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MICROFOUNDATIONS OF STRATEGIC PROBLEM FORMULATION†

MARKUS BAER, KURT T. DIRKS, and JACKSON A. NICKERSON*
Olin Business School, Washington University in St. Louis, St. Louis, Missouri, U.S.A.

Before a strategy can be developed, the problem it is supposed to address needs to be formulated. We establish the microfoundations of strategic problem formulation by developing a theory that predicts a core set of impediments to formulation that arise when complex, ill-structured problems are addressed by heterogeneous teams. These impediments fundamentally constrain and narrow problem formulation, thereby limiting solution search and potential value creation. We establish these impediments as a set of design goals, which, if remedied by an appropriately constructed mechanism, can expand problem formulation to be more comprehensive. Finally, we consider how organizations can improve problem formulation by creating a structured process that satisfies the theoretically derived design goals and detail a specific example of this mechanism (collaborative structured inquiry). Copyright © 2012 John Wiley & Sons, Ltd.

INTRODUCTION

Designing new business strategies, producing innovations to grow profit, or developing novel supply chain configurations to achieve a cost advantage are some of the complex, ill-structured strategic challenges organizations must grapple with in creating sources of competitive advantage (e.g., Camillus, 2008; Nickerson, Silverman, and Zenger, 2007).[1] Tackling these strategic challenges is often the domain of teams, particularly those that bring together actors from heterogeneous backgrounds and disciplines, such as top management or cross-functional/interdisciplinary teams (e.g., Amason, 1996; Bantel and Jackson, 1989; Finkelstein, Hambrick, and Cannella, 2009; Nickerson and Zenger 2004; Schweiger, Sandberg, and Ragan, 1986; Wanous and Youtz, 1986). To create valuable solutions to strategic problems, however, these teams first must know *what* problem they should be addressing. Indeed, as many scientists recognize, 'the formulation of a problem is often more essential than its solution...' (Einstein and Infeld, 1938: 92).

Problem formulation has long been acknowledged as a core activity in strategic decision making (Quinn, 1980; Shrivastava and Grant, 1985; Witte, 1972). Problem formulation is distinguishable from the more frequently studied activity of problem solving, which comprises the generation, evaluation, and selection of alternative solutions. Problem formulation can, for example, allow firms to identify fundamental challenges in their value chain for which they can generate alternative innovative solutions and choose the optimal

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* Correspondence to: Jackson A. Nickerson, Olin Business School, Washington University in St. Louis, One Brookings Drive. St. Louis, MO 63130, U.S.A.
E-mail: nickerson@wustl.edu
† Authors are listed alphabetically.
[1] Challenges include both problems and opportunities. Throughout the remaining paper, we use the more conventional term 'problem' but do so with the intent of referring to problems and opportunities.

one to provide unique value. Thus, problem formulation profoundly determines *what* problem is solved and ultimately the quality of the solution (e.g., Ackoff and Emery, 1972; Churchman, 1971; Duncker, 1945; Loasby, 1976; Nutt, 1992; Simon, 1973; Simon and Hayes, 1976; Volkema, 1983). Indeed, according to Mitroff and Featheringham (1974), one of the most important challenges of the problem solving activity is solving the 'wrong' problem by adopting a formulation that is either too narrow or inappropriate. Similarly, Mintzberg, Raisinghani, and Theoret (1976) concluded that diagnosing or formulating the problem may be the most important aspect of strategic decision making.

