DEFINING UNCERTAINTY: THE IMPLICATIONS FOR STRATEGIC MANAGEMENT

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Introduction

The uncertainty construct dominates the administrative science literature and the management of uncertainty has been identified as the primary task facing managers (Thompson, 1967; Weick, 1969). Uncertainty arises from both the ambiguous and complex causal structures underlying organisations' internal operations, surrounding environments and the nexus of relationships between organisations and the environment (March and Olsen, 1976; Collis, 1992). Some theorists have advocated that managers reduce, absorb or avoid uncertainty (Cyert and March, 1963; Thompson, 1967) while others have proposed that "uncertainty creation" can provide strategic benefits to the organisation by confounding competitors (Jauch and Kraft, 1986). As Gerloff, Muir and Bodensteiner (1991) note, there are two categories of uncertainty research: the contingency and perceptual approaches. The former are concerned with "fitting" the organisation's architecture with the exigencies of the external environment. For instance, Lawrence and Lorsch (1967) related differing levels of environmental uncertainty with differing requirements for differentiation and integration. The information-processing view of organisational design (Galbraith, 1973) explicitly related environmental uncertainty as imposing extensive information processing demands on the organisation.

On the other hand, the perceptual view of uncertainty is more process oriented, and seeks to establish relations between top management's perceptions of environmental uncertainty and strategy, structure, learning and performance (Gerloff, et. al., 1991). For example, Duncan (1972) addressed managers' own meanings of uncertainty and concluded that managers felt uncertain when (i) there was a lack of information regarding environmental factors in the decision making situation, (ii) they did not know the outcomes in terms of how much the company would lose if the decision was incorrect and (iii) they lacked confidence in the assignment of probabilities to outcomes. Bourgeois (1980) has argued that perceived environmental uncertainty is "more relevant, conceptually and perhaps empirically, to the study of strategy making than to the study of an organization's external environment" (1980: 25).

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While many would agree that uncertainty is a basic feature of the business environment (Wack, 1985), and that organisational survival is partially explained by the ability to cope with uncertainty (Pfeffer and Salancik, 1978), it has been pointed out that "research has yielded inconsistent and often difficult to interpret results" (Milliken, 1987: 133). Thus, improved clarification in conceptualisation should benefit research in the area. Further, improved explication of the uncertainty concept should help top management teams to design planning systems and organisations with improved "absorption" and knowledge-creating capabilities (Hrebiniak and Joyce, 1986; Lyles and Schwenk, 1992; March and Simon, 1958).

In an important effort at providing clarification, Milliken (1987) hypothesized that organisational administrators face three types of perceptual uncertainty, namely: state, effect and response uncertainties. Moreover, she identified specific implications for strategic planning activities across each of these conditions of uncertainty. This paper supplements her conceptualisation by integrating it with another trichotomy of perceptual uncertainty developed by Dermer (1977). Further, this paper seeks to differentiate between the *types* or components of uncertainty, which both Milliken and Dermer identified, and the *extent* of uncertainty about a phenomenon. This is an important distinction, since uncertainty can be characterised as the absence of information about an event (Arrow, 1974). Synthesizing the types of uncertainty with the extent of uncertainty provides us with conceptual tools to decompose this absence of information into two categories, namely, what is not known, and the extensiveness of that ignorance. In addition, the synthesis of the two approaches helps explicate further the differences between perceptual notions of uncertainty and the "objective" uncertainty which is a property of the environment.

The paper is organised as follows. First, the contributions of both Milliken and Dermer are reviewed and integrated. Second, the nature of uncertainty is contrasted with the orthogonal dimension of extent (or degree) of uncertainty. An integrated model that incorporates both the type and the extent of uncertainty is developed. After this discussion, some general implications for top management teams and the design of strategic management systems are explicated. Finally, the potential contributions of this conceptualisation of uncertainty for both practitioners and researchers are delineated.

