



# Deliberative attention management

Dave Valliere

*Entrepreneurship and Strategy, Ryerson University, Toronto, Canada, and*

Thomas Gegenhuber

*Johannes Kepler University, Linz, Austria*

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## Abstract

**Purpose** – The aim of this study is to explore the drivers of supply and demand for attention in the managerial context, and develop a framework of managerial tools for allocating attention to various competing demands.

**Design/methodology/approach** – Deliberative attention refers to the application of attention to prolonged reflection and consideration of problems where routine approaches are insufficient. Drawing on theories of cognitive and structural constraints to the allocation of attention among competing stimuli, the paper investigates how managers match the strategic demands for deliberative attention and the supply available to individuals in their firms. This is used to develop a model of factors influencing the matching of supply and demand.

**Findings** – The paper uses this model to recommend specific strategies for explicitly managing deliberative attention and to categorize the appropriate application of a range of existing strategic management tools based on the nature and inherent uncertainty of the organizational problem being faced.

**Practical implications** – The model suggests that a primary strategic task of top managers is the appropriate management of attention within the firm. Understanding attention as a firm resource to be appropriately and deliberately managed helps to advance theoretical understanding of the human side of valuable resources in the firm. Such knowledge may also help practitioners to be more cognizant of their investments of valuable attention resources.

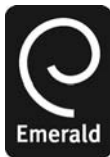
**Originality/value** – This is one of the first studies to treat attention as a scarce and valuable firm resource to be managed, and to use this as the foundation for more appropriate application of a wide range of current management techniques.

**Keywords** Attention, Decision making, Cognition, Wicked problems, Uncertainty, Epistemic plurality, Design thinking, Bricolage, Arts-based methods, Management development

**Paper type** Research paper

Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought [...] it implies withdrawal from some things in order to deal effectively with others (James, 1890, p. 403).

When William James made his statement more than a century ago the world was a simpler and slower-moving place where managers usually had sufficient time to process information about their environment, to reflect on its meaning, and to decide appropriate strategic responses for their firms. But the world has changed much since those days. It has become more complex, more interconnected, and more rapidly changing – to the point where many managers find it a challenge to deal effectively with the glut of information and constant demand for quick action. The information age has placed new and almost insurmountable demands on the information processing abilities of managers and on their abilities to discern and pay attention to that which is most important to the success of their firms. As Herbert Simon (1996)



famously noted, “What information consumes is rather obvious: It consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention” (p. 40). In an environment characterized by plenitude of information resources and an insatiable demand for managerial attention it seems that this attention is becoming the ultimate scarce resource.

Recently, management researchers have begun to make some initial explorations into the role of attention in the realm of strategic management (e.g. Ocasio, 1997; Davenport and Beck, 2001). Kiesler and Sproull (1982) used a social cognition perspective to show that attentive actions of managers to the noticing, interpreting, and incorporating of stimuli were reflected in organizational problem sensing, which provides a basis for understanding how managerial attention affects sense making and behaviours, particularly in times of crisis or extreme change. But there is still very much to be done to fully understand the demands on the attention of people in the firm, the supplies of attention available to them, the processes by which demand and supply are matched, and the effects of their activities on firm performance. Despite a general recognition that attention matters and that it is worthy of being consciously managed in the firm, very little research has been done into providing frameworks or guidelines to assist managers in using their attention resources wisely and effectively. This paper is a small attempt to contribute to this goal.

It is important that strategic managers develop a fuller awareness of attention as a resource and that they develop tools to help them manage the utilization of this resource. Failure to do so puts the firm at a severe competitive disadvantage because, in a rapidly changing environment, attention will eventually be misallocated to the point that important environmental cues will be missed or will be incorrectly interpreted. As a result of this inattentive blindness (Simons, 2000) managers may be so focused on the wrong things that they are blindsided by some other transformative external event or may become swamped by insignificant and unimportant noise and minutiae.

The business world has many examples of firms and managers who failed to give adequate attention to subtle but important cues in their dynamic environments. Take the example of Microsoft in the early 1990s, where a failure to attend to and recognize the enduring significance of the emerging internet led to their initial forfeiture of the browser market to Netscape – a strategic error that took years to recover from, and one which they arguably repeated with the search engine market that they are now struggling to take from Google. As a more general example, Christensen’s (1997) concept of the “innovator’s dilemma”, in which firms fail to notice emerging competition from radically different disruptive technologies until it is too late, is a widespread demonstration of the potential consequences of insufficient attention.

Examples of the potential negative consequences to firms whose managers provided excess attention are similarly widespread, although often less dramatically visible (sins of omission can be harder to spot than sins of commission). One example can be seen in the recent efforts that natural gas producers put into acquiring conventional assets in North America in response to the higher commodity prices that arose from shortage fears. This attention and the resulting conventional acquisition costs turned out to be largely wasted when unconventional shale gas reserves became feasible to exploit. Another example could be the efforts made by North American producers of genetically modified foods to avoid repeating the negative consumer market reactions that occurred in Europe. Much attention and many firm resources were devoted to this goal – attention that turned out to be unnecessary when it was

later discovered that North American consumers were much less sensitive to this issue than their European counterparts.

Such situations are lamentable as they are value destroying for firm stakeholders and yet would have been avoidable, at least in principle, had those managers directed their attention and that of their employees more astutely. This executive function of directing attention towards some information and away from other information is a defining characteristic of the cognitive mechanisms of attention. While it is conversationally convenient to refer to the attention of the firm being directed somewhere, it is important to understand that attention is a property of the individuals who are performing management functions within the firm, one derived from the cognitive functions of individual minds.

This paper will attempt to inform the understanding of attention allocation and to provide guidance to achieve more effective management of deliberative attention. It will make the novel argument that the strategic management of organizational attention is not simply an allocation problem, but is an active matching process in which sources of attention supply and demand are actively manipulated to provide appropriate levels of deliberation to tasks with the greatest demand for insight and wisdom. First will be a review of the literatures of the cognitive psychology of attention and the role of attention in strategic management. Next, will be the presentation of a conceptual supply/demand management model and an examination of the drivers of demand and supply of deliberative attention to better understand the parameters or managerial “levers” available to the matching challenge. Finally, will be a review and contextualization of a wide range of strategic management tools with recommendations as to the types of problems they are best suited to address.

### Literature review

A common visible manifestation of the “management” of attention is the inability to process many simultaneous competing stimuli and a resulting coping strategy of noticing only selected stimuli while blocking out others. Early psychological researchers developed an explanation of this human attention that posits a “bottleneck” in the capacity to process information. Researchers have therefore suggested the existence of a cognitive filter that prevents stimuli from reaching conscious awareness and thereby consuming attention (e.g. Broadbent, 1958). The common example to demonstrate this filtering are “cocktail party effects” where an individual may be in the cacophony of a crowded and noisy party, unable to understand what the many people are saying. Yet, they are still able to focus on the words spoken by conversational partners while ignoring the background noise. Yet further, if someone in the background noise happens to speak their name, somehow that sound arises clearly from the background noise to be noticed by them – it passes through the filter and receives their attention. Among the many competing demands, humans have the ability to select and attend to a single input channel and provide progressively higher-order processing to make sense of the stimulus. Through progressively greater investment of attention individuals determine the physical characteristics of the stimulus (a loud sound being spoken), its meaning (someone is calling my name), and the appropriate response (I turn to see what they want). It has been shown that at each progressive level of attentional investment new filters are applied to prevent stimuli from demanding further processing (Treisman and Geffen, 1967), thereby minimizing the attention burden yet making available when necessary.