Despite its long-recognized importance, strategic problem formulation (SPF) has attracted only limited attention from scholars and there is a lack of understanding as to the microfoundations of this important activity.[2] In fact, the observation by Lyles and Mitroff (1980) that most efforts have been directed toward identifying and describing optimal methods for solving already well-defined problems and that little is known about how problems are formulated appears to be as true today as it was three decades ago. Mirroring this lack of scholarly attention, Mintzberg *et al*. (1976) and Nutt (1984) portrayed managers as being equally oblivious to the importance of systematically formulating problems, frequently skipping or abbreviating formulation activities. In fact, analyzing 33 case histories of SPF processes in large U.S. companies, Lyles (1981) found that 75 percent of problems that went through a problem-solving process had to be recycled back to problem formulation suggesting that many managers were either initially defining the problem inappropriately or neglecting this stage altogether (Niederman and DeSanctis, 1995). A systematic approach to effectively formulating strategic problems appears to be rare. Given the importance of problem formulation for strategic decision making, however, developing insights into this activity should be of great theoretical and practical relevance.

In the present paper, we advance the science and practice of SPF in three ways. First, having highlighted the importance of problem formulation for strategic management, we provide a novel conceptualization of the problem formulation activity in teams and the criterion by which to evaluate its success. Our focus is on SPF in teams because tackling multifaceted and difficult-to-define strategic issues typically requires the formation of teams, particularly those that bring together individuals from heterogeneous backgrounds and disciplines, to assemble broadly dispersed information and knowledge sets (e.g., Mason and Mitroff, 1981; Mitroff and Emshoff, 1979). We conceptualize problem formulation as a collective activity aimed at translating an initial problem symptom or web of symptoms into a set of questions or alternative formulations of the problem that are sufficiently well-defined in terms of the causes of the symptoms to enable the subsequent search for or generation of solutions (Lyles and Mitroff, 1980; Mason and Mitroff, 1981). Specifically, problem formulation encompasses two sets of interdependent activities—one that involves establishing the web of correlated regularities spanning all symptoms that are related to the initial symptom that launched the inquiry and another activity that involves the formulation of all causes that explain one or more of the previously identified symptoms.

Second, relying on a set of assumptions common to the field of strategic management—strategic problems are complex and ill-structured; individuals are boundedly rational and may be self-interest seeking with guile; teams involved in strategic decisions consist of individuals with heterogeneous information, knowledge, and motivation—we theoretically identify a set of impediments that impact problem formulation.[3] We then consider the set of impediments as criteria—call them design goals—against which mechanisms for improving the problem formulation activity can be evaluated.

Third, we consider how organizations can improve problem formulation by creating a structured process that satisfies the design goals that emerged from our theoretical analysis. The extant literature provides limited guidance as to how firms can improve their SPF capabilities. Although existing work has provided descriptive accounts of how organizations formulate problems (e.g., Lyles and Mitroff, 1980) and has begun to explore the strategies and approaches that promote successful problem formulation (e.g., Mason and Mitroff,

[2] We use the term 'microfoundations' to refer to the analysis of behaviors and interactions of economic actors that underpin aggregate phenomena, such as strategic problem formulation.

[3] Our theory begins with the recognition of a situation to be addressed. Such recognition assumes managerial attention has enabled the identification of the symptom (e.g., Ocasio, 1997).

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1981; Volkema, 1986), most efforts have lacked theoretical grounding. Our effort represents one of the first attempts to theoretically motivate the design of a structured process. We provide an illustrative example of a structured process that is a unique recombination of known process steps that collectively mitigate the set of impediments and satisfy the design goals. It is the specific sequence of steps and the ability to verify execution of the steps that is unique about the structured process. In doing so, we integrate theories of individual and group behavior with theories of strategic decision making (see Coff and Kryscynski, 2011). In addition, as we consider in the Discussion section, our analysis has implications for the dynamic capabilities perspective (Eisenhardt and Martin, 2000; Helfat *et al.*, 2007; Teece, Pisano, and Shuen, 1997), particularly, for the various 'organizational and managerial processes, procedures, systems, and structures that undergird each class of capability' (Teece, 2007: 1321).

