidimensional construct. Child (1972), however, disaggregated the environmental uncertainty construct into its three separate dimensions: variability (frequency of change in relevant environmental activities), complexity (the degree of difference involved at each change) and illiberality (the degree of irregularity in the overall pattern of change). Aldrich (1979) extended Child's view of environmental uncertainty by re-configuring the environment into six dimensions: environmental capacity, environmental homogeneity-heterogeneity, environmental stability-instability, environmental concentration-dispersion, domain consensus-dissensus and turbulence. Dess and Beard (1984) reduced Aldrich's codification of environmental dimensions in a more parsimonious set to include munificence, dynamism and complexity. Achrol and Stern (1988) integrated the work of Aldrich (1979) and Dess and Beard (1984) by examining the environment in terms of its diversity, dynamism, concentration, capacity or munificence, interconnectedness, conflict and interdependence.

There is limited empirical evidence available on which environmental dimensions are key (Walker and Reukert 1987). In essence, past researchers have empirically examined primarily two dimensions of the environment: dynamism (the rate of change, variability or volatility) and complexity (the number and nature of factors affecting the organization and their interrelationships). Previous research has shown that, compared with complexity, dynamism is a more important contributor to decision-making uncertainty (Duncan 1972; Achrol and Stern 1988).

Components of the environment

Another issue in operationalizing environmental uncertainty concerns the components to be included in a multi-item measure of the construct. Duncan (1972), in his definition of the environment, included customers, competitors, suppliers and regulatory groups. Similarly, in the marketing channels literature, Achrol, Reve and Stern (1983) classify the environment into its major sectors: input sector, output sector, competitive sector and regulatory sector. Elements within each of these sectors represent, to a greater or lesser degree, stakeholders in the organization. Bourgeois (1978), who refined Duncan's (1972) instrument, acknowledged that his instrument did not include supply of capital as a component. Miles and Snow (1978), who included the supply of

capital in their instrument, on the other hand, omitted supply of labor. Achrol and Stern (1988) operationalized environmental dynamism as three derived subconstructs: dynamism in marketing practices, stakeholders (i.e., suppliers and regulatory groups) to environmental dynamism.

By incorporating only selected components of the environment in their measures of environmental uncertainty, researchers may inadequately represent the domain of the construct in those measures. For example, the supply of labor is critical to marketing management, especially in the distributive trades; by ignoring it in their measures, researchers may have neglected a key contributor to environmental uncertainty.

The operationalization of environmental uncertainty developed here extends previous research by incorporating components from each sector of a firm's environment (i.e., the input sector, the output sector, the competitive sector and the regulatory sector). Thus, the relevant environment is being defined here as the organization's customers, competitors and suppliers (of materials, labor and capital) as well as governmental agencies regulating its activities.

Alternative measurement approaches

A third issue that has frequently been debated in the literature deals with whether environmental uncertainty should be measured using archival or perceptual data. Child (1972) suggests that the environment can have an impact on the organization only if it is perceived. In stressing the greater importance of perceptual measures from both a philosophical and methodological viewpoint, Anderson and Paine explain: 'internal characteristics (rather than the objective characteristics of the environment) are the most important properties to consider' (1975: 831). In support, Snow and Darran argue:

> Relying on perceptions is appropriate when an investigation is attempting to determine how an organization (its managers) views the behavior of the environment, because any response subsequently developed will be consistent with these perceptions. (Snow and Darren 1975: 279)

Marketing researchers that have used archival measures of environmental uncertainty have called for the development of additional measures (McKee, Varadarajan

and Pride 1989; Oliver and Weitz 1991). In recommending an approach to measuring environmental uncertainty, Bergen *et al.* offer the following:

> Subjective measures of the uncertainty perceived by individual agents, such as the perceived uncertainty in the linkage between individual effort and job performance, might be used in conjunction with more objective financial measures (e.g., Oliver and Weitz 1991, p. 20). (Bergen *et al.* 1992)

Further, a growing body of research centering on the relationship between managerial beliefs and perceptions and organizational survival and performance supports the idea that managers derive strategies based on their world view (Bourgeois 1985; Oliver and Weitz 1991). In resolving the perceptual/archival issue, Boyd, Dess and Rasheed (1993: 221) offer guidelines for the relative appropriateness of archival versus perceptual measures: 'those studies of firm actions, such as executive information search or decision making,' they offer, 'would benefit most from the use of perceptual measures.'

Environmental uncertainty and marketing research

A number of recent studies have used the environmental uncertainty construct in marketing research (Table 1). These studies are based on a variety of theoretical frameworks predominated by organization theory (Achrol and Stern 1988; Burke 1984; Dwyer and Welsh 1985; Etgar 1977; McKee, Varadarajan and Pride 1989; Spekman and Stern 1979), transaction cost analysis (Anderson 1985; Heide and John 1988; Klein, Frazier and Roth 1990), and agency theory (Bergen, Dutta and Walker 1992).

In including environmental uncertainty as an exogenous variable, marketing researchers have employed a variety of conceptual and methodological approaches to define this construct. A review of these studies reveals some important shortcomings. Three major concerns are: (a) level of analysis, (b) inconsistent labels, (c) validity and reliability.