But such filtering and processing takes mental effort, which appears to also be of limited supply. The attentiveness of individuals is limited, both in their ability to process simultaneous stimuli and in their ability to filter and decide to which stimuli they should attend. Daniel Kahneman (1973) argues that this constrained capacity is mitigated by an executive function that decides how to allocate limited attention capacity. This allocation would depend on available unused attention capacity (such as when in a low-stimulus environment) and the overall level of individual arousal (such as when under a perceived threat).

As William James noted in the quotation that opens this paper, everyone knows what attention is, if only through simple introspection. Yet despite the self-evident nature of attention, few have offered a clear definition of the underlying construct and the term has therefore been used quite broadly by different researchers. In their seminal paper, Posner and Boies (1971) remark on the very wide range of phenomena that researchers have categorized under the term “attention”, and therefore suggest that the concept subtends several sub-elements that pertain to alertness, selectivity, and processing capacity. Throughout the 1990s many studies attempted to use factor analysis to differentiate a consistent set of sub-elements to attention. Spikman *et al.* (2001) argue that these efforts have had somewhat poor repeatability in their details, but there has emerged a generally held view that one of the broad elements of attention is the ability to selectively concentrate or sustain cognitive focus on one domain or set of stimuli, at the expense of other domains. In this paper, such sustained cognitive focus is referred to as “deliberative attention” to differentiate it from the related concepts of vigilance, signal detection and encoding of new knowledge, and from the executive function that controls these.

Humans appear to have developed a method of improving attention allocation in the face of limited capacity – the automatization of practiced activities. Many difficult cognitive or physical actions require considerable attention to perform when they are novel to us. But with sufficient practice they become routine to the point where they no longer demand the same effort; as actions become routine they demand successively less attention resources. Humans therefore appear to be capable of a two-process approach to investing scarce attention, using automatic “back of mind” processing wherever possible, and using scarce “front of mind” attention capacity only where needed (Shiffrin and Schneider, 1977). Automatic processing can be used for routine activities, while conscious attention is brought to bear only when exceptional cases arise. Moreover, with sufficient additional practice, even the processing of some exceptional cases can be automated (LaBerge, 1975).

This individual processing of attention applies to all dimensions of human activity, including the managerial. And so, within the realm of strategic management research there is now arising an attention-based view based on the managerial psychology of Herbert Simon (1947). Simon’s view was that the decision-making challenge of matching of problems, solutions, and actors within an organization is constrained by the limited attention capacity of individual decision makers, and that organizations therefore allocate and channel environmental stimuli to individual decision makers to make best use to their attention capacity.

The literature of decision making has a long history of development from the eighteenth century thoughts of Bernoulli on expected utility. The resulting rational choice theory of utility maximization and the expected utility of decisions under risk assumes that decision makers behave rationally according to the four von Neumann-Morgenstern axioms (von Neumann and Morgenstern, 1944) of

completeness, transitivity, independence, and continuity of preferences. Yet the assumption of complete and axiomatic rationality is clearly violated in many observable human decisions, leading subsequent researchers to develop a line of “behavioral economics” to better explain the actual observed choices of decision makers. This field includes prospect theory (Kahneman and Tversky, 1979), hyperbolic discounting (Ainslie, 1974), anticipated or rank-dependent utility (Quiggin, 1982), and Herbert Simon’s (1947, 1956) work that introduced the idea that the occasional irrationality of human decisions being attributable to innate and environmental cognitive constraints and to the replacement of an objective of goal optimization with a goal of “satisficing”.

The allocation of stimuli to attention channels is constrained not only by the limitations in cognitive capacity described by psychological theorists, but also by structural influences. Of these two constraints, the role of cognitive-capacity limitation has been more studied and is relatively well understood. It is primarily limited by bounded rationality and the routines of individual actors (March and Simon, 1958) and the focusing effects of hedonic psychology (Kahneman *et al.*, 1999, 2006) that draw the attention of decision makers to specific environmental features. But in a social context the allocation of attention capacity is also influenced by enactment of social scripts (Weick, 1979), the loose coupling of the “garbage can” model of organized anarchy (Cohen *et al.*, 1972).

In marked contrast to the cognitive-capacity limits on attention allocation, the structural constraints are much less well understood. Building on the initial work of Ocasio (1997), Barnett (2008) proposes a three-stage model of structural constraint in which contextual structures (such as culture and informal rules) influence whether stimuli in the business environment are enacted within the firm, these enacted opportunities are then processed through concrete structures (such as formalized business processes, job specializations, and tools) that allocate the opportunities to specific attention channels, and decision makers in the firm consciously attend to those channels to evaluate the stimuli and determine the appropriate organizational response. Under this model, organizations can mimic the filtering abilities of individuals by establishing specific contextual structures to influence what stimuli get noticed and specific concrete structures to bring those stimuli to the attention of managers.

We therefore can characterize the attention challenge to organizations as one in which we understand that capacity constraints effectively place limits on the supply of attention, but that these limits are somewhat flexible in response to techniques of routinization and automatic processing. We also understand that environmental demands for attention from strategic managers are increasing significantly, and that the costs of inattention to a critical issue can be very high. We also understand that the managerial challenge is one of attempting to reduce demands on attention and increase supply of attention in order to allocate scarce attention resources to the most pressing problems and stimuli facing the firm. But we do not yet understand how to achieve this optimal allocation, nor can we make operational recommendations to strategic managers for the appropriate use of tools and frameworks to achieve this balance. Existing theories of attention management in organizations fail to fully explain the differences between allocation rules as designed and as actually implemented, and fail to inform or guide the actions of managers in better allocation of organizational attention. The model being proposed in this paper is an attempt to begin progress on this task.

### Theory development

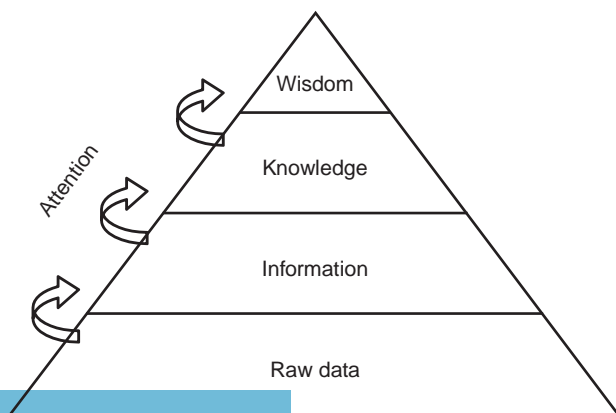
Addressing this gap will entail inquiry into the role the attention plays in the functions of management and how managerial attention can be most effectively used to make sense of a rapidly changing environment and to determine the wisest course of action for the firm.