THEORETICAL BACKGROUND

Strategic problems

We focus our theoretical development explicitly on the formulation of strategic problems. Strategic problems are typically those that have high stakes and are of critical importance to a firm's success, especially in the long term (Ireland and Miller, 2004). We define a (strategic) problem as a deviation from a desired set of specific or a range of acceptable conditions resulting in a symptom or a web of symptoms recognized as needing to be addressed (e.g., Cowan, 1986; Cyert and March, 1963; Newell and Simon, 1972). Strategic problems, by their very nature, are *complex* and *ill-structured* (Kilmann and Mitroff, 1979; Lyles and Mitroff, 1980; Watson, 1976). A problem is *complex* when it involves (1) a large number of different variables, many of which may not be directly observable such that only knowledge about symptoms is available from which the underlying state then has to be inferred; (2) a high degree of connectivity among the elements of the problem such that change in any one variable will affect the status of many other variables making it difficult to anticipate the potential consequences of a given situation, especially because the effects of these interactions are generally not immediately observable; and (3) a dynamic component resulting in the pattern of interactions changing over time. Due to a general lack of understanding of the variables involved and the interdependencies among them, few formalized and agreed upon approaches are in place for formulating and making decisions regarding such problems, rendering them not only complex but also *ill-structured* (e.g., Fernandes and Simon, 1999; Funke, 1991; Mason and Mitroff, 1981). Because of these features, strategic problems invite the development of multiple, often competing views of the problem. As a result, problem formulation activities have been suggested to be of particular importance with respect to strategic problems and the decision making activities surrounding them (Lyles, 1981; Lyles and Mitroff, 1980; Mason and Mitroff, 1981). In the following sections, we (1) consider the criterion of success for the problem formulation activity and (2) theoretically analyze the key impediments that firms face in formulating strategic problems.

Evaluating the success of the problem formulation activity

What constitutes successful problem formulation? Ultimately, we expect that problem formulation will result in better quality decisions as well as in decisions that are likely to be more acceptable to senior management and thus more likely to be implemented successfully and expeditiously. It may, however, be difficult to use those downstream metrics as reliable gauges of problem formulation. For example, using acceptability as the criterion carries the risk of curtailing problem formulation as less acceptable or controversial formulations, despite their potential to contribute to the understanding of the underlying problem, and are likely to be withheld. Using the quality of the decision as the relevant yardstick may also be problematic because activities other than problem formulation (e.g., solution derivation, decision implementation) are likely to impact quality, thereby providing an unreliable and invalid measure of the formulation activity. Given these shortcomings, we propose *comprehensiveness* as a primary metric by which to judge the success of the problem formulation activity.

Comprehensiveness is defined as the extent to which *alternative, relevant* problem formulations are identified with respect to an initial symptom or web of symptoms. Although the concept of comprehensiveness in strategic decision making is not

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new (Fredrickson, 1984; Fredrickson and Mitchell, 1984), our use of the concept and term differs in at least two ways from previous work. First, we use comprehensiveness as a criterion to evaluate specifically and exclusively the problem formulation activity, as opposed to the entire strategic decision making process. Second, whereas previous work has used comprehensiveness to evaluate the process of strategic decision making (e.g., Goll and Rasheed, 1997; Miller, Burke, and Glick, 1998), we use this concept to evaluate an outcome of the formulation activity.

According to our definition, comprehensiveness increases as the number of *alternative* problem formulations grows. The ultimate success of the problem formulation activity is intimately connected to the number of alternative formulations proposed regarding a symptom or web of symptoms (Boland, 1978; Volkema, 1986, 1988). For example, Niederman and DeSanctis (1995) suggested that a necessary criterion for achieving accurate and complete problem formulation is for teams to engage in intensive search for information—an activity that should allow for alternative problem perspectives to emerge, that is, for equivocality to surface, encouraging more successful problem solving in the future. In a similar vein, Volkema and Gorman (1998) considered problem formulation to flourish to the extent that teams extensively search for information allowing for the generation of alternative, competing problem understandings. Lyles and Mitroff (1980) also suggested that improved formulation entails the generation and selection of alternative views of the problem.