Contrasting Conceptualisations of Uncertainty

March and Olsen (1976) suggest that uncertainty arises from the ambiguous and complex causal situations underlying the internal operations and external environment of an organisation. Milliken (1987) addresses both environmental and internal aspects of uncertainty. In her paper, the author defines *state uncertainty* as an inability to assign probabilities to the likelihood of future events. This situation could arise due to a perceptual distortion in prediction, through, for instance, amplifying bad events but attenuating good events (Starbuck and Milliken, 1988). The second element, *effect*

uncertainty, reflects a perceptual distortion in causal attributions or an absence of understanding about cause-effect relationships; specifically, the potential impact of environmental events on the focal organisation (Starbuck and Milliken, 1988). Finally, the author identifies *response uncertainty* as an inability to understand the response options available to the firm and/or the likely consequences of the response choice. This last element of uncertainty is comprised of two sub-components not explicitly identified by Milliken (1987). The first sub-component refers to uncertainty over the set of available response options, specifically the inability to identify appropriate alternatives (response-selection). This could reflect perceptual distortions in noticing ad sensemaking. In particular, a top management team may not perceive certain responses, or they could apply the wrong frameworks to generate response options. The second sub-component refers to the inability to specify the range of likely outcomes associated with each potential response (response-outcome). This, again is a distortion in prediction.

This "troika" of uncertainties echoes a similar trichotomy developed earlier by Dermer (1977), who identified conceptual, administrative and environmental risks[1]. Dermer's contribution focuses on the inadequacy of internal knowledge about organisational response options and resultant outcomes. Thence, like Milliken, he is referring to a perceptual risk. Specifically, Dermer (1977) characterizes *conceptual risk* as an imperfect formulation of an issue or problem. He provides examples of using an incorrect model, making the wrong assumptions about an issue, and choosing incorrect decision criteria as instances of conceptual risks. These again, reflect a distortion in sensemaking. The second element is *administrative risk* which is defined as the risk that even a well-conceptualized issue and resultant response may not be implemented properly. The final component discussed is *environmental risk*, which suggests that the "state of nature" (or environment) changes in unanticipated ways even after well-conceived and appropriately implemented actions have been taken.

Figure 1: Synthesis of Uncertainty Types

	Learning			
Daft and Weick, 1987 (modified)	**Scanning**	**Interpretation**	**Action**	**Outcome**
Milliken	State	Effect	Response-selection	Response-outcome
Dermer	Conceptual	Conceptual	Conceptual Administrative	Environmental
Synthesis	State (Formulation & likelihood assessment)	Effect (Formulation & cause-effect)	Response-selection Administrative	Environmental

In Figure 1, an attempt is made to integrate these twin conceptualisations of uncertainty around the scanning-interpretation-action linkage of interpretation systems formulated by Daft and Weick (1984). Milliken (1990) has already forged direct relationships between her uncertainty trichotomy and Daft and Weick's work, but it is felt that the linkages can be better explicated in expanding the components of uncertainty by integrating Dermer's conceptualisation with Milliken's trichotomy.

In particular, Milliken suggests that scanning addresses state uncertainty, where the objective is to minimize unpredictability about a particular state of nature. However, such uncertainty is not obviated by scanning alone, rather the correct formulation of the "state of nature" is required. The ability of boundary spanners to formulate and identify the particular environmental event is a form of conceptual risk. Hence, state uncertainty consists of the uncertainty of assigning likelihoods to identified states (Milliken's state uncertainty) as well as uncertainty of formulation (Dermer's conceptual risk). Similarly, at the interpretation stage, the decision maker faces two uncertainties. First, effect uncertainty arises regarding the cause-effect relationship between the environmental event and the effect. In other words, the linkage between environmental "events" and their potential effect(s) on the organisation is often unclear. Second, a form of conceptual risk is also present. There is uncertainty regarding effect formulation since meaning and organisational implications of environmental occurrences must be specified. Again, the ability to identify the range of potential impacts on the organisation is apt to be difficult.

Response uncertainty arises at the action stage, where the appropriate action is complicated by response-selection uncertainty due to the difficulty in identifying potential responses and specifying outcomes associated with them (i.e. a conceptual risk). Even when the response-selection uncertainty is resolved, response implementation uncertainty remains due to the organisational difficulty in implementing the chosen response (i.e. administrative risk).

At the outcome stage, ambiguity over the likely outcomes associated with each potential response (response-outcome) is exacerbated by unforeseen "exogenous shocks" from the environment (i.e. environmental risk). In such ambiguous situations the attribution that outcomes directly result from organisational actions is confounded with the observation that such outcomes may arise through chance and may only be loosely coupled with action (March & Olsen, 1975). It should also be noted that even where a top management team would report a high degree of certainty with respect to response-outcome relationships, environmental risk (an objective feature of the environment) can still be high.