Figure 1 illustrates the “knowledge pyramid” familiar to systems theorists (Ackoff, 1989; Lanham, 2006). It suggests a hierarchical relationship in which raw symbolic data is interpreted to impute meaning as “information”, this information is applied within a context and understood to be useful as “knowledge”, and this knowledge is synthesized and extrapolated as “wisdom”. For the big questions of strategic management, it is this final level which is of greatest value since it is wisdom alone that can be applied to a non-deterministic future and to situations that have not been previously encountered.

Moving upwards in this hierarchy requires mental attention and the understanding achieved only through deliberation and sustained concentration. The wisdom necessary to tackle the challenges of strategic management is achieved through appropriate deliberation, mindful reflection, and deep insight. Weick and Sutcliffe (2006) argue that this mindfulness acts to stabilize the attention and permit reconceptualization or modification of existing mental categories. The “deliberative attention” of this paper comprises this sustained and mindful application of human attention to prolonged reflection and consideration of the most difficult problems, ones where routine approaches are insufficient to achieve a solution. Deliberative attention is therefore a valuable resource to managers – the cognitive capability of sense making in a complex business environment, and the ability to draw meaning from it and to identify opportunities and threats. Deliberative attention is what enables managers to make the wise decisions (not merely “informed” decisions) that may lead to superior performance. But deliberative attention is a scarce resource, since it is the limited product of minds that are distracted with many competing attentional demands. The strategic managerial task is therefore one of acquiring this scarce resource and deploying it effectively.

### Management model

If deliberative attention is a scarce and valuable resource it should be managed like other resources to suitably benefit the strategic performance of the firm. Its supply



**Figure 1.**  
Hierarchy of attention  
and meaning



must be understood, including when it comes, what factors constrain its availability, and how it can be directed and allocated appropriately. Its demand must also be understood, including the types of managerial problems that consume it, what factors constrain its utilization, and how it can be most effectively employed. The strategic challenge of managers is, above all, to effectively strike an appropriate match between this supply and demand.

Sullivan (2010) has found that organizations establish rules by which attention is allocated to solving problems. But, while such rules may be multifaceted and nuanced during the rule proposal stage, at the rule finalization the application of these rules becomes more simplistic and less nuanced in response to pressures of urgency and industry performance characteristics. As a result organizations may fail to allocate appropriate attention to problems that are important but may be subtle and not urgent when there are many other competing demands on attention which consumer all available supply.

If, on the one hand, the demand for deliberative attention exceeds the available supply then decision quality will be poor. Decision makers will not be attending sufficiently to important information, so this information will be either overlooked entirely or will be interpreted too superficially and therefore increase the likelihood of imputing an incorrect meaning. We refer to this situation as “ineffective” because the decision-making process is neglecting important but subtle information and is therefore reaching inappropriate conclusions. For example, busy managers may not notice that buried in the glut of information available about market reactions to their offerings are tiny contrary voices – clues about an unserved niche that has the potential to be very profitable. Under the pressure of time and with insufficient attention to notice these clues or, if noticed, to fully explore these clues, the managers may make the simplifying assumption that the contrary voices are just normal levels of noise and variance in market data, and therefore may miss a lucrative market opportunity.

If, on the other hand, the available supply of deliberative attention exceeds demand then decision quality will be good, but will be wasteful. Decision makers will be reflecting and attending too much to issues that could be decided more quickly with no loss of decision quality. For example, expensive yet idle managers may devote too much time and effort to analyzing routine information that could be better handled through automatic processing rules in the firm or by lower-paid employees. We refer to this situation as “inefficient” because the decision-making process is consuming unneeded management attention that is costly, and potentially leading to overthinking the problem and therefore reaching inappropriate conclusions or failing to act at all. This is sometimes referred to as “analysis paralysis”, wherein decision makers spend so much time in deliberation that either they must rush to poorly implement their decision, or the opportunity to take a business decision passes away from them entirely. In Kotov’s (1971) book *Think Like a Grandmaster*, he describes a situation when a player thinks very hard for a long time about a complicated chess position, unable to decide on the best next move. Then, running low on time, the player quickly makes a blunder. This “Kotov syndrome” is about people trying to reach a decision, deliberating too much, running out of time, and ultimately making a poor choice.

The optimal situation is therefore one where the supply of deliberative attention matches the demand. In this situation efficiency is achieved since no costly excess of attention is provided to problems that can be adequately handled through routine or automatic processing. Effectiveness is also achieved as no difficult managerial problem is short-changed with inadequate attention leading to incorrect decisions or ineffective

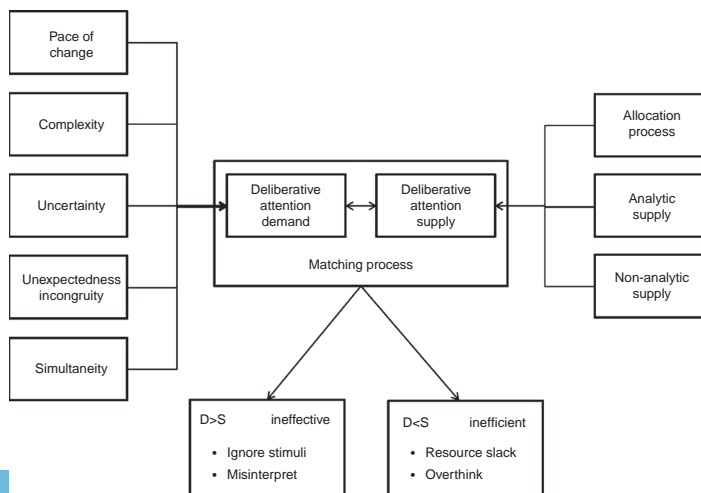
actions. This matching of supply and demand is the ideal position to strive towards, but from a practical perspective can be very difficult to achieve due to the dynamic nature of the firm's processes and of the attentional demands of the changing environment.

In Figure 2 we present a model of demand and supply of deliberative attention in the firm. This deliberative attention management (DAM) model identifies specific antecedents for demand and supply, which will be discussed in the sections below. The model also suggests the consequences of non-optimal management and matching of supply and demand, which are reflected as specific propositions for each antecedent. Where the antecedent is a driver of demand the propositions reflect the consequences of experiencing demand that exceeds available supply. And where the antecedent is a driver of supply the propositions reflect the consequences of creating supply in excess of actual demand.