Level of analysis

The 'level' of the environment is an important consideration when assessing a decision maker's coping response. The studies we reviewed included CEOs, general

managers and retail store managers' decisions being related to the same construct (cf. Etgar 1977; Klein, Frazier and Roth 1990; McKee, Varadarajan and Pride 1989). Consideration needs to be given to matching the decision maker's domain with the appropriate environmental domain. For example, while the environmental domain for a CEO might more appropriately be the general environment (e.g. social, political, etc.), the relevant domain for a retail store manager is more likely to be the task environment (e.g. customers, competitors, etc.). While the CEO is concerned primarily with corporate strategy or domain definition, the retail store manager may be more concerned with business strategy or domain navigation (Bourgeois 1980).

Inconsistent labels

Another problem that permeates environmental uncertainty research is the inconsistent use of terms or labels. This has often led to inconsistencies in the operationalization and measurement of the construct. We identified fifteen different operationalizations of uncertainty that have been used in marketing research studies. For example, what Etgar (1977) called *demand stability* has been referred to as *retailer's output sector variability* (Dwyer and Welsh 1985), *customer dynamism* (Achrol and Stern 1988) and *volatility and turbulence in output markets* (John and Weitz 1989). Additionally, the choice of characteristics to include in different studies varies even if the relevant dependent variables are the same. For example, in studying channel integration, researchers have used a variety of operationalizations of environmental uncertainty, including *technological instability* (Balakrishnan and Wernerfelt 1986), *environmental diversity and environmental volatility* (Klein, Frazier and Roth 1990) and perceived environmental uncertainty (Spekman and Stern 1979). We are suggesting that, while environmental uncertainty is a multidimensional construct, a choice must be made to include those dimensions that are particularly appropriate to the research question being investigated.

Validity and reliability

The usefulness of measures used in the studies we reviewed were often compromised by reliability and validity problems. With the notable exception of Achrol

and Stern (1988), there is limited evidence of the assessment of measurement reliability and validity.

In this study, we develop and test a measure of environmental uncertainty that: (1) focuses on operationalizing dynamism as its key explanatory dimension, (2) includes a comprehensive set of stakeholders as components, (3) measures perceptions of the decision maker regarding his or her task environment and (4) presents a comprehensive assessment of reliability and validity.

Method

Context

The context for this study is the US hotel industry. This industry was selected for two primary reasons. First, it represents a substantial segment of the US economy, generating $40 billion in sales, employing about 1.64 million people (American Hotel and Motel Association 1991). Second, the hotel industry faces varying amounts of environmental uncertainty with nationwide capacity utilization (occupancy) at 61 per cent, aggregate industry losses in excess of $2.7 billion and 60 per cent of all hotels operating at a loss (Yoshihashi 1992).

The focus of our study is the measurement of environmental uncertainty (dynamism) as perceived by the chief operating officer (general manager) of the business unit (hotel) who acts as an ‘agent’ on behalf of the ‘owner’ (corporation or individual investor) in making strategic and operating decisions.

Research design

A cross-sectional field study of hotel general managers was designed. The hotels invited to participate in this study were selected from a national database of 25,711 hotels maintained by the former public accounting firm of Laventhol and Horwath. Of the total database, 200 hotels with 150 rooms or more were randomly selected to be included in the study. This minimum hotel size ensured that hotel management consisted of a team (as opposed to a single manager). This condition was necessary for determining the multiple informant or inter-rater reliability of the environmental uncertainty item.

To enhance the content validity of the measures used in this study, the questionnaire was extensively pretested with knowledgeable experts and practicing hotel managers. After appropriate revisions, the questionnaire was mailed to general managers of the sampled hotels. After mail and telephone follow-ups, 176 usable questionnaires were obtained from 1952 delivered questionnaires. This 9 per cent response rate compares favorably to that obtained in other surveys of hotel executives (cf. Laventhol and Horwath 1988; Schaffer 1986), where financial data were requested.

General characteristics of the responding organizations were compared with secondary information on the study population (Laventhol and Horwath 1988; US Department of Commerce 1987). While the location within which sample hotels operate (e.g. central city, suburban, airport) was not significantly different ($p > 0.10$) from the population, two key differences between the sample and the population were found. First, franchised hotels were overrepresented in the sample and, correspondingly, independent hotels were underrepresented in the sample ($p > 0.05$). Second, the sample hotels had more rooms on average than did the population of hotels. Because the sample was designed to include only those hotels with 150 or more rooms, these two key differences were not unexpected. Thus, care must be taken in generalizing the results of this study to smaller, independent hotels.

To test for the possibility of nonresponse bias, the Armstrong and Overton (1977) test was undertaken. With this test, late responders are presumed to be more like nonresponders than are early responders. The sample was split into two groups based on the median response time (fourteen days) to the questionnaire mailing; the difference in mean response time between the two groups was significant at the 0.01 level. No significant differences between the two groups were uncovered on a number of key variables including total sales, net income, rooms available for sale, days open for business and the overall measure of perceived environmental uncertainty developed in this study. These results, then, suggest that respondents are not likely to differ from nonrespondents.

Measurement

Although a number of strategic marketing issues were measured in the mail survey, our focus is upon *perceived environmental dynamism.* This construct was measured by questionnaire items developed by Miles and Snow (1978: 200) for their study of the food processing and electronics industries. These items are applicable to a broad variety of industries and were slightly modified to fit the specific context of the hotel industry (Sasser, Olsen and Wycoff 1978).