It is important to note, however, that, in contrast to some previous accounts, we do not equate comprehensiveness with completeness (number of formulations divided by total number of possible formulations). The total number of possible formulations for a given problem—especially when it is complex and ill-structured and, as a result, multiple, competing, yet equally valid views of the problem are plausible—often remains unknown and may even be unknowable. As stated by Rittel and Webber (1973: 161, emphasis in original), 'the formulation of a [complex] problem *is* the problem.' This impossibility implies that any optimality criterion, such as completeness, is not appropriate for evaluating the success of the problem formulation activity (Miller *et al*., 1998; Mitroff, Emshoff, and Kilmann, 1979; Rittel and Webber, 1973; Smith, 1989).

Relevance is the second component of our conceptualization of problem formulation comprehensiveness. Each alternative formulation must be relevant by illustrating at least one mechanism that causes one or more of the identified symptoms (Mitroff *et al*., 1979). A set of formulations that addresses only a subset of symptoms is hence considered to be less relevant and, as a result, less comprehensive than a set that addresses the entire web of symptoms. There is a caveat to this conceptualization. Formulations that suggest mechanisms that produce symptoms *outside* the web of symptoms, even while explaining some identified symptoms, are not considered relevant. Thus, comprehensiveness increases to the extent that an additional formulation (1) adds to the overall number of identified symptoms that can be explained without considering irrelevant symptoms or (2) provides an alternative explanation for at least one of the identified symptoms.

By focusing on formulation comprehensiveness, we assume a probabilistic relation between the comprehensiveness of a problem's formulation and the likelihood with which the root causes of a particular problem context will be discovered. Although problem formulation comprehensiveness by no means guarantees that teams are able to isolate the root causes of a strategic problem, the likelihood that such causes are detected improves as a function of the number of alternative, relevant problem formulations that are being detected.

Heterogeneous teams as vehicles for comprehensive problem formulation

Establishing the microfoundations for SPF requires the analysis of the behaviors of and the interactions between economic players that collectively constitute and determine the formulation activity.[4]

[4] Given our focus on the interactions between economic actors that undergird the problem formation activity as an aggregate phenomenon, the level of analysis in the present examination is the team or collective. Consequently, we give limited attention to individual differences and their effects on problem formulation comprehensiveness. We recognize, however, that numerous individual-level decision biases exist. One of the reasons for creating heterogeneous teams is to reduce the effect of these biases and we assume that is the case here. Furthermore, we assume that other individual differences will be randomly distributed across teams and will not systematically affect problem formulation comprehensiveness. Evidence supporting this assumption is provided by Papadakis, Lioukas, and Chambers (1998). Examining the factors shaping the comprehensiveness of strategic decision making processes, these authors found that none of the wide

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Indeed, comprehensively formulating strategic, that is, complex, ill-structured problems is not an individual activity (e.g., Ireland and Miller, 2004; Mitroff and Emshoff, 1979). Given that strategic problems typically constitute complicated mixtures of a range of different, yet highly interdependent issues that cannot be addressed in isolation from each other, comprehensively formulating these problems poses extraordinary demands on the breadth and depth of information and knowledge required. Such demands naturally confront bounded rationality, that is, the limitations of both knowledge and cognitive capacity (i.e., memory and attention) characterizing human rationality (Simon, 1955, 1957). Bounded rationality makes information and knowledge acquisition, accumulation, and application costly activities—for example, new communication channels and codes may have to be established cutting into limited resources, such as time and attention, necessary for other activities—and constrains the ability of any one actor to tackle strategic problems (Arrow, 1974; Simon, 1955). Indeed, research suggests that when confronted with such problems, individuals often only identify the most obvious symptoms, or those to which they are most sensitive, resulting in the problem being described inappropriately (Mitroff and Featheringham, 1974; Watson, 1976) or in overly simple terms (March and Simon, 1958). As noted by Volkema (1997: 31), '[p]roblems have a way of growing during discussions, often beyond the limitations of the human mind. When this occurs, there is a temptation to oversimplify the problematic situation to fit human capacity, rather than to find ways to extend memory.'