*Demand for deliberative attention*

It is becoming widely recognized that the emerging knowledge economy is placing increased demands on the deliberative attention capacity of managers in the firm, to integrate rapidly changing knowledge of the world and to reflect upon it and make sense of it (Cegarra-Navarro and Cepeda-Carrion, 2008). As O'Carroll (2008) says, "there is a deep irony at the center of the knowledge economy [...] the use of metaphors of speed and efficiency bypass any appreciation of the qualitative nature of time found within these work processes. Knowledge production is based on creativity, communication and knowledge development, processes that move at their own pace" (p. 179). Our model incorporates five significant drivers of this demand for deliberative attention.

*Pace of change.* The first driver of demand is the rapid pace of information flow that must be channelled and processed by managers. The information age is characterized by increasing amounts of raw data and a continuously accelerating rate of technological change that alters the competitive landscape and presents a new set of strategic challenges for managers (Judge and Miller, 1991; Bettis and Hitt, 1995; Graetz, 2000). This increase in both the amount of new information to be processed and the pace at which it arrives results in a reduction in available attention to the challenges of strategic management, creating what Davenport refers to as an "attention



**Figure 2.**  
Deliberative attention  
management



crisis” (Davenport and Beck, 2002). Recent expansion of digital culture and the internet further exacerbates the problem by exponentially increasing the rate of change and the degree of interconnections among elements (Lanham, 2006).

Firms may respond to this accelerating pace of environmental change by rapid prototyping of individual and organizational behaviours and by semi-structured improvisation (Baker *et al.*, 2003), in effect making quick and low-cost probes into the future (Brown and Eisenhardt, 1997). Such responses may culminate in a strategy of bricolage – the making do with what is at hand, either indirectly or through its incidental effects (Lévi-Strauss, 1967) – whereby strategic managers engage in social reconstruction by refusing to enact constraints of existing resource meanings and instead make rapid and experimental combinations of resources and behaviours to quickly see what is effective as a response to a given environmental stimulus (Baker and Nelson, 2005):

*P1(a).* At a given supply of deliberative attention, firms that operate in environments characterized by rapid change are more likely to ignore or overlook environmental stimuli, resulting in diminished firm performance.

*P1(b).* At a given supply of deliberative attention, firms that operate in environments characterized by rapid change are more likely to misinterpret environmental stimuli, resulting in diminished firm performance.

*Complexity.* The increased complexity of the business environment and its information flow is the second driver of our model, as firms and industry environments can be regarded as being “complex systems”. Complex systems are systems having both many components and many constraints to the interactions among these components (Simon, 1962). It is the interplay of these two defining characteristics that makes complex systems interesting – a system with few interacting components and many constraints is deterministically simple, and a system with many interacting components and few constraints is chaotic yet statistically simple (Brown and Eisenhardt, 1997; Rivkin, 1998; Rivkin and Siggelkow, 2002). Complexity increases the demand for deliberative attention because the complex system has more elements and a greater number of connections among them, all of which are sources of information to be understood. But a complex system can demand additional attention because it can exhibit unexpected behaviours that cannot be predicted from the behaviours of the individual elements. Together with the increase in amount and pace of new information, this complexity and turbulence of the environment and the global interconnectedness of business substantially increases the demand for deliberative attention (Diehl and Sterman, 1995; Adler, 2006; Dennis, 2007).

One frequent managerial response to increased complexity is to establish a sufficiently clear organizational mission and an adaptive culture that can respond to emergent phenomena of complexity (Chaffee, 1985; Johnson, 1992), one which is not so rigid and immutable that no change can occur, but is also not so flexible and unstructured that the organization is unguided in its response to the changing environment (Brown and Eisenhardt, 1997):

*P2(a).* At a given supply of deliberative attention, firms that operate in environments characterized by complexity and interconnectedness are more

likely to ignore or overlook environmental stimuli, resulting in diminished firm performance.

*P2(b).* At a given supply of deliberative attention, firms that operate in environments characterized by complexity and interconnectedness are more likely to misinterpret environmental stimuli, resulting in diminished firm performance.

*Uncertainty.* A third driver can be found in the amount of uncertainty in the information that managers are required to process. Uncertainty in information means that, not only are some data known only in a probabilistic sense, but some data are fundamentally unknowable (even probabilistically) and therefore not amenable to statistical decision-making approaches – a much harder managerial problem. Knight (1921) argues that the essence of the uncertainty problem “is the forward-looking character of the economic process itself” (p. 8) – firms do not know in advance if there is a need for their products and services. Sarasvathy *et al.* (2005) builds on Knight and identifies three types of uncertainty: Type 1, in which the future can be predicted probabilistically; Type 2, in which the future can be characterized by statistical parameters, but the values of these parameters are unknown; and Type 3, in which the future distribution is both unknown and fundamentally unknowable.

This third type of uncertainty can be viewed as an underlying condition of the so-called “wicked problems” that vex many modern decision challenges (Rittel and Webber, 1973). Many of the most challenging problems of business strategy can be characterized as wicked problems that are especially hard to solve due to contradictory or dynamic requirements (Camillus, 2008), and therefore are especially taxing to the supply of deliberative attention. Demand for deliberative attention is therefore a function of the number of problems the firm faces and the degree of uncertainty each problem entails (Bellman and Zadeh, 1970). Maximum demand occurs when the firm faces several wicked problems simultaneously:

*P3(a).* At a given supply of deliberative attention, firms that operate in environments characterized by uncertainty and ambiguity are more likely to ignore or overlook environmental stimuli, resulting in diminished firm performance.

*P3(b).* At a given supply of deliberative attention, firms that operate in environments characterized by uncertainty and ambiguity are more likely to misinterpret environmental stimuli, resulting in diminished firm performance.

*Unexpectedness and incongruity.* Innovation is an important source of new information in the world, and therefore a potential driver of demand for attention. Peter Drucker (1985), in his seven sources of innovation, identifies a range of antecedents of an innovation. While many of these sources require only a routine level of front-of-mind attention for sense making (e.g. the innovation inherent in addressing “process needs” through process improvements), two of his seven sources demand a more deliberative level of attention. The first is “unexpectedness”, the occurrence of outside events contrary to expectations or prediction. And the second is “incongruity”, reality not acting in accordance with assumptions or contrary to how it “ought” to be. These innovation sources particularly require deliberative attention because, being

essentially contrary to preconceptions or expectations, there is a greater cognitive demand to make sense or derive meaning from such occurrences.

Unexpected or incongruous environmental stimuli are difficult to plan for and therefore to address with the demand management approaches mentioned already (Hunsaker, 1975). But it may be possible to mitigate the burden of any such cases by allowing enough space for serendipitous resolution of attention demands (Baker *et al.*, 2003). For example, it may be effective to have a small portion of activities without firm deadlines or rigidly defined success metrics, as a means of preserving organizational slack that can absorb the unexpected. Deadlines may work to improve performance of simple tasks, but tight deadlines may actually decrease performance of complex tasks requiring deliberative attention (Macan, 1994):

*P4(a).* At a given supply of deliberative attention, firms that operate in environments characterized by unexpected or incongruous change are more likely to ignore or overlook environmental stimuli, resulting in diminished firm performance.