Hence, Milliken's framework is enhanced by Dermer's administrative and environmental notions of risk. The synthesized classification provides a more complete treatment of the risks at the action stage by extending Milliken's definition of response uncertainty to include administrative and environmental uncertainties. Moreover, Dermer's conceptual risk supplements Milliken's state and effect uncertainties by

clarifying the need to formulate events conceptually at the scanning and interpretation stages before an assessment of likelihood or an understanding of cause-effect relationship can be made.

Therefore, in seeking to minimise semantic confusion and to define the concept of uncertainty better, one can identify a sequence of uncertainty components corresponding to the stages in the interpretation process by synthesizing both conceptualizations outlined above. Specifically, the synthesized conceptualization of types of uncertainty ranges from state (formulation and likelihood assessment), effect (formulation and cause-effect), response-selection, administrative to environmental types, as shown in Figure 1.

Two Orthogonal Dimensions of Uncertainty

Whilst the synthesized conceptualisation of uncertainty provides a comprehensive framework of the types of uncertainty facing decision makers at each stage of the planning process, it remains unidimensional and insufficient. In an attempt at further clarification, one needs to distinguish between two separate dimensions of uncertainty. The first refers to the type of uncertainty, that is, whether the entity under investigation, is a particular environmental state, effect, response or environmental outcome. The second refers to the extent of knowledge that exists about that entity.

States of knowledge vary between perfect certainty and ignorance. Ackoff (1970), building on earlier work by March and Simon (1958) and Knight (1921), has identified these knowledge states as risk, structured uncertainty and unstructured uncertainty. The first condition holds when the top management team is aware of the range of potential states of nature or occurrences and can encode probabilities on each. The second condition, structured uncertainty, occurs when the team, aware of the range of potential conditions, is unable to encode probabilities on their likely occurrence. The third condition, unstructured uncertainty or, more prosaically, "ignorance", is most malign in the sense that the management team does not know the range of potential states of nature.

In other words, the first two conditions imply knowledge of environmental states, impacts, responses, sources of administrative risk and sources of environmental risk. However, the last condition, unstructured uncertainty, implies the absence of such knowledge. Whereas, the former two conditions are far from benign, at least intelligence gathering activity or organisational intrusiveness into the environment provides the organisation with a lever on reducing such uncertainties. Indeed a central tenet held by many theorists is that the decision maker can assign subjective probabilities to all uncertain events being considered (Knight, 1921). However, the last condition, unstructured uncertainty, is a state of ignorance, where "knowledge" is absent and surprises arise from events that are not considered. Thus, uncertainty ranges between relatively high degrees of knowledge where probabilities can be attached to specific "known" events, to ignorance of the range of potential occurrences.

The crucial point is that each of these different degrees of knowledge can occur across all types of uncertainty previously identified by Dermer (1977) and Milliken (1987). Such ranges of unpredictability not only attach to environmental occurrences but also to knowledge of effects on the focal organisation, the response options available, the "implementability" of those responses and the outcomes attaching to the action responses. For example, in the corn-wet milling industry Wernerfelt and Karnani, (1987), identified demand, process technology, competition and externalities such as government regulation, as key state uncertainties. These state variables in turn lead to effect, response, administrative and environmental uncertainties. Moreover, the level of uncertainty attaching to each of these components can differ. For instance, the size of the market may be uncertain. Wernerfelt and Karnani (1987) point out that demand estimates made in 1972 ranged from 2.5 billion pounds to 10 billion pounds. If this range can be encoded with probabilities, then the position can be described as that of "state risk". Alternatively, if planners feel that it is impossible to encode probabilities on the demand range, then a position of "state structured uncertainty" exists because the range of demand levels is known.

From the same industry, the development of alternative technologies for manufacturing high fructose corn syrup ("HFCS") is an important state variable. If the possible alternative technologies are known, then the likely effects on the focal firm of betting on the wrong technology can be estimated. Thus, at worst, one is in a position of structured effect uncertainty. However, if industry players are unaware of technological developments in other process technologies that may superannuate the existing HFCS process technology, then decision makers are literally unaware of what they don't know. In other words, they are in a position of unstructured uncertainty. This latter position requires that organisations continually evaluate their knowledge base and also puts a premium on becoming responsive to unanticipated events (Ansoff, 1975).

Similarly, with types of response uncertainty, for instance response selection, the decision maker may "weight" the criteria of choice inappropriately (structured uncertainty), or one may employ inappropriate criteria in making choice (unstructured uncertainty). Also, implementation uncertainties may arise in situations where the decision maker estimates that the effort directed at implementing a plan ranges from lethargic to enthusiastic, but is unable to specify the likelihood of the extent of commitment (structured uncertainty). Moreover, implementation uncertainties extend to situations where action plans unexpectedly violate group norms or the preferences of key actors (Leblebici and Salancik, 1981), resulting in sabotage of plan implementation. Finally, even after action is taken, it may result in unexpected outcomes (positive and negative) as exogenous shocks occur which impact the intended outcomes.