The challenges associated with comprehensively formulating strategic problems in conjunction with the limitations resulting from bounded rationality and the fact that information processing is costly suggest that no single actor is likely to possess or to be able to easily accumulate the range of information and breadth of knowledge needed to span the problem space (Newell and Simon, 1972). We therefore assume that the relevant information sets and cognitive structures (mental models, knowledge sets, etc.) needed to comprehensively formulate strategic problems is likely to be dispersed across multiple individuals.[5] As Mason and Mitroff (1981 : 13–14) noted, 'the raw material for forging solutions to [complex, ill-structured] problems is not concentrated in a single head, but rather is widely dispersed among the various parties at stake.' As a consequence, teams comprising individuals with different information sets and cognitive structures must be engaged if comprehensive formulation of a strategic problem is to be achieved.[6]

Along with information sets and cognitive structures, members of heterogeneous teams also are likely to possess different objectives (Cyert and March, 1963). As a key assumption of the political perspective of organizations, we subscribe to the view that organizations consist of actors with at least partially competing interests and objectives (e.g., Allison, 1971; Pettigrew, 1973; Pfeffer, 1981). Although we acknowledge that some objectives may be shared among all actors, other objectives may be at odds with each other due to differences among individuals' interests resulting from occupying different positions, belonging to different departments, or pursuing different career goals (Eisenhardt and Zbaracki, 1992). It is therefore inevitable that teams composed of members from different functional and hierarchical backgrounds also possess different interests and objectives—both in terms of content (what objectives are preferred) and in terms of degree (the extent to which a given objective is preferred) (Dean and Sharfman, 1996). This heterogeneity can be functional for problem formulation in that it ensures that no single interest controls the lens through which the problem is viewed. Following a common behavioral assumption in strategy, however, individuals have the potential to pursue this self-interest with guile (e.g., Williamson, 1975), which, as we discuss below, has the potential to severely undermine the problem formulation activity, for example, by restricting and distorting the flow of information (Cyert and March, 1963; Nickerson and Zenger, 2004; Pettigrew, 1973).

range of top management team personality characteristics studied (e.g., risk propensity, need for achievement, etc.) impacted process comprehensiveness.

[5] We use the term 'cognitive structure' to describe the basic mental processes used to make sense of information. Thus, this concept encompasses comparative thinking structures, symbolic representation structures, logical reasoning structures, and mental models that serve to govern the interpretation, organization, and use of information.

[6] This assumes that the information and cognitive structures within the team span the problem space. We explore the implications of relaxing this assumption in the Discussion section.

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With our definition of problem formulation comprehensiveness and assumptions about human nature (i.e., bounded rationality with the potential to pursue self-interest with guile) as well as the relevant contextual conditions (i.e., need for teams composed of individuals with heterogeneous information and cognitive structures, existence of heterogeneous objectives and 'stakes' in the issues), we consider the team-level impediments to this activity.