*P4(b).* At a given supply of deliberative attention, firms that operate in environments characterized by unexpected or incongruous change are more likely to misinterpret environmental stimuli, resulting in diminished firm performance.

*Simultaneity.* The final driver of demand for deliberative attention is simultaneous competition from other tasks that also require attention. The cumulative demand arising from competing tasks depends on the number of simultaneous tasks and on the attention consumed by each task. The amount of attention consumed by a competing task will depend on the inherent size of the task and on the type of uncertainty it entails. So, significant competing demand for attention can be generated by competing tasks in two different ways. First, there may be a large number of tasks that must be attended, each of which may require only a modest amount of managerial attention, but the sum of which may still be significant. Second, there may be a smaller number of competing tasks, but these may be ones that each require significant deliberative attention. Clearly, the case with the greatest attentional demands will be the one where many deliberative tasks arrive simultaneously – tasks that are sufficiently urgent that the parallel and excessive demands for attention cannot be rescheduled into serial and successive demands. In such a case the demands for deliberative attention may easily exceed the supply available to the firm, whereas, had the same tasks arrived serially and sequentially their attentional demands may have been sufficiently accommodated by the firm (Judge and Miller, 1991). Moreover, the coordination of parallel tasks incurs additional costs to the individual and organization, adding to the challenge (e.g. Gulati and Singh, 1998; Schumacher *et al.*, 2001).

One approach to the reduction of simultaneity is the use of filters. These might be as simple as “architectural” filters that minimize distractions by closing doors and switching off e-mail notification programs (Speier *et al.*, 2003), choosing workplace space design to support individual concentration (Voort, 2004), or deliberately not accessing certain information sources (e.g. not reading the morning newspaper if it is felt that such activity is likely to generate many distractions of low value).

But coarse filters like these are relatively “dumb” in that they are not sensitive to context or the potential importance of the information they block. A more effective

approach may be to implement better, “smarter” filters. Smart filtering is one of the potential organizational roles for experts, since part of the nature of expertise is in knowing which information to attend to and which to ignore. By judicious use of expertise as smart filters in the information stream, the firm can reduce attentional demands without risking the loss of important information that should be permitted to pass through the filters to the decision makers. This expert filtering can be partly achieved through the use of individuals possessing expertise, but can also be achieved through organizational design goals of repeated practice, routinization of business processes, formalized artefacts (reports and meetings), and automatic processing. Through the creation of subsystems and technology that absorbs more information than it produces (i.e. listens more than it talks) it is possible to further simplify the attention demands on decision makers (Simon, 1996).

This structural filtering is an objective of organizational ambidexterity (Birkinshaw and Gibson, 2004; Raisch and Birkinshaw, 2008). By establishing structural or contextual means to direct the organizational balance between the demands of current operations and attentiveness to environmental changes and opportunities for the future, firms are in effect applying smart filters to the various demands on attention. Ambidexterity makes the world smaller by realigning structures to enable managers to focus on both exploration and exploitation.

A more proactive managerial response to simultaneity is to better plan the serializing and sequencing of organizational tasks to avoid excessive parallelism and the resulting simultaneity of attentional demands. In practice this would mean a more comprehensive approach to project planning and project management within the firm. Managers would need to treat attention as a limited-capacity resource in the same way that they currently treat limited resources like manufacturing plant capacity or departmental budgets – the scheduling and sequencing of organizational initiatives would have to take into consideration the attentional demands that they place on managers, in light of the competing demands placed by other initiatives:

*P5(a).* At a given supply of deliberative attention, firms that operate in environments characterized by simultaneous or parallel changes are more likely to ignore or overlook environmental stimuli, resulting in diminished firm performance.

*P5(b).* At a given supply of deliberative attention, firms that operate in environments characterized by simultaneous or parallel changes are more likely to misinterpret environmental stimuli, resulting in diminished firm performance.

#### *Supply of deliberative attention*

Against these demands for the deliberative attention of managers is a limited supply that must be managed and allocated effectively to ensure that the most important problems are adequately addressed. The limited rationality and cognitive capacity of decision-makers necessitates some combination of either following simplifying rules or bringing multiple actors to bear on a problem that demands deliberative attention (March, 1994). Our model incorporates three significant drivers of the supply of deliberative attention to respond to the overall demand placed on the managers in the firm.

*Allocation process.* The first and simplest driver of supply is the skilled allocation of a fixed quantity of attention between deliberative tasks and more routine tasks. The supply of deliberative attention can be increased by consciously devoting more time and energy to deliberation, at the expense of more routine activities. At the level of the individual this means both selective attention to maintain cognition despite distractions from competing stimuli, and sustained attention to maintain a consistent and prolonged attentiveness during the continuous task. Manifesting selective and sustained attention requires the individual to exercise an executive cognitive function to choose which stimuli to attend and which to ignore, and to keep on-task for prolonged continuous tasks (Warm, 1984; Sergeant, 1996).

Contextually, this executive function can be enabled through cultural cues (Thornton and Ocasio, 1999) and through the influence of a dominant logic (Prahalad and Bettis, 1986). Structurally, this executive function can also be enabled through formalized time management practices. This represents a form of short-term goal setting, including the use of deadlines to help keep one focused on the task (Sutcliffe and Weick, 2008). But time management is in general a poor proxy for attention management, and the use of goals and deadlines may provide improved perceptions of attentiveness without necessarily improving actual performance (Macan, 1994).

At the organizational level, this structural approach is sometimes implemented as formalized deliberation time, such as so-called “away days” where managers devote a significant block of time to deliberating on strategic issues, and typically does so by “retreating” to a different environment than the usual office workplace (e.g. a conference room, resort, or remote cabin) in the belief that the change of location effects a change in attention. Away days can be useful as a formalized ritual signaling an alternative context open to change and not automatically constrained by the usual contextual structures. Some organizations additionally signal and encourage this shift through the use of formalized “play” time. For example, up to 20 per cent of work time allocated to exploration and play in areas not directly related to the employee’s regular work at companies such as Google and 3M (Bergmann, 1977; Schrage, 2000; Striebeck, 2006).

All of these approaches are attempts to manage the supply of deliberative attention by allocating more time and energy to it, at the expense of giving less attention to routine day-to-day activities. The allocation therefore comes at a cost that should not be undertaken beyond the actual needs of the firm:

*P6(a).* At a given demand for deliberative attention, firms that allocate greater attention to deliberative tasks are more likely to have over-paid for their human resources, resulting in diminished firm performance.

*P6(b).* At a given demand for deliberative attention, firms that allocate greater attention to deliberative tasks are more likely to overthink and needlessly complicate problems, resulting in diminished firm performance.

*Analytic supply.* The second driver of attention supply is the number and quality of minds that are brought to bear on the problem. Hiring a sufficient number of smart and attentive people ensures that the firm will have adequate supply of deliberative attention to address business problems effectively. Enrolling more people in the problem-solving effort, partitioning problems into sub-problems that can be the focus of individuals or small groups, and making use of people who are innately intelligent

and perceptive are all ways of bringing a greater supply of analytic thinking to the problems that require deliberative attention.