Thus, one can think of moving from a position of complete certainty or certainty equivalent (risk) to one where the analyst is aware of what he does not know (structured uncertainty) to a position where the organisation is unaware of what it does not know (unstructured uncertainty) (Davis, 1982). In the discussion of implications that follows,

extent of uncertainty is restricted to the inclusion of structured and unstructured uncertainties as these are the least favourable conditions.

Implications for Strategic Management

Structured Uncertainty

Escaping ignorance is at the heart of the phenomenon called organisational learning, which can be thought of as improving actions through better knowledge and understanding of both states of nature and action-outcome relationships (Duncan and Weiss, 1979; Fiol and Lyles, 1985; Lyles and Schwenk, 1992). In this context, organisational learning addresses itself to generating improved knowledge of states of nature, response options and causal structures such as impact analyses, administrative implications and response-outcome relationships.

Milliken identifies a series of implications for strategic behaviour. These implications can be distinguished between those for strategic planning processes and those for strategic action. With increasing *state uncertainty*, Milliken proposes that more resources be allocated to scanning and forecasting. Likewise, with *effect uncertainty*, Milliken (1987) focused on the importance of appropriate and extensive threat/opportunity analyses. The relationship between effect and response uncertainty is clear from the scanning, interpretation, action sequence provided by Daft and Weick (1984).

Response-selection and *administrative uncertainties*, (in the sense of uncertainty over the range of potential responses and their implementation) are usually minimised through the execution of standard operating procedures and organisational routines (Nelson and Winter, 1982). However, the blind implementation of these routines and an inadequate appraisal of the full range of response options open to an organisation can lead to disaster. Thus Milliken, in her discussion of overcoming response uncertainty, identified imitation of leading competitors and increased analysis as the appropriate actions open to organisations facing structured response uncertainty.

Structured *environmental uncertainty* can be managed by pursuing a strategy of resource allocation that guarantees a return to the organisation under all foreseeable future outcomes. Since all potential outcomes are known, but not the associated likelihoods, broad (or multiple) investments in flexible resources can be made to ensure pay-offs under all possible outcomes. For example, exploiting multiple distribution channels is one way of risk reduction through resource allocation activity that expands the range of outcomes under which the organisation will remain profitable.

Milliken's overall focus in identifying managerial implications was to emphasize activities that would help the organisation "predict and prepare" for future environmental contingencies (Allaire and Firsirotu, 1989). Such an emphasis presumes considerable insight and knowledge of the transformation process. However, Milliken ignored dealing with the phenomenon of "unstructured uncertainty", as this form of uncertainty was omitted from her discussion. Planning approaches aimed at improving prediction

are particularly suitable when the knowledge level about the future is relatively high, such as situations of structured uncertainty.

Notwithstanding this, conditions of unstructured uncertainty are fundamentally different to the other, more benign degrees of unpredictability. The "predict and prepare" response needs to be supplanted by interventions aimed at flexibility and adaptability (Eppink, 1978).

Unstructured Uncertainty

With unstructured situations, the top management team's capability for environmental analysis is overwhelmed by the complex, dynamic and "opaque" interconnections between environmental and organisational components. Decision makers' abilities to absorb uncertainty by drawing inferences from data reductions made by boundary spanners (March and Simon, 1958) are increasingly attenuated as both the internal and external environments become more turbulent and unstructured. Qualitatively different ways of dealing with such discontinuous events are called for.

A number of approaches are available to facilitate management in an environment characterised by unstructured uncertainty. These include developing techniques to "think the unthinkable", through scenario development (Wack, 1985); building organisational structures, such as parallel organisations (Zand, 1984) or strategic issue management systems (Ansoff, 1984) to be more responsive to unanticipated events; and committing resources in such a way that downside risks of loss are minimised (Collis, 1992).