General managers' perceptions of the dynamism in the environments facing their hotels were obtained on 6-point semantic differentials ranging from stable to volatile. These differentials were based on twenty items descriptive of six components of a hotel's task environment (e.g. suppliers, competitors, customers, regulatory groups). Table 2 enumerates the complete list of the task environment components used in this study.

To determine the adequacy of any measure of any marketing construct, evidence of its reliability and validity must be offered. A number of tests were undertaken to assess the reliability and validity of the measure of environmental uncertainty developed here. First, the unidimensionality and reliability of the measure were examined. Next, the content validity of our measure was assessed. Then, convergent and discriminant validity were evaluated. Finally, the nomological validity of the measure was determined.

Validating a measure of perceived environmental uncertainty

Unidimensionality and reliability

A critical failing of traditional methods for determining the reliability of a measurement scale is that they do not consider the unidimensionality of the items comprising the scale. 'Unidimensionality refers to the existence of a single trait or construct underlying a set of measures' (Gerbing and Anderson 1988: 186). If a set of items is multidimensional, it represents more than one trait or construct. Because measurement theory presumes that a single trait or construct is measured by a set of items (Hattie 1985: 49), any assessment of a scale's reliability and validity without ensuring its unidimensionality is meaningless.

To overcome these difficulties, Gerbing and Anderson (1988) have offered a covariance analysis approach for developing unidimensional measurement scales. We use

this approach for evaluating the unidimensionality and reliability of the perceived environmental uncertainty items described above.

The first step in developing a unidimensional and reliable measure of perceived environmental uncertainty was to determine whether the twenty items represented a single underlying construct. Using LISREL VII, a confirmatory factor analysis model, assuming a single underlying construct, was estimated (Chi-Square = 630.10; df = 104; P = 0.000; GFI = 0.636; RMSR = 0.319; CFI = 0.565; Chi-Square/df = 6.059).

The poor fit of the single construct model points out that the perceived environmental uncertainty scale lacks unidimensionality. A plausible explanation for this is that the twenty items reflect not one dimension but the six major components of the environment facing hoteliers. Accordingly, a first order model which posited six underlying dimensions (i.e. the factor structure implicit in Table 2) was developed and then estimated.

The initial six-factor model (Model Ml of Table 3) with all twenty items failed to achieve an acceptable fit (Chi-Square = 289.50; df = 155; p = 0.000; GFI = 0.848; RMSR = 0.129; CFI = 0.889; Chi-Square/df = 1.868). An examination of the standardized residuals suggested that the GOVPERS item was not tapping the government regulatory component of the environment as strongly as were the other five indicators. In other words, the measurement of this component was not unidimensional with the GOVPERS item included in the model.

The model was respecified by eliminating the GOVPERS item and then re-estimated. This modified model (M2) still did not achieve acceptable fit (Table 3). The pattern of normalized residuals again suggested how to change the model. This iterative procedure continued until the final model (M5) was reached. In that model, no normalized residual exceeded 2.0 (Bagozzi and Yi 1988: 81) and, in addition, the model achieved an acceptable fit (Chi-Square = 119.46; df = 90; p = 0.021; GFI = 0.916; RMSR = 0.082; CFI = 0.976; Chi-Square/df = 1.327). While the fit of the final model could be improved further, such improvements were not conceptually justified. Parameter estimates for this model are reported in Table 4.

These findings point out that the original perceived environmental uncertainty scale is composed of six dimensions. They also show that these six dimensions are

reflected by sixteen observable indicators. Moreover, the reliabilities of the six dimensions are all well above Nunnally's (1978) 0.70 guideline.

To determine whether these six dimensions or components were reflective of a single higher-order construct, perceived environmental uncertainty, a second-order confirmatory factor analysis was conducted. Figure 1 shows the second-order factor model solution. The hypothesized second-order factor model fitted the data marginally well (Chi-Square = 138.42; df = 99; p = 0.005; GFI = 0.902; RMSR = 0.124; CFI = 0.987; Chi-Square/df = 1.398). In this model, however, nineteen of 120 possible standardized residuals (15.8 per cent) were larger than 2.0.

As a further indicator of the goodness-of-fit of the second-order solution, Marsh and Hocevar's (1985: 570-1) target coefficient (*T)* was calculated. *T* measures how well a higher-order factor solution explains the covariation among first-order factors and is computed as the ratio of the chi-square of the first-order model to that of the higher-order model. The higher the value of *T,* the more the second-order solution is a parsimonious representation of the first-order factors (Marsh and Hocevar 1985: 570). *T,* like GFI and CFI, has unknown distributional properties and an upper bound of 1.

For this model, *T* was computed to be 0.863. Although *T* is less than the usual rule of thumb of 0.90 for fit indices of this type (i.e. those whose distributions are unknown), it approaches that criterion. Attempts at improving the fit of the model proved fruitless; increased fit could only be achieved at the expense of conceptual rigor. Thus, for purposes of our study, the second-order factor analysis model explains the variation in the first-order factors adequately. Moreover, the reliability of this second-order construct, which we term perceived environmental uncertainty, was found to be 0.861.[1]

Two additional pieces of evidence support the reliability of this measure. First, Coleman and Gaetan (1985) have also found the internal consistency of the perceived environmental uncertainty measure employed in this study to be acceptable. Next, for a subsample of respondents (n = 70), a second member of the top management team rated the perceived environmental uncertainty items. From these data, measures of uncertainty were created for the second respondent. A comparison of the means of uncertainty scales for the general managers and the second member of the top management team indicated

no significant difference ($p > 0.10$). Thus, the perceived environmental dynamism measure appears to possess adequate multiple informant or inter-rater reliability.