Impediments to comprehensive problem formulation in heterogeneous teams

By combining different sets of information and cognitive structures, in the abstract, a heterogeneous team is more likely to find formulations that encompass the root causes of a problem and engender discovery of more valuable solutions than either an individual alone or a homogenous team. Whether this ideal is achieved in practice, however, is not clear (e.g., Watson, Kumar, and Michaelsen, 1993). Some studies seem to support a positive relation between heterogeneity and the quality of the overall strategic decision making process, or various downstream outcomes of it (previous research has rarely examined the effects of heterogeneity on formulation comprehensiveness) (see Finkelstein *et al.*, 2009). For example, Bantel and Jackson (1989) studied the adoption of various technical and administrative innovations at 199 banks and found a positive association between top management team (TMT) heterogeneity of functional backgrounds and innovativeness. Results from the broader TMT literature, however, appear to be mixed. For example, a meta-analysis examining the effects of TMT heterogeneity on firm performance found no consistent associations between different TMT indicators, such as functional and educational heterogeneity, and different indicators of firm performance (Certo *et al.*, 2006). Similarly, in a recent review, van Knippenberg and Schippers (2007) concluded that there is little evidence that heterogeneous teams outperform homogeneous teams on a variety of tasks, including decision making and problem solving. Some studies even report negative associations between TMT heterogeneity and performance. For instance, work by Miller and colleagues (1998) suggests that diversity among upper echelon executives has the potential to limit strategic decision making. Drawing upon three studies examining the impact of executive cognitive diversity—defined in terms of differences in beliefs and preferences held by upper echelon executives within a firm—on comprehensiveness of strategic decision making, the authors found that executive diversity inhibits rather than promotes comprehensive examinations of problems and opportunities (for similar results, see Simons, Pelled, and Smith, 1999).

In sum, although heterogeneity creates the potential for improved decision making and problem solving, this potential may not always be realized. Previous research suggests that it is the *interactions* among actors that frequently seem to get in the way of teams fully realizing their potential (Janis, 1972; Steiner, 1972). Consequently, analyzing the behaviors and interactions of the individual actors that underpin SPF, that is, establishing the microfoundations of problem formulation, should provide valuable insights into the dynamics that determine whether and when heterogeneity may constrict formulation comprehensiveness. Drawing on our assumptions, in the following we theoretically derive a core set of impediments following from the three types of heterogeneity—information sets, cognitive structures, and objectives—and describe how these impediments, individually and jointly, limit comprehensiveness. Although our list may not reflect all possible impediments, it nonetheless derives from only a few assumptions and identifies a set of biases that have been reported to be common and important.

Impediments resulting from heterogeneous information sets

We begin our theory development assuming homogeneity of objectives. We relax this assumption in a later section (entitled 'Impediments resulting from heterogeneous objectives') to explore the unique effects of heterogeneous objectives, as well as how this heterogeneity interacts with and amplifies the negative effects of heterogeneous information sets and cognitive structures on problem formulation comprehensiveness.

The promise of assembling teams of individuals with different sets of information is that it provides the potential for a more complete understanding of the many facets of a strategic problem and the opportunity to derive a more comprehensive formulation of the problem. However, the potential is often not realized (Miller *et al.*, 1998; Simons *et al.*, 1999). We propose that teams composed

DOI: 10.1002/smj

of executives with homogeneous objectives but heterogeneous information sets will discuss and consider only a small subset of the total amount of information available to the team. There is a tendency, as we describe below, to discuss information that is commonly held at the expense of unique and uncommon information (when resources are limited (see effect '1' in Figure 1). In turn, this tendency will narrow and limit the extent to which teams are able to comprehensively formulate strategic problems.

Heterogeneity in information sets implies that although there may be some problem-relevant information that is held in common by the members of a team (known to most or all members), each member also holds unique information (known only to a single member). Given the limitations associated with bounded rationality, individuals will find it difficult to initially judge which elements of the information they hold are most likely to be relevant to a particular problem. Team members therefore will begin communicating by sending cues they believe are most likely to be understood. Generally, understanding signals requires recipients to recognize cues and then engage in a conversation to transfer and verify the information sent and received. Individuals are more likely to respond to cues that they recognize, which is far more likely to involve information that they hold in common (e.g., Larson *et al*., 1996, 1998; Stasser, Taylor, and Hanna, 1989). Sharing unique information incurs additional costs for an individual as new communication channels and codes may have to be established before unique information can be understood and appropriately interpreted. With information processing, memory, and attention capacities being limited (i.e., the assumptions of bounded rationality), teams members are more likely to discuss and consider information that incurs lower communicating and decoding costs, such as information that is held in common, leaving unique, individually held information less likely to be communicated (Stasser and Titus, 1985, 1987).