In dealing with unstructured *state uncertainty*, for instance, the question of what to scan and what to investigate can only be answered after the appropriateness of the lenses used to scan the environment are analysed. The typical scanning devices are useless as they may typically be focused on the "normal" sources of unpredictability in the environment. Yet these normal sources are usually not the seedbeds of crises which can overturn plans. It may be more important in this case to question the filters, strategic assumptions and information sources that limit understanding. In particular, utilizing approaches which go to the heart of challenging the "world views" underlying the organisation's strategy can be of help (Mason and Mitroff, 1981). The traditional assumptions underlying a strategy help focus attention on specific competitors, technologies and environments. Surfacing contrarian assumptions helps identify many potential avenues for threats or opportunities to emerge which could otherwise be overlooked. An interesting practical example of how to transcend the conventional wisdom in an organisation is provided by Johnson (1988). In challenging complacency in two organisations, each without identifiable competitors, Johnson "invented" a phantom competitor to sharpen managerial thinking and to encourage risk taking and innovation. Such an effort provided the impetus for both challenging complacent thinking and for generating innovative ideas.

Unstructured *effect uncertainty* represents the unanticipated shocks, opportunities and crises that buffet many organisations. For instance, the experience of British speciality retailers, such as "Sock Shop" in moving to larger U.S. cities from its home base is a case in point. The underlying rationale was the typically touted one of international expansion. Unfortunately, the unanticipated explosion of drug-related crime in downtown areas (effect, unstructured uncertainty) forced the company to employ armed guards. This action was intended to safeguard both shoppers' and employees' lives, however the action also negatively impacted the stores' ambience and sales (environmental, unstructured uncertainty). Therefore, in addition to the expected effects of high street competition, "surprises" such as security were the real culprits in explaining poorer than expected performance (Business Week, 1990). In addressing effect uncertainty, developing impact scenarios utilizing a series of assumptions contrary to the ones underlying the firm's strategic plan can be seen as an attempt at "getting out" of the straitjacket of thinking that rescinds the creative input in strategic planning (De Geus, 1988).

These strategic surprises (Ansoff, 1975) are sudden, unfamiliar events which threaten the survival of the organisation. With these unanticipated phenomena the selection of a response and the estimation of the causal relationship between response and outcome are inexorably intertwined. Unanticipated opportunities and threats give rise to problems over establishing first mover advantages and crisis management respectively. There has been a rash of literature in the organisational sciences addressing crisis management. These solutions to *unstructured response-selection* and *administrative uncertainties* typically involve the combination and synthesis of multiple viewpoints on the crisis, by listening to "dissenting voices" and acting as if actions and responses are experiments rather than irrevocable commitments in the face of uncertainty. Mitroff (1988) advocates the development of early warning signals for crises and the institutionalization of both damage limitation and recovery mechanisms. These exhortations are aimed at getting organisations to think the unthinkable and to assess their abilities to handle such catastrophes. It is believed that new management strategies of crisis management, rather than new technologies, can help to prevent disasters such as the Exxon Valdez or Chernobyl. An article in Business Week (1991) cites the work of researchers at the University of California at Berkeley, which show that the best way to prevent a crisis is not tight control from the top. Even though the organisations studied were hierarchical, roles and decision making change dramatically when an emergency arises. The fast flow of information and quick decision making that are necessary dictate that people of different ranks operate as equals. Employees who know their jobs and are most in touch with the problem must be given the freedom to act swiftly rather than be required to go through the formal channels of authority. The emphasis should therefore be on training employees for that role and providing them with the best possible information at the right time.

In dealing with unstructured *environmental uncertainty*, the impact assessment of potential responses is problematic. For example, in the case of "Sock Shop" cited earlier, the response to the company's action of employing armed guards was largely unanticipated. Another example is provided by Coca Cola's introduction of "New Coke". After extensive taste tests, Coca Cola introduced a new formula to replace the original "Real Thing". Unfortunately, the action-outcome relationship was not subjected to tests before launch. Coca Cola assumed that the new product "tasted" better, but that assumption was not shared by its customers, and a significant loss of market share occurred (Ghemawat, 1991).

Milliken anticipates such problems in her recommendation to employ incremental strategic management styles in environments characterized by high uncertainty (Lindblom, 1959). Ultimately, it is necessary to treat actions and responses as experiments (Nystrom and Starbuck, 1984). With experiments, the results may be guessed a priori, but never known with certainty. Action and evaluation of action are necessary preconditions for the generation of knowledge. For example, Coca Cola could have test-marketed new Coke extensively before national launch (see Ghemawat, 1991). Quinn's (1985) research on the behaviours of successful innovators is indicative of this experimental approach. These innovators are all reported to foster "atmospheres" of creativity. This atmosphere is underpinned by the encouragement of multiple approaches to technology development, short-circuiting the elapsed time to prototype development and physical testing, and finally, interaction and communication with outside research and technological organisations. These policies are directed at improving the odds of innovative success through increasing sensitivity, adaptability and flexibility. In many ways, these approaches either delay commitment of resources until crucial uncertainties have been resolved, or investments are made in fungible resources to maintain flexibility (see Collis, 1992, for a discussion).