In summary, the above evidence attests to the dimensionality and reliability of the measure of perceived environmental uncertainty developed here.

Content, convergent and discriminant validity

The content validity of our measure was demonstrated by the steps taken in developing the questionnaire items. Our measure was based on previous measures reported in the literature, especially those developed by Miles and Snow (1978: 200) and Coleman and Gaetan (1985). In addition, they were subjected to extensive pretesting by both knowledgeable experts and practitioners. Moreover, those items not consistent with the domain of the content of each environmental component's measure of uncertainty were eliminated in the analysis.

Convergent validity is indicated by the significance of the confirmatory factor analysis loadings. Each loading not fixed a priori was indeed significant ($p < 0.05$), providing evidence of the measure's convergent validity (Table 4).

To test the *discriminant validity* of the measure, we examined whether the intercorrelations of the six environmental component uncertainty measures were significantly different from 1.0 (Phillips 1982). All of the fifteen possible component intercorrelations, tested one at a time, were found to be significantly less than 1.0; this was taken as evidence for the measure's discriminant validity (Table 4).

Nomological validity

This facet of validity evaluates the degree to which a construct's measure performs as predicted by marketing theory. As McKee, Varadarajan and Pride (1989) point out, perceived environmental uncertainty moderates the relationship between an organization's strategy type and its performance. A test of this moderating effect was undertaken to determine the nomological validity of our measure of perceived environmental uncertainty. Organizational strategy type was measured by Miles and Snow's (1978) self-typing instrument and performance was indicated by net income as a percent of sales revenue.[2] The data were analyzed using moderated multiple regression.

The dependent variable was performance and the independent variables were dummy variables representing the defender and prospector organizational strategies,[3] the overall measure of perceived environmental uncertainty,[4] and two interactions terms (i.e. the product of the perceived environmental uncertainty measure and each of the two organizational strategy dummy variables). These latter two terms were included to capture the moderating effects under investigation (Cohen and Cohen 1983).

The regression results ($R = 0.287$; $df = 5, 163$; $p < 0.05$) showed perceived environmental uncertainty to moderate the defender - profit performance link as well as the relationship between the prospector strategy and the hotel's profit performance ($p < 0.05$). These findings provide evidence of the nomological validity of the perceived environmental uncertainty measure developed in this study.

Summary, further research and managerial implications

In this study, we present evidence for the reliability and validity of a measure of environmental uncertainty. In addition, the measure was found to be multidimensional, reflecting the six components or sectors of the environment (supply environment, competitive environment, demand environment, financial/capital environment, labor environment and regulatory environment) as opposed to the environment as a whole. The results also indicated that the six sector measures reflected a second-order construct which we term overall perceived environmental dynamism. Apparently, in the US hotel industry, the different environmental components seem to be consistent in terms of variation in their perceived uncertainty. In such cases, an overall measure of uncertainty is appropriate.

We examined environmental uncertainty using a cross-sectional measure of perceived dynamism in a single industry in one country at a point in time. In future studies, it would be useful to: (a) determine the conditions under which this perceptual measure of environmental uncertainty converges with objective (archival) measures of the construct, (b) validate this measure across a number of industries in different countries and (c) test the stability of the measure across time.

From a managerial perspective, understanding and dealing proactively with uncertainty in the environment surrounding marketing activities is critical to their success

(Ansoff 1991). To evaluate the extent of that uncertainty, managers need valid and reliable measures. This research reports the development of such a measure. Additionally, given Balakrishnan and Wernerfelt's (1986) argument that uncertainty within different environmental components has differential implications for marketing strategy, our multidimensional scale enables researchers and managers to examine these differential effects. Finally, there is the link between environmental uncertainty and performance. The nomological validity test shows that the measure developed here does in fact moderate the strategy-performance link. Therefore, when formulating marketing strategy, managers need to recognize the performance implications of measuring and managing environmental uncertainty.

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Notes

1 We had some concern that the second-order factor might be an artifact of our sample. Coleman and Gaetan (1985), in their study of perceived environmental uncertainty in apparel manufacturing, reported the intercorrelations among their uncertainty measures for the six sectors we examined in this study (i.e., supply, competitive, demand, financial, regulatory and labor environments). After subjecting their intercorrelations to confirmatory factor analysis, we found strong evidence for a single second-order factor of their uncertainty measures. Thus, it appears that our measure of overall perceived environmental of uncertainty, as derived from the second-order confirmatory factor analysis, is not an artifact of the sample.

2 The nomological validity of the perceived environmental uncertainty measure partially depends upon the validity of the measures of the other constructs in the theoretical network. Financial indicators such as net profit as a percentage of sales are objective measures and are generally considered to be reliable and valid without any specific tests. On the other hand, perceptual indicators, such as the self-typing measure of Miles and Snow's strategic types, are more problematic. However, because Shortell and Zajac (1990) offer evidence for the reliability and validity of the self-typing measure, we are confident in employing it in the test of our environmental uncertainty measure's nomological validity.