Research on the effectiveness of collective information sharing processes in decision making groups provides evidence supporting these arguments. Hearing other members reveal information makes similar and commonly held information appear more important or relevant (Wittenbaum, Hollingshead, and Botero, 2004). Moreover, previous research shows that groups often make suboptimal decisions because they tend to discuss and incorporate information that is shared at the expense of information that is unshared (e.g., Larson *et al*., 1996; Stasser *et al*., 1989, Stasser and

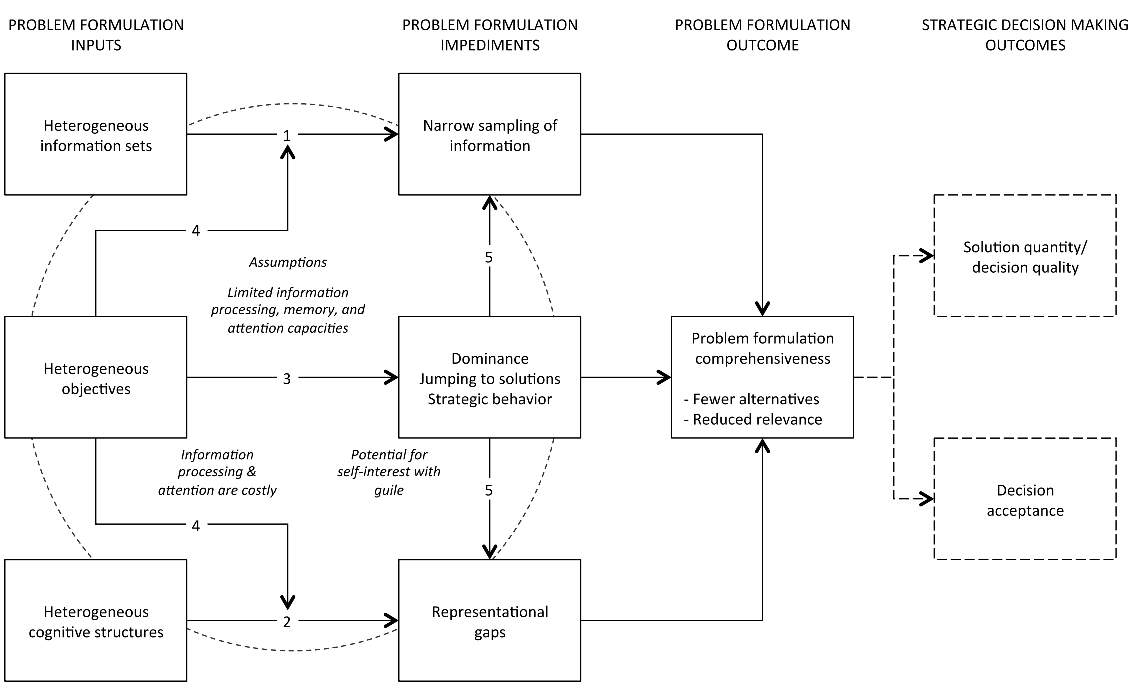

Figure 1. Model of strategic problem formulation

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Titus, 1985). Finally, earlier work supports the notion that common information has a sampling advantage over unshared information because it is often considered to be more important, relevant, and accurate than unique information (Postmes, Spears, and Cihangir, 2001; Wittenbaum, Hubbell, and Zuckerman, 1999).

Sharing and discussing information that is commonly held by many members rather than revealing unique information is likely to undermine comprehensive problem formulation. Failure to discuss or share information that is unique undermines the ability of teams to generate not only different or alternative but also relevant problem formulations. This limitation arises because teams are likely to prematurely, that is, before the entire problem space is explored, converge on the first common denominator—a problem understanding that everyone can easily agree upon but that does not necessarily reflect the complexity of the underlying problem.