Increased analytic supply is another potentially valuable role for expertise within the firm. Expert knowledge includes meta-knowledge of what stimuli to be attuned to, what to notice, and how to interpret it correctly; experts are able to see environmental cues that novices overlook, and thereby increase the attention that is brought to bear on those cues. With greater expertise individuals use their limited deliberative attention more effectively, by directing it to the aspects of the problem that matter most (Chi *et al.*, 1982).

The recent rise of crowd sourcing (Raymond, 1999; von Hippel, 2005; Brabham, 2008; Malone *et al.*, 2009) is another approach to bringing more minds to bear and increasing the supply of deliberative attention. The essence of crowd sourcing is to take an attentional demand that the firm is facing and to outsource it to a “crowd” – a group of interested and motivated parties who are willing to devote individual attention to a collective task. Crowdsourced tasks may include anything that the firm faces that requires human attention and cognitive processing, such as monitoring and signal detection (e.g. Choffnes *et al.*, 2010), analysis and decision making (e.g. Christophe *et al.*, 2010), or problem solving in general (e.g. Brabham, 2008). Crowdsourcing has the effect of increasing the total supply on attention that can be brought to bear on the analysis of problems and information.

Finally, a newer and somewhat controversial approach to increasing analytic supply is the potential use of methods of individual cognitive enhancement to increase their attentional capacity (Hughes, 2007; Greely *et al.*, 2009). Brain researchers are beginning to explore methods to invoke top-down neurological executive functions that trigger the sustained attention performance-associated activation needed for sustained deliberative attention (e.g. Sarter *et al.*, 2001). Such approaches may result in yet another source of supply for deliberative attention in the firm.

But again this supply of deliberative attention comes at a cost that should not be undertaken beyond the actual needs of the firm, as these additional human minds must be identified and incited to direct their efforts towards the current attentional demands of the firm:

*P7(a).* At a given demand for deliberative attention, firms that hire more people or acquire more expertise are more likely to have over-paid for their human resources, resulting in diminished firm performance.

*P7(b).* At a given demand for deliberative attention, firms that hire more people or acquire more expertise are more likely to overthink and needlessly complicate problems, resulting in diminished firm performance.

*Non-analytic supply.* If purely analytic approaches prove ineffectual in tackling significant managerial problems there may be a need for a still greater variety of organizational responses and managerial behaviours. Organizations with a greater variety of available behaviours are better able to adapt to diverse and unexpected environmental challenges (Ashby, 1962), and therefore organizations that can bring to bear diverse “non-analytic” approaches may be able to better understand unusual stimuli and better develop appropriate strategic responses.

This recognition opens the door to attentional and cognitive approaches that are not limited to rational analytic processing, but recognize that deliberation and reflection can also include a wide range of other human abilities. While analytic thinking is



focused on optimizing solutions for well-structured problems in well-defined solution spaces, other more difficult problems may benefit from a more holistic approach that pays attention to the full range of problem cues and stimuli and that listens with the whole self to discover meaning and potential solutions within that meaning.

This non-analytic approach may seem too vague or ill structured for professional managers accustomed to dealing rationally with quantitatively precise and well-structured problems. But Bauer and Eagen (2008) argue that it can be very effective in dealing with problems that are not amenable to purely rationalistic and analytic approaches that focus on optimization. Such problems may be better tackled with an approach based on “epistemic pluralism”, a philosophy that integrates Jung’s four modes of thinking, feeling, sensing, and intuiting, to acknowledge that there may be multiple ways of knowing a problem, and therefore multiple ways of arriving at a solution (Jung, 1921). For ill-structured or wicked problems these other ways of knowing may be much more productive of solutions than simple analytic approaches, a position that underpins much of the recent attention given to “design thinking” as a tool of strategic management (e.g. Dunne and Martin, 2006; Bauer and Eagen, 2008; Brown, 2008).

For example, non-analytic approaches to the solution of strategic problems may include arts-based methods (Nissley, 2010). The development of artistic skills can be highly useful in managerial settings by projecting unrecognized or unarticulated inner thoughts and feelings, by distilling the “essence” of concepts, and by affording access to deep inner life (Taylor and Ladkin, 2009). Adler (2006) argues that organizations need to engage in new, more spontaneous, and more innovative ways of managing, and should therefore consider using professional artists and the artistic cognitions of managers to make a shift from analytic planning to the low-cost improvisation and rapid iteration typified by artists, designers, and experimenters.

Providing a psychically safe work environment may be another non-analytic approach to the supply of deliberative attention. Amabile and Conti (1999) argue that workload pressure and organizational impediments have a negative influence on creativity. And Zhou *et al.* (2011) have found that, while firms with high proportions of contract workers tend to have higher sales of imitative new products, they perform significantly worse on sales of innovative new products. These examples suggest that non-analytic cultural factors may also have a role in determining the ability of workers to supply deliberative attention to organizational tasks.

And once again, this supply of deliberative attention comes at a cost that should not be undertaken beyond the actual needs of the firm, as these additional human minds must be identified and incited to direct their efforts towards the current attentional demands of the firm:

*P8(a).* At a given demand for deliberative attention, firms that employ more non-analytic employees are more likely to have over-paid for their human resources, resulting in diminished firm performance.

*P8(b).* At a given demand for deliberative attention, firms that employ more non-analytic employees are more likely to overthink and needlessly complicate problems, resulting in diminished firm performance.

### Discussion

Having thus examined the sources of demand and supply of attention, we now turn to the methods by which senior managers may attempt to direct these sources to achieve

an appropriate match. It is a critically important task of senior managers in the firm to achieve the optimal match between supply and demand of deliberative attention. This can be done by reducing demand for attention or increasing its supply. Managers can seek a match through three different domains of action: capacity, context, and structure. The capacity domain refers to management of the total attention resources available to the firm through its various employees and stakeholders, and is the practical reflection of theories of attentional constraints and bounded rationality (e.g. Simon, 1947). The context domain refers to how informal norms, values and contextual cues influence the way available attention is allocated within the firm, and is the practical reflection of theories of dominant institutional logics (e.g. Prahalad and Bettis, 1986; Thornton *et al.*, 2012). And the structure domain refers to how formal processes, artefacts, and systems are employed to influence the way attention is allocated, and is the practical reflection of theories of structural constraint (e.g. Ocasio, 1997; Thornton *et al.*, 2012). Within each of these domains managers seek to identify tools and perform actions appropriate to the type of strategic problem to be resolved.