3 The responding hotels classified their organizational strategies into one of the four Miles and Snow (1978) organizational strategy types. Because only six of the responding firms classified themselves as reactors, they were eliminated from the nomological validity test. Thus, only firms characterized as defenders, prospectors or analyzers were included in the evaluation of the nomological validity of the environmental uncertainty measure.

4 The overall measure, based on the second-order factor analysis results (Figure 1), was computed as the sum of the unweighted first-order factors (i.e. the ns). A more theoretically appealing approach would have been to weight each factor by its factor loading. However, incorporating such weights in a number of other contexts such as work motivation (Campbell and Pritchard 1976) and marketing

channel power (Lusch and Brown 1982) did not significantly increase explained variance. For this reason, such weights were not included in the measure of overall perceived environmental uncertainty.

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Appendix. Means, standard deviations and intercorrelations of environmental uncertainty items.

Indicator	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*
1. SUPPRIC	1.000																			
2. SUPPROD	.451	1.000																		
3. SUPSPEC	.407	.736	1.000																	
4. SUPNEW	.386	.482	.478	1.000																
5. COMSUP	.002	.079	.092	−.027	1.000															
6. COMRATE	.078	−.002	.078	.004	.416	1.000														
7. COMRENO	.002	.062	.144	.138	.307	.344	1.000													
8. COMNEW	−.084	.045	.085	.065	.652	.404	.499	1.000												
9. CUSTSVC	.186	.274	.270	.212	.267	.239	.148	.183	1.000											
10. CUSTFAC	.044	.251	.197	.095	.389	.336	.268	.351	.496	1.000										
11. FININT	.411	.321	.221	.145	.051	.270	.207	.101	.255	.272	1.000									
12. FINCRD	.166	.216	.157	.135	.135	.224	.204	.159	.245	.263	.532	1.000								
13. LABWAGE	.128	.121	.187	.175	.297	.139	.370	.315	.234	.260	.204	.170	1.000							
14. LABAVEM	.050	.069	.139	.071	.245	.173	.250	.270	.129	.242	.055	.076	.734	1.000						
15. GOVRATE	.147	.231	.328	.248	.072	.174	.150	.108	.252	.196	.142	.100	.107	.069	1.000					
16. GOVQUAL	.175	.171	.228	.267	.022	.115	.150	.062	.126	.165	.163	.125	.185	.156	.701	1.000				
17. GOVSVCS	.219	.179	.287	.226	−.046	.108	.177	.094	.104	.093	.345	.129	.167	.168	.525	.641	1.000			
18. GOVPERS	.230	.012	.002	.072	.209	.289	.161	.135	.114	.269	.258	.265	.270	.230	.261	.360	.364	1.000		
19. GOVMKTG	.252	.176	.223	.244	−.003	.148	.230	.131	.111	.162	.330	.250	.185	.166	.523	.584	.657	.390	1.000	
20. GOVACCT	.263	.236	.205	.257	.051	.180	.205	.093	.194	.185	.274	.178	.206	.194	.300	.301	.493	.411	.555	1.000
Mean	2.617	2.358	2.296	2.784	3.414	3.630	3.006	3.074	2.833	3.000	2.648	2.549	3.216	4.148	1.710	1.704	1.901	2.864	2.179	2.722
Std. Dev.	1.093	1.061	1.080	1.173	1.700	1.466	1.390	1.514	1.277	1.285	1.193	1.305	1.618	1.735	1.085	0.965	1.138	1.421	1.220	1.467

Table 1. Measures of environmental uncertainty in marketing research: a summary.

Study	*Sample*	*Theoretical foundation*	*Relevant dependent variables*	*Operationalization*
Achrol & Stern (1988)	269 retailers	Organization theory	Decision-making uncertainty	*Environmental diversity – individual customers* (Weighted sum of 4 items reflecting the degree of dissimilarity among the household end user market target) – Reliability (alpha = 0.908); Unidimensionality (confirmatory factor analysis) *Environmental diversity – organizational customers* (Weighted sum of 4 items reflecting the degree of dissimilarity among the business customer market target) – Reliability (alpha = 0.945); Unidimensionality (confirmatory factor analysis) *Environmental dynamism – marketing practices* (Sum of 3 items reflecting the rate of change in the marketing practices needed to reach the focal dyad's output market) – Reliability (alpha = 0.763; Unidimensionality (confirmatory factor analysis) *Environmental dynamism – competitors* (Weighted sum of 3 items reflecting the rate of change in competitors' marketing practices within the focal dyad's output market) – Reliability (alpha = 0.794; Unidimensionality (confirmatory factor analysis) *Environmental dynamism – customers* (Weighted sum of 3 items reflecting the rate of change in customer preferences in the focal dyad's output market) – Reliability (alpha = 0.799); Unidimensionality (confirmatory factor analysis) *Environmental concentration* (Weighted sum of 3 items reflecting extent to which focal dyad's output markets are controlled by a few organizations) – Reliability (alpha = 0.589); Unidimensionality (confirmatory factor analysis) *Environmental capacity* (Weighted sum of 4 items reflecting the munificence of the focal dyad's output market) – Reliability (alpha = 0.827); Unidimensionality (confirmatory factor analysis) *Environmental interconnectedness – input linkages* (Sum of 3 items reflecting the number and pattern input linkages among relevant organizations in the focal dyad's output market) – Reliability (alpha = 0.695); Unidimensionality (confirmatory factor analysis) *Environmental interconnectedness – output linkages* (Sum of 2 items reflecting the number and pattern output linkages among relevant organizations in the focal dyad's output market) – Reliability (alpha = 0.694)