A summary of the implications of each combination of type and extent of uncertainty for strategic planning is presented in Table 1.

Table 1: Implications for Strategic Planning

EXTENT OF UNCERTAINTY	TYPE OF UNCERTAINTY: *State*	*Effect*	*Response-Selection & Administrative*	*Environmental*
Structured	Scanning and forecasting activities	Threat/Opportunity Analyses	Standard operating procedures; Imitation of leading competitors; Increased analysis	Planning approaches to improve prediction; "Predict and Prepare" Broad resource investment
Unstructured	Question strategic assumptions and information sources; Challenge "world views"	Develop Impact Scenarios utilising assumptions contrary to those in strategic plan	Crisis Management techniques: - Early warning systems; - Damage limitation and recovery mechanisms; - "Think the Unthinkable"	Incremental strategic management styles; Experimental approach Flexibility in resource commitment

Conclusion

The classification of uncertainty identified by synthesizing the frameworks of Milliken and Dermer serves to crystallise management's conceptualisation of risk in all stages of the interpretation process. This allows managers to systematically identify the uncertainties they face, thereby allowing them to adopt the necessary actions to deal with them. In many ways, this synthesis itself reduces one source of conceptual risk that managers face by explicitly identifying, and labelling in a complete manner the sources of uncertainty confronting decision makers. However, as discussed in the model, the appropriateness of the actions does not depend only on the type of uncertainty identified, but more critically hinges on the extent of ignorance.

Using the conceptual frame of uncertainty offered in this paper, one can think of single loop learning as the accretion of knowledge about states of nature or action-outcome relationships, given a particular strategic framework. With double loop learning, first principles are challenged and new insight generated. Davis (1982) points out that the move from not knowing what you don't know to knowing what you don't know typically represents a "major breakthrough" in insight. The very context of decision making is transformed. Changing the context may require the type of second order or double loop learning activity that goes to the heart of uncovering worldviews. This is as much an "internal" affair and is more concerned with intelligence development than intelligence gathering. This combination of commitment to knowledge and openness to the outside world are characteristics of so-called "learning organisations" (Mills and Friesen, 1992). Therefore rather than closing out uncertainty, the stimulation of uncertainty may be useful for challenging thinking (Bourgeois, 1985; Jauch and Kraft, 1987; Mason and Mitroff, 1981).

The assumption that unpredictability is tractable to increased analysis is only valid for the less malignant forms of unpredictability. New ways of thinking and scanning new areas are called for in dealing with conditions of unstructured uncertainty. These methods are increasingly directed at uncovering the assumptions and organisational routines that serve as filters for information gathering and as constraints on organisational experimentation. Since "developments" in unstructured situations, by definition, cannot be modelled adequately, improved flexibility and adaptability need to be fostered in organisations (Eppink, 1978; Leblebici and Salancik, 1981). Two ways of managing such uncertainties are firstly, to increase the scope of investments so that multiple future options are kept open by a particular commitment, and secondly by delaying investments since front-end loaded investments are more vulnerable to unpredictable outcomes than back-end loaded ones (Collis, 1992). Ultimately, top management teams need to reduce their organisations' dependence on critical, uncertain contingencies (Pfeffer and Salancik, 1978).

For researchers, our framework of uncertainty, alongside Daft and Weick's interpretation process model provides a useful means of structuring the problems facing

decision makers. By recognising the complete array of uncertainties impacting decision makers at the various stages of the decision making process, researchers can better analyse the information needs required to resolve these uncertainties, where appropriate, or suggest tools or managerial skills that can be utilised to better manage or exploit these uncertainties. Researchers can conduct field studies of companies that succeed in managing specific uncertainties identified in the framework and further prescribe action necessary for survival and success. An important contribution of the framework is that it provides a systematic and comprehensive conceptualisation of uncertainty that is not currently available in the literature.

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Note

1 Demmer's use of the term "risk" and Milliken's use of "uncertainty" are somewhat confusing. The term risk and uncertainty have very specific meaning (see later); however, these two authors employ the terms in similar ways, ignoring their precise meanings.

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