A link can be drawn between the types of problems the firm faces and the degree or type of environmental uncertainty. A well-structured problem corresponds to the first type of uncertainty, and deals in a situation where the range of possible future states is known, at least probabilistically. In contrast, an ill-structured problem is characterized “by the absence of given alternative solutions, but still assumes a clearly defined solution space” (Bauer and Eagen, 2008, p. 65). An ill-structured problem therefore corresponds to the second type of uncertainty where the range of possible future states is not known. Finally, Rittel’s wicked problem describes a situation that lacks both a clearly desired future state and a clearly defined solution space to be searched (Rittel and Webber, 1973). These are problems that are essentially unique in themselves and therefore do not have a clear range of potential solutions or a defined set of permissible actions that can be taken. Moreover, when actions are taken it is not clearly apparent whether or not the problem has been addressed, making trial-and-error approaches ineffective. Moreover, the problem can be expressed in different, mutually incompatible frames, the choice of which determines the nature of the problem’s resolution – these types of problems can be especially demanding of deliberative attention. Such a problem is analogous to Sarasvathy’s concept of the “suicide quadrant” (Sarasvathy *et al.*, 2005) and therefore corresponds to the third type of uncertainty where the range of possible future outcomes is not only unknown, but is fundamentally unknowable.

As we have illustrated above, there are three possible ways to increase the supply of deliberative attention and five ways to drive demand for deliberative attention. For each of these it is possible to identify strategic levers or managerial instruments to effect change and achieve the balance that the firm seeks. Table I provides a list of selected managerial instruments or tools that may be employed manage the supply and demand of deliberative attention within the firm.

Not all of these potential instruments will have the same impact in every situation. Some instruments are suited better to deal better with one type of problem than another. Consequently, in Table II, we attempt categorize a range of existing managerial tools that affect attention within the firm by identifying the type of problem they are well suited to (well-structured, ill-structured, or wicked problems), by establishing the domain within which the tool has effect (cognitive capacity of decision makers, context of decision making, or structural frameworks for decision making), and by indicating whether the tool addresses the objective of managing the demand or the supply of deliberative attention.

Tool	Practical description	More information
Perceptual filtering	Automatic screening of perceptual information based on learned constructs and expectations. Amplifies relevant information and attenuates irrelevant information, so that the relevant information receives more attention	Starbuck and Milliken (1988), Rerup and Feldman (2011)
Automatic processing	Automatic response to environmental stimuli based on repeatedly practiced business routines. Lessens the attention demands of the routine stimulus	LaBerge (1975), Shiffrin and Schneider (1977)
Crowdsourcing	Outsourcing activities that demand human attention to groups of interested stakeholders, most typically not employees of the firm	Brabham (2008), Huberman (2009)
Away days	Retreats by management teams, typically to isolated locations where day-to-day activities cannot demand attention. Leaves more attention available for strategic issues	Bourque and Johnson (2008)
Cognitive enhancement	The use of exercises, technology, or pharmaceuticals to increase the cognitive capacity of individual brains	Farah <i>et al.</i> (2004), Greely <i>et al.</i> (2009)
Arts-based methods	The use of artistic and creative activities to engage additional non-rational dimensions of the mind in the solution of managerial problems	Taylor and Ladkin (2009), Nissley (2010)
Design thinking	Application of creative design approaches and adductive reasoning to investigate ill-defined or wicked problems and potential solutions	Schön (1983), Rowe (1987)
Epistemic pluralism	Philosophy by which there are many different internally consistent set of truths about the world, such as objective scientific views and subjective cultural views. Encourages management to seek truths that may be obscured by the dominant logic of the firm	Spender (1998), Bauer and Eagen (2008)
Time management, deadlines	Formal practice of scheduling set time periods for particular management tasks as a tool to constrain attention from being given elsewhere	Macan (1996), Betsch <i>et al.</i> (1998), Waller <i>et al.</i> (2001)
Reports and meetings	Concrete structural artifacts, the production or enactment of which guides or allocates the attention of employees to selected stimuli	Ocasio (1997)
Architectural filters	Using the constraints and affordances of the physical workspace (closed office doors, window views, open work areas) to encourage or inhibit focusing attention on particular tasks	Nichols <i>et al.</i> (2002), Speier <i>et al.</i> (2003)
Ambidexterity	Dividing organizational attention between the demands of day-to-day operational activities and longer-term strategic tasks	March (1991), Raisch and Birkinshaw (2008), Raisch <i>et al.</i> (2009)
Subsystems	Decomposition of the organizational response to environmental stimuli to reduce the information processing demands on individuals	Simon (1996)
Business processes	A form of automatic processing and subsystems (above) where the organizational response to a stimulus is designed to comprise a set of activities done by individuals with formalized	Davenport and Beck (2001), Wang and Wang (2006)

**Table I.**  
Attention management  
tools

(continued)

Tool	Practical description	More information
Rapid iteration, improvisation	handoffs between them. These handoffs act as simpler stimuli to the employees performing the activities, which therefore require less attention The trial-and-error solution of problems through rapid experimentation and modification of approaches	Barrett (1998), Katayama and Bennett (1999)
Bricolage	Making creative use of whatever resources are at hand, regardless their original purposes or intent	Baker <i>et al.</i> (2003), Baker and Nelson (2005)
Play time	Formally allocating time and resources for employees to play and experiment. Engages employees in cognitive, affective and motivational dimensions of creativity	Hjorth (2004), Mainemelis and Ronson (2006)

Table I.

Domain	Objective	Well-structured	Ill-structured	Wicked problem
Capacity	Demand management	Perceptual filtering, Experts, Automatic processing	Perceptual filtering, Experts	Experts
	Supply management	Experts, Practice, Crowdsourcing	Formalized deliberation, Away days, Smart hiring, Crowdsourcing, Cognitive enhancement	Away days, Arts-based methods, Smart hiring, Cognitive enhancement
Context	Demand management	Strategic plans Mission, vision	Mission, vision	Serendipity
	Supply management	Culture, informal rules	Design thinking, Epistemic pluralism	Arts-based methods, Design thinking, Epistemic pluralism
Structure	Demand management	Serializing, Time management, Deadlines, Reports and meetings, Routinization, Architectural filters	Serializing, Time management, Routinization, Ambidexterity, Architectural filters	Ambidexterity, No deadlines
	Supply management	Technology, Task automation, Subsystems, Business processes	Rapid iteration, Improvisation, bricolage, Play time	Rapid iteration, Improvisation, bricolage, Play time

Table II.  
Effective use of DAM tools

The first observation to note from this table is that every column is populated with very many options. There is a great deal strategic choice available in how to approach each type of problem. For example, a particular well-structured problem may have as many as 18 different managerial responses available for use, depending on whether it will be addressed from the demand side or the supply side, and whether the preferred solution is to manage attentional capacity, decision-making context, or formal business structures. This wide range options means that problems can be solved and attentional demands can be met while also addressing some other desired objective, such as the speed/cost of decision making or implementation.

The categorization between well-structured, ill-structured and wicked problems helps managers to figure out how to achieve an effective and efficient balance between demand and supply of attention. For instance, applying design thinking (a contextual method of managing supply in ill-structured or wicked problems) to a well-structured problem like minor product change is waste of attentional resources. Conversely, a manager cannot solve wicked problems by simply organizing more meetings and requiring more status reports from participating departments (a structural method of managing demand in well-structured problems).