Table 1 con't

Study	*Sample*	*Theoretical foundation*	*Relevant dependent variables*	*Operationalization*
				Environmental conflict – abnormal competitive severity (Sum of 5 items reflecting the level of abnormal stress due to competitive activities aimed at controlling the focal dyad's output market) – Reliability (alpha = 0.878)
				Environmental conflict – unfair trade practices (Sum of 5 items reflecting the level of unfair trade practices aimed at controlling the focal dyad's output market) – Reliability (alpha = 0.864)
				Environmental interdependence (Weighted sum of 5 items reflecting the mutual reactivity & sensitivity to one another's acts among parties competing for output market resources) – Reliability (alpha = 0.845); Unidimensionality (confirmatory factor analysis)
Anderson (1985)	159 district sales managers of electronic component mfgrs.	Transaction cost analysis	Direct vs. rep sales force	*Environmental unpredictability* (sum of 9 items reflecting extent to which the sales environment is unstable & the degree to which the firm emphasizes new activities) – Reliability (alpha = 0.65)
Balakrishnan & Wernerfelt (1986)	Secondary data from FTC Line of Business Reports for 93 SIC-4 digit level manufacturing industries	Microeconomic theory	Degree of vertical integration	Single item (i.e., reciprocal of average age of plant & equipment used by industry) reflective of *technological instability* (frequency of technical change within the industry) – No assessments of reliability or validity were reported.
Burke (1984)	Managers with bottom-line responsibility for 86 SBUs from 6 firms	Organization theory	Strategic thrust of the business unit	Single item (i.e., weighted index of uncertainty, importance and responsive ness to 13 environmental elements) reflecting degree of *overall uncertainty in the manager's decision-making environment* – No assessments of reliability or validity were reported
Dwyer & Oh (1987)	167 automobile dealership managers	Political economy framework	*Formalization *Participation *Centralization	*Environmental munificence* (weighted sum of 5 items reflective of the availability & abundance of critical resources in the output sector) – Reliability (alpha = 0.82); Unidimensionality (confirmatory factor analysis); Discriminant validity (correlation)
Dwyer & Welsh (1985)	457 US retailers	Political economy framework	*Channel structure *Retailer control *Channel decision structure	*Retailer's channel environment heterogeneity* (sum of 13 items reflecting the number & dissimilarity of environmental elements) – Reliability (alpha = 0.84); Unidimensionality and discriminant validity (exploratory factor analysis).
				Retailer's output sector variability (sum of 10 items reflecting variation in demand & competition) – Reliability (alpha = 0.72); Unidimensionality and discriminant validity (exploratory factor analysis)

Table 1 con't

Study	*Sample*	*Theoretical foundation*	*Relevant dependent variables*	*Operationalization*
Eisenhardt (1985, 1988)	Managers of 54 specialty retail stores	*Agency theory *Organization theory	Salesperson reward structure	*Outcome uncertainty* (sum of 3 items reflecting degree to which uncontrollable factors moderates the effectiveness appropriate salesperson behaviours) – Reliability (alpha = 0.82); Convergent & discriminant validity (correlations)
Etgar (1977)	99 Northeastern US retailers	Organization theory	Supplier control	Single-item scale measuring *demand stability* (7-point semantic differential: very stable/very unstable) – no assessments of reliability or validity were reported
Heide & John (1988)	199 owners/gen'l. mgrs. of mfgrs' agencies	Transaction cost analysis	*Extent of investments to offset dependence upon largest principal *Cost performance	Single-item scales measuring *various facets of agency's sales territory* for largest principal's product line – no assessments of reliability or validity were reported (modified 7-point semantic differentials)
Heide & John (1990)	175 purchasing agents/directors in mfg industries	Transaction cost analysis	*Expectations of continuity in the relationship with focal supplier *Verification of focal supplier	*Sales volume unpredictability* (sum of 3 items reflecting inability to forecast accurately the volume requirements in the relationship) – Reliability (alpha = 0.72); Unidimensionality (confirmatory factor analyses) *Technological unpredictability* (sum of 3 items reflecting the inability to forecast accurately the technical requirements in the relationship) – Reliability (alpha = 0.58); Unidimensionality (confirmatory factor analyses) *Performance ambiguity* (sum of 4 items reflecting the difficulty of accurately measuring *ex post* the exchange partner's compliance with expected output – Reliability (alpha = 0.66); Unidimensionality (confirmatory factor analyses)
John & Weitz (1988)	87 industrial goods firms	Transaction cost analysis	Extent of using direct channels	Mean of 5 items reflecting the degree of *volatility & turbulence in output markets* for a distinct self-selected product line – Reliability (alpha = 0.73); Unidimensionality (exploratory factor analysis)
John & Weitz (1989)	161 sales mgrs & vps in US manufacturing firms	Transaction cost analysis	*Role of salary in salesperson compensation *Difficulty in assessing salesperson output performance	*Environmental uncertainty* (sum of 4 items assessing the stability in sales and forecasting accuracy) – Reliability (alpha = 0.65); no assessment of validity was reported

