European Management Journal 32 (2014) 658–671

Contents lists available at ScienceDirect

European Management Journal

journal homepage: www.elsevier.com/locate/emj

Archival or perceived measures of environmental uncertainty? Conceptualization and new empirical evidence

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ARTICLE INFO

Article history:
Available online 7 January 2014

Keywords:
Environmental uncertainty
Perceived
Archival
Methodology
Objective
Correlation
Learning
Decision making

ABSTRACT

Environmental uncertainty is a major determinant in many managerial decisions and evaluations. Yet, there is no consensus what constitutes a valid measure of uncertainty to which executives can respond. This paper explicates conceptual and methodological differences between Archival Environmental Uncertainty (AEU) and Perceived Environmental Uncertainty (PEU).

Conceptually, we discuss the controversial development of these measures in the literature. We propose a framework showing that AEU and PEU differ due to the specificity of the decision unit, the predictability of volatility, and the use of leading indicators.

Empirically, we are the first to investigate the statistical association between prevailing measures of AEU and PEU. Our analysis combines archival data on AEU (annual reports) with survey data on PEU from top executives of the 110 largest listed German companies (55% response). As predicted, AEU and PEU correlate moderately on a significant level ($r = 0.257$ to 0.374). Also, AEU indicators (mainly volatility in sales and earnings) explain over 26% of the PEU measure. Yet, adjustment of the AEU measure for predictable volatility does not improve its relationship to PEU. Overall, our findings imply that AEU and PEU are not perfect substitutes, but valid proxies for each other if the relevant limitations are considered.

Introduction

The advents of contingency- and open systems theories have drawn substantial attention to the external environment of companies. Especially 'environmental uncertainty' has attracted much research interest as it has proven to affect almost any type of managerial planning or control. Rich empirical evidence suggests that uncertainty affects the design of management practices, decision making, and performance (Besson, Löning, & Mendoza, 2008; Burkert, Davila, Mehta, & Oyon, 2013; Burkert & Lueg, 2013; Franco-Santos, Lucianetti, & Bourne, 2012; Gils, Voordeckers, & van den Heuvel, 2004; Mintzberg, 1979). Early definitions of uncertainty emphasize its distinction from risk. According to Knight (1921, p. 233), uncertainty is non-quantitative in nature, while in the concept of risk *"[…] the distribution of the outcome in a group of instances is known"*.

Major obstacles to managing uncertainty in practice or investigating it empirically are that its theoretical concept is still blurry, and it has not been found to match with empirical findings. Beyond the distinction between uncertainty and risk, research is inconsistent in both conceptualizing and empirically measuring uncertainty (Kreiser & Marino, 2002; Milliken, 1987; Rasheed & Prescott, 1992; Slangen & van Tulder, 2009). These disagreements on uncertainty split into two major schools of thought: The positivistic approach ('Archival Environmental Uncertainty' or AEU) asserts that uncertainty exists independently from the perceptions of decision makers, while the behavioral approach ('Perceived Environmental Uncertainty' or PEU) proposes that uncertainty results from the interplay of the environment with the inability of executives to predict the outcomes of their actions or to assign probabilities to them.

In addition to these different conceptualizations, there is no agreement on whether the empirical measures of AEU and PEU correlate or *should* correlate (Jauch & Kraft, 1986, p. 778–780). These issues constitute not only an intriguing intellectual puzzle to academics but substantially affect executives' performance in practice (Ensley, Pearce, & Hmieleski, 2006; Mezias & Starbuck, 2003; Von Gelderen, Frese, & Thurik, 2000): on the one hand, quantitative researchers or corporate top executives must be able to gauge the appropriateness of archival data in their research if perceptual data is not available. On the other hand, qualitative researchers and executives at all levels need to know how valid perceptions are compared to more 'inter-subjective' data. If executives want to respond to the environmental uncertainty surrounding their companies *effectively*, they need at least a vague idea of what constitutes a reliable indicator of uncertainty. At our current

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http://dx.doi.org/10.1016/j.emj.2013.11.004

state of knowledge where the differences between AEU and PEU are so heavily disputed, researchers cannot advise executives on the most appropriate indicator of uncertainty. Additionally, the substantial loss of trust in managing risk and uncertainty due to the financial crisis warrants revisiting this steadily important topic to ensure its relevance for research and practice (Parnell, Dent, O'Regan, & Hughes, 2012; Van der Stede, 2011). To advance the debate on uncertainty, we address the research question: *What is the relationship between archival and perceived environmental uncertainty?*