The second observation, which flows from the first, is that every row is similarly populated with very many options. There is variety in the types of problems that each objective domain can address. The attentional demands placed on managers by the environment can be addressed by the attentional capacity, the decision-making context, or the formal business structures. So, for example, a firm that is very able to manage by structure but not by context (perhaps due to shortcomings in leadership capabilities) can still leverage that ability to address attentional demands regardless whether they arise from problems that are well structured, ill structured, or wicked.

Finally, observe that most cells in the table have multiple options. There is choice in which tool to apply to a specific problem, even when restricted to a particular domain of action. This flexibility allows for firm-specific preferences such as the development of managerial expertise or the optimization of usage parameters. Also observe with regard to the detailed choice of tools that, while some tools appear in more than one cell, none cross all three columns – tools have areas of specialization or sweet spots, and therefore managers need to develop facility with a range of tools and approaches.

Managers with an understanding of the options contained in Table I and II can make appropriate choices to improve the allocation of scarce attention within their firms. Consider the example of a firm that has skill in implementing structural guidance and constraints for employee actions, and leaves the decision of new product innovation to its technical staff. These experts may attend to market cues from their environment or may rely on serendipitous development of new technologies as the primary methods of directing attention towards new product opportunities. Suppose further that the senior managers of the firm are dissatisfied with the innovation process, observing that the process is disorganized and wasteful, and that many attempts at new product development are discarded as too costly or poor fits to the strategy of the firm. By using the tools of DAM managers are better able to manage where to focus their attention. In this example the managers have several alternatives open to them. In the case of routine incremental innovation, they should consider implementing greater use of strategic planning and regular project reports and status meetings to better focus environmental scanning behaviours of the employees. And in the case of radical innovation (a more ill-structured problem), they should consider harnessing the ambidexterity of creating a new division that concentrates on exploration of dramatic change possibilities while the existing company sticks to the exploitation of the current business model. The specific capabilities and history of their firm, and the nature of the environmental challenges it faces guide the managerial choice of method and tools, so that a better allocation of attention demand and supply can be achieved.

#### *Conclusions*

This paper has been an examination of the concept of deliberative attention and the ways that it can be managed within a firm to achieve better performance. Deliberative

attention refers to the application of human attention to prolonged reflection and consideration of the most difficult problems, ones where routine approaches are insufficient to achieve a solution.

An examination of the role of deliberative attention in the firm is increasingly important because the competitive business environment places almost insurmountable demands on the information processing abilities of managers and on their abilities to discern and pay attention to that which is most important to the success of their firms. Despite a recognition that attention matters and that it is worthy of being consciously managed, very little research has been done into providing frameworks or guidelines to assist managers in using their attention resources.

Towards this need we contribute a novel model of DAM in which demand for deliberative attention is driven by five exogenous factors and supply is driven by three endogenous factors that are amenable to explicit management by the application of methods and tools. As described earlier, the demand-side factors are pace of change, complexity, amount of uncertainty, unexpectedness and incongruity, and the simultaneity of demands. The supply-side factors are allocation processes, analytic supply, and non-analytic supply. Theorists may note that this model represents a shift from a simple allocation problem to a more dynamic problem of two-sided matching with additional degrees of freedom. The managerial objective within this model is to utilize methods and tools to achieve a matching of the deliberative attention demand and supply, and to thereby avoid situations that are ineffective (demand exceeds supply) or inefficient (supply exceeds demand). Managers may recognize ineffective attention allocation in their firms by missed business opportunities that can be attributed to a perceived lack of decision-making time and an overwhelming degree of environmental complexity and ambiguity. And they may recognize inefficient attention allocation by the needless overthinking and overcomplicating of routine challenges, and by disproportionately high human resource costs.

In addition to the development of this model we contribute a framework, represented in Table I and II, for categorizing a wide range of management methods and tools by their attentional characteristics. This framework illustrates how these various methods and tools may be used to manage either the demand or supply of deliberative attention, and whether they have effect through direct change in attentional capacity of the firm, through changes to the decision-making context of managers, or through changes to the formal information-process structures and artefacts of the firm. The framework also provides a novel set of recommendations for the appropriate application of these methods and tools to specific managerial problems, based on the type of uncertainty associated with the specific problem. Moreover, it makes the characterization of wicked problems as those that have Type 3 uncertainty (in the typology of Knight and Sarasvathy), which we believe is a novel linkage of these concepts in a strategic management context. This categorization framework enables managers to choose the most appropriate organizational tools by their attentional characteristics, reflecting the degree of uncertainty in the challenge being faced and the most appropriate domain for proposed firm actions. In this way their choices of tool are more likely to have the desired effect on producing wise solutions to problems.

The ideas, models and frameworks proposed in this paper will require future research to benefit from empirical validation and elaboration that extends these initial contributions and provides a greater range of practical diagnostics and tools for strategic managers. Our propositions contain a range of high-level constructs. Some,



like performance, have a variety of well-established metrics. But others will require novel operationalization to support subsequent empirical research. For these we suggest these potential lines of exploration: pace of change (e.g. periodicity, continuity, dynamism), unexpectedness of change (e.g. seasonality, technology generational change), incongruity of change (e.g. managerial opinion congruity, semantic distances), simultaneity of change (e.g. scope of firm operations, range of stakeholders), environmental complexity (e.g. heterogeneity, diversity, interconnectedness), and environmental uncertainty (e.g. munificence, resource dependence). For future theoretical extensions suggest there is additional work to be done in developing conceptions of organizational level attention, not just the individual-level construct we employ here. Similar to the theoretical work being done on the absorptive capacity of firms, there is a need to define the bridging and aggregation rules that would define how the deliberative attention capacity of the firm arises from the deliberative attention of the constituent individuals of the firm.

Finally, as a result of this investigation we suggest two non-obvious conclusions about deliberative attention in firms. First, while attention is recognized as an individual-level phenomenon arising from cognitive processes, it has firm-level effects in the choices of contextual and structural methods used to manage supply. Second, our argument about effectiveness and efficiency in the matching of attention demand and supply suggests that attention is not the absolute good that is sometimes supposed. Since attention behaves like a scarce resource, it is not always better to pay more attention to the firm's environment at the expense of attention elsewhere. Paying attention also costs attention.

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#### About the authors

Dave Valliere is Associate Professor of Entrepreneurship and Strategy and Director of the Entrepreneurship Research Institute at Ryerson University. His current research interests are in cultural and cognitive influences on entrepreneurial behaviors and in the regional economic functions of entrepreneurship. Dave Valliere is the corresponding author and can be contacted at: [valliere@ryerson.ca](mailto:valliere@ryerson.ca)

Thomas Gegenhuber is a graduate student in Business Administration and a writer for *Wikinomics*. His academic research interests are in politics, new media, crowdsourcing and collective intelligence, and entrepreneurial cognition.



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