Table 1 con't

Study	*Sample*	*Theoretical foundation*	*Relevant dependent variables*	*Operationalization*
Klein, Frazier & Roth (1990)	Owners/general managers of 375 Canadian export firms	Transaction cost analysis	Degree of channel integration	*Environmental diversity* (3 items reflecting the extent of multiple sources of environmental uncertainty) – Reliability (alpha = 0.55); Discriminant validity (exploratory & confirmatory factor analyses) *Environmental volatility* (3 items reflecting the extent to which the environment changes rapidly) – Reliability (alpha = 0.70); Discriminant validity (exploratory & confirmatory factor analyses)
Kumar, Stern & Achrol (1992)	98 vehicle leasing dealers & 63 telecommunications dealers	Organization theory	Reseller performance	*Environmental diversity* (a single-item reflecting the degree of dissimilarity within the market target) – no assessments of reliability or validity were reported. *Environmental dynamism – competitors* (two separate items reflecting the rate of change in competitors' marketing practices within the focal dyad's output market) – no assessments of reliability or validity were reported. *Environmental dynamism – consumers* (a single item reflecting the rate of change in consumer preferences in the focal dyad's output market) – no assessments of reliability or validity were reported. *Environmental munificence* (a single item reflecting the richness of the focal dyad's output market) – no assessments of reliability or validity were reported.
McKee, Varadarajan & Pride (1989)	CEOs of 330 US banks	Organization theory	*Marketing tactics *Financial performance & market share	Single-item (i.e., the square root of the sum of the squared deviations of year-to-year differences in sales from the average of those differences, divided by that average) reflective of *market volatility* (extent to which the pertinent environmental elements have a random pattern over time) – no assessments of reliability or validity were reported.
Noordewier, John & Nevin (1990)	140 OEM buyers of ball and roller bearings	Transaction cost analysis	*Relational governance *Buyer transaction performance	*Environmental uncertainty* (mean of 5 items reflecting unanticipated changes in circumstances surrounding an exchange) – Reliability (alpha = 0.64); Unidimensionality (confirmatory factor analyses)
Spekman & Stern (1979)	322 organizational buying group members	Organization theory	*Centralization *Division of labour *Degree of rules & procedures *Participation in decision making *Influence of purchasing agent	Sum of 11 items reflecting *perceived environmental uncertainty* facing organizational buying groups (5-point scales – 1: never; 2: seldom; 3: occasionally; 4: rather often; 5: nearly all the time) – Reliability (alpha = 0.68); no assessments of unidimensionality or validity were reported.

Table 2. Task environment components*

Competitors' Actions
- Supply of rooms (COMSUP)
- Rates charged (COMRATE)
- Renovation and refurbishment (COMRENO)
- New services/facilities offered (COMNEW)

Customers' Demand
- For the hotel's services (CUSTSVC)
- For new facilities/services (CUSTFAC)

Suppliers of Food, Beverage, and Operating Supplies
- Prices charged (SUPPRIC)
- Product quality standards (SUPPROD)
- Product/service specifications (SUPSPEC)
- Introduction of new products (SUPNEW)

Suppliers of Capital
- Interest rates (FININT)
- Availability of credit (FINCRD)

Suppliers of Labour
- Wage and salary rates (LABWAGE)
- Availability of employees (LABAVEM)

Regulatory Agencies (i.e., changes in laws or policies)
- Regarding rates charged (GOVRATE)
- Regarding room, food or beverage quality (GOVQUAL)
- Regarding provision of services (GOVSVCS)
- Affecting personnel/labour decisions (GOVPERS)
- Affecting sales and marketing (GOVMKTG)
- Affecting accounting/bookkeeping (GOVACCT)

Note
*These specific items represent the lodging industry's task environment and are readily adaptable to other industry contexts.

Table 3 Covariance structure analysis: model fit statistics

*Model**	χ^2	*df*	*p*	*GFI*	*RMSR*	*CFI*	χ^2/df
Null	1398.92	190	.000	.426	.443	—	7.363
M1	289.50	155	.000	.848	.129	.889	1.868
M2	241.41	137	.000	.865	.113	.914	1.762
M3	187.59	121	.000	.884	.107	.945	1.550
M4	147.06	105	.000	.902	.095	.965	1.401
M5	119.46	90	.021	.916	.082	.976	1.327

Notes

*Each of the covariance structure models estimated is described below.

Null Model: assumes complete independence among the 20 uncertainty items.

M1: assumes that the items load into 6 factors as depicted in Table 2 and that the 6 factors are intercorrelated.

M2: same as M1, except that GOVPERS is dropped from the analysis due to high normalized residuals (i.e., residuals ≥ 2.0).

M3: same as M2, except that FININT is dropped from the analysis due to high normalized residuals (i.e., residuals ≥ 2.0).

M4: same as M3, except that GOVACCT is dropped from the analysis due to high normalized residuals (i.e., residuals ≥ 2.0).

M5: same as M4, except that COMRENO is dropped from the analysis due to high normalized residuals (i.e., residuals ≥ 2.0).