We address this question in two ways: first, our literature review contributes to theory by illustrating that the differences between AEU and PEU are threefold: (1) AEU relates to the company as a whole, while PEU is unique to each decision unit, (2) the measurement of PEU contains only unpredictable changes, while AEU simultaneously accounts for systematic dynamism like seasonality, and (3) AEU is based on historical data, while PEU employs forward-looking, leading indicators. Second, we empirically test the relationship between AEU and PEU using archival and survey data from the largest listed companies in Germany. As predicted, AEU and PEU correlate moderately on a significant level ($r = 0.257–0.374$), and AEU indicators can predict a substantial amount of variance of the PEU construct ($R^2 = 0.264$). Thereby, our study also contributes to empirical research and practice: Empirically, we conclude that AEU and PEU are not perfect substitutes, but can be considered as valid proxies if the relevant delimitations are considered. Opposed to purely theoretical conjectures, we are the first to empirically demonstrate that the AEU measure that adjusts for systematic dynamism (Dess & Beard, 1984) does not outperform the unadjusted measure (Tosi, Aldag, & Storey, 1973) in correlation or regression analyses with PEU as the dependent variable. We specifically contribute to practice by suggesting that inter-subjective measures like AEU are best applicable for performance evaluations and for issues that span *across* decision units or companies e.g., in strategic alliances. Subjective measures like PEU are best used as a decision base *within* decision units for the purposes of scanning as well as for decision making (strategic/operational). We also contribute the insights that executives can make use of the interchangeability of AEU and PEU: they can use PEU as a proxy for AEU in case data for AEU is not available. The other way around, the existence of data for AEU can help executives in compensating for lacking experience in a market, or limited insight into another decision unit beyond their own. We can also show that top executives' PEU is driven by the AEU-related historic volatility of sales and earnings of a company. This interrelatedness suggests that executive perceptions of uncertainty can be historically biased. Thus, we propose that complementing with non-financial data may improve the obtained measure.

The remainder of this article is organized as follows: Section 2 reviews the literature and derives the hypothesis for the empirical test in Section 3. We present the results in Section 4 and discuss limitations as well as implications in Section 5.

Literature review and hypothesis development

The emergence of AEU and PEU

Milliken (1987, p. 134) defines uncertainty both as "the state of organizational environments" (AEU) and as "the state of a person who perceives herself/himself to be lacking critical information about the environment" (PEU). These varying understandings imply different measurements. The first definition (AEU) assumes that uncertainty is a characteristic of the environment. Therefore, AEU is homogeneous for all executives and contexts in a company. Such assumptions are 'positivistic' and belong to the economic research tradition. The appropriate measurement of the concept should involve data whose interpretation is largely shared among executives ('archival' or 'inter-subjective'). This might include accounting data like revenues, profit, or spending on research and development (R&D) (Tosi et al., 1973).

The second definition (PEU) asserts that uncertainty stems from the relationship between the environment and the characteristics of executives. Thus, groups of executives can differ in their ability to assess outcomes of their decisions or assign probabilities to them (Piaskowska & Trojanowski, 2012). Hence, it does not matter to executives how uncertain the environment is '*objectively*' but as how uncertain they *perceive* it (Miles, Snow, & Pfeffer, 1974; Pondeville, Swaen, & De Rongé, 2013). These assumptions belong to the behavioral research tradition. Appropriate measurements of PEU include data collected in field research, e.g., surveys, observations or interviews. We now follow the relationship of AEU and PEU throughout the literature:

The first measures that emerged belonged to PEU. In their seminal study, Lawrence and Lorsch (1967) conceptualize and operationalize uncertainty as the manner in which executives *perceive* their relevant environment. The three proposed components include (1) clarity of information, (2) uncertainty of causal relationships and (3) time span of definitive feedback. Lawrence and Lorsch (1967) argue that executives differentiate between several domains of PEU and that each domain has different implications for decision making. Still, the authors aggregate the PEU scores for the three domains.

Duncan (1972) then contributes a further influential study that varies the components of Lawrence and Lorsch (1967). His constructs based on Duncan (1968) describe three components of PEU: similar to Lawrence and Lorsch (1967) (1) the lack of information about the environment and (2) not knowing the consequences of the decisions alternatives for the company. Different from Lawrence and Lorsch (1967), he also proposed (3) the unknown influences of the environment on the success or failure of the decision. Duncan (1972, p. 315) looks at two continuous dimensions of environment: the "*simple-complex*" dimension refers to the number and similarity of the environmental factors, while the "*static-dynamic*" dimension includes their frequency of renewal. He then develops a unified scale that matches the two dimensions of environment with the three states of uncertainty.

As a validation of these two studies, Downey, Hellriegel, and Slocum (1975) test the adequacy of the scales of Lawrence and Lorsch (1967) and Duncan (1972). Their results support the internal reliability of both scales but reveal that they do not correlate.

As a response to this non-correlation puzzle, Milliken (1987) proposes that the scales of Duncan (1972) and Lawrence and Lorsch (1967) measure different types of environmental uncertainty. Based on Weick (1979) stages of information processing, Milliken (1987) distinguishes between three components of uncertainty. *State uncertainty* refers to an inability to predict the future state of the environment, and/or a lack of information about the interconnections between components of the environment. *Effect uncertainty* reflects the "*uncertainty about the nature, severity, and timing of the impact*" of the environment on the company. *Response uncertainty* refers to a lack of information about available response options and/or their consequences. As a root cause for the non-correlation, Milliken (1987) conjectures that Duncan (1972) subscale measures state uncertainty while Lawrence and Lorsch (1967) scale partly relates to effect uncertainty. The third subscale dealing with "*time span of definitive feedback*" may be connected to response uncertainty, but this correlation is "*open to question*" (Gerloff, Muir, & Bodensteiner, 1991, p.755). Gerloff et al. (1991) further suggest that Duncan (1972) unified scale contains three underlying components that correspond to Milliken (1987) state, effect and response uncertainty and propose several changes in