Table 4 First-order confirmatory factor analysis results

Variable	*Standardized factor loading*	*t-Value*[b]	*Reliability*
Supply Environment (F_1)			0.909
SUPPRIC	0.522	6.545	
SUPPROD	0.862[a]	—	
SUSPEC	0.843	10.630	
SUPNEW	0.580	7.384	
Competitive Environment (F_2)			0.822
COMSUP	0.824[a]	—	
COMRATE	0.522	6.011	
COMNEW	0.783	8.051	
Demand Environment (F_3)			0.852
CUSTSVC	0.639	5.679	
CUSTFAC	0.776[a]	—	
Financial/Capital Environment (F_4)			1.000
FINCRD	1.000[a]	—	
Labour Environment (F_5)			0.909
LABWAGE	0.949[a]	—	
LABAVEM	0.774	6.101	
Regulatory Environment (F_6)			0.778
GOVRATE	0.762	9.099	
GOVQUAL	0.847	9.929	
GOVSVCS	0.770	9.180	
GOVMKTG	0.735[a]	—	

Factor Intercorrelations[c]

	F_1	F_2	F_3	F_4	F_5	F_6
F_1	6.201	0.958[ns]	3.423	2.606	2.153	3.547
F_2	0.091	5.391	4.624	2.254	3.918	1.029[ns]
F_3	0.376	0.571	4.358	3.498	3.430	2.472
F_4	0.228	0.203	0.353	8.972	2.007	2.108
F_5	0.195	0.391	0.362	0.168	5.155	2.399
F_6	0.355	0.098	0.264	0.183	0.220	5.132

Notes

[a]Fixed parameter.

[b]All t-values are significant at $p \leq 0.05$ except where noted.

[c]Lower-left, off-diagonal elements are correlations; all diagonal correlations (not shown) are 1.0. Diagonal and upper-right, off-diagonal elements are t-values.

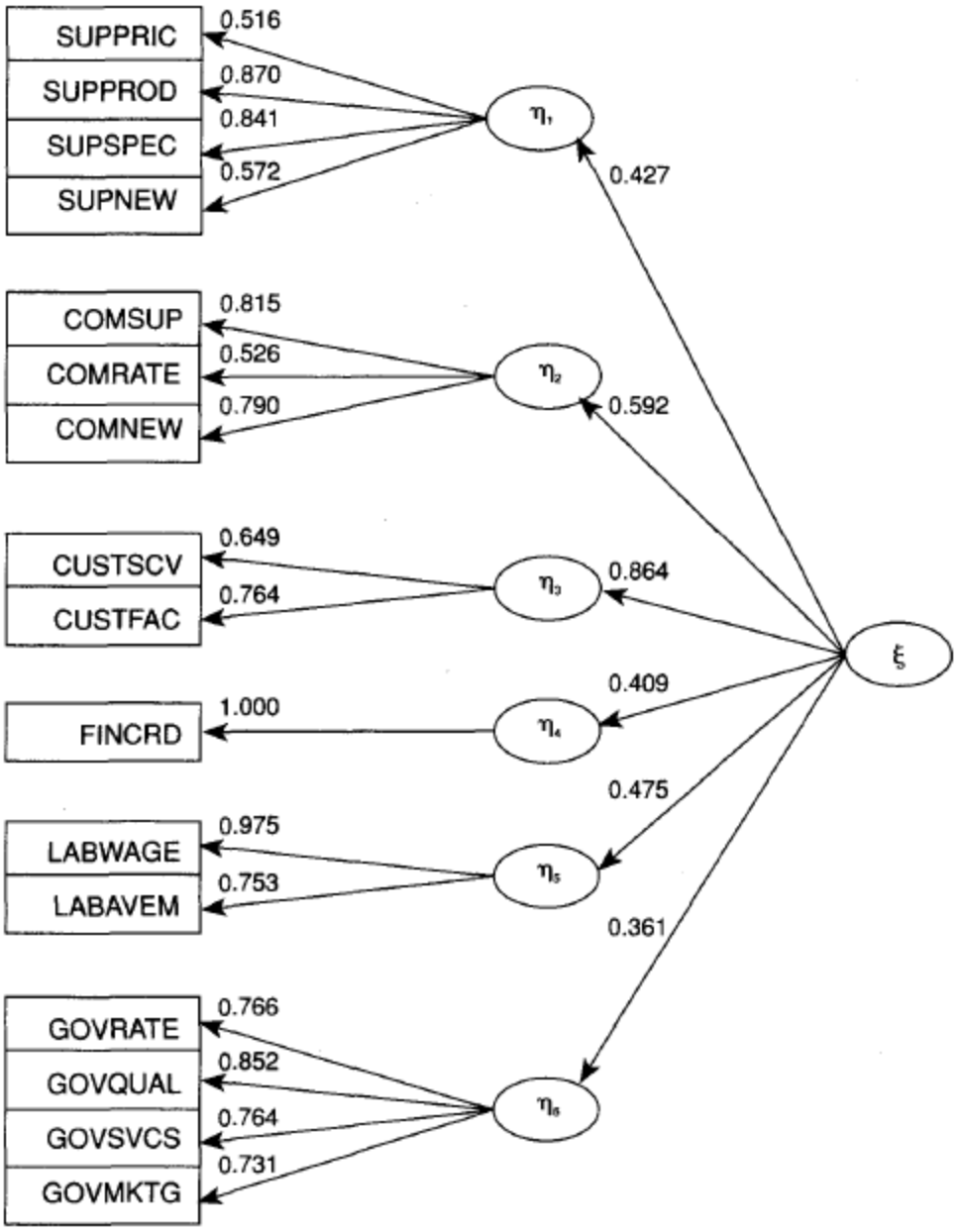

Figure 1 Second-order confirmatory factor analysis

Note: all coefficients significant at p = 0.05 level