Impediments resulting from heterogeneous cognitive structures

The promise of teams of individuals with different cognitive structures is that they provide varying perspectives of the problem and describe potential causes in a more multifaceted and intricate way. This promise, in turn, enhances the number of alterative formulations as well as their relevance and, ultimately, the comprehensiveness of the strategic problem formulation activity. However, we suggest that teams composed of members with homogeneous objectives (we consider heterogeneous objectives later in the section entitled 'Impediments resulting from heterogeneous objectives') but heterogeneous cognitive structures will not fully realize their potential due in part to the emergence of representational gaps. A representational gap is a team-level phenomenon capturing differences in representations—understandings of a problem situation constructed on the basis of an individual's domain-related knowledge—among the members of a team (Cronin and Weingart, 2007). Due to the limits associated with bounded rationality, individuals faced with strategic problems are likely to formulate those problems in a way that capitalizes on the knowledge they possess. In other words, existing knowledge and its organization determines how people come to see and formulate a given problem context, resulting in what Mason and Mitroff (1981: 25) have termed, 'tunnel vision' (the phenomenon can occur even with homogeneity in information sets).[7] Conceptualizing a problem in accordance with one's cognitive structures allows an individual to focus his or her attention and capitalize on scarce cognitive resources and can have significant consequences for comprehensive problem formulation in the context of a heterogeneous team. Specifically, differences in cognitive structures are likely to produce problem understandings that are at least partially incompatible with one another thereby triggering the emergence of representational gaps (see effect '2' in Figure 1). Such gaps jeopardize problem formulation comprehensiveness in at least two ways.

First, the emergence of representational gaps makes it difficult and costly for team members to share knowledge and recombine representations to explore additional problem formulations. As different representations or problem understandings involve different concepts and terminologies, communication across these divides will be difficult. For example, a concept that exists in one domain may not exist or may carry a different meaning in another. Naturally, these differences make the communication of such concepts not only difficult but also costly as significant time and energy would have to be invested in order for members to be able to identify and bridge the gaps.

Different cognitive structures may not only involve different concepts and terminologies but also differences in the assumptions about the way those concepts are interrelated. Such assumptions, which are often unarticulated, provide the foundations on which representations are not only constructed but also transferred from one team member to another. Discovering differences in assumptions along with differences in concepts and definitions, then codifying and transmitting them is costly for boundedly rational actors and, as a result, likely to impede the sharing and recombination of such representations. As both the

[7] The tendency of tunnel vision has been supported by previous research (e.g., Boland and Greenberg, 1988; Walsh, 1988). For example, Dearborn and Simon (1958) investigated departmental affiliation as a contributing factor to executives' problem formulation activities. Their results suggested that problem formulation is selectively directed toward the department to which the executive belonged. Looking at the same data, for example, 83 percent of sales executives identified sales as the most important problem compared with 29 percent of executives from other areas.

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communication and integration of different problem understandings are essential to formulating problems, differences in assumptions are likely to undermine the comprehensiveness of this activity.

Second, differing cognitive structures and the resulting inability of team members to understand each other can promote conflict and distrust, which further impedes the sharing and recombination of representations, let alone the recognition of one another's formulations. In general, task conflict consumes scarce cognitive resources, which can negatively impact overall team performance (De Dreu and Weingart, 2003), particularly when there are also tensions and disagreements over values and beliefs (i.e., relationship conflict) (Shaw *et al.*, 2011). For instance, Carnevale and Probst (1998) suggested that conflict limits problem solving abilities because it makes individuals more rigid in their thinking processes—that is, less able to see or integrate alternative ideas or perspectives—and, as a result, less creative. As strategic problems require that different problem understandings are generated and integrated, such rigidity will necessarily undermine the production of alternative and relevant problem formulations, that is, formulation comprehensiveness. Furthermore, in the absence of trust, task conflict can turn into relationship conflict, thereby diverting even more resources away from problem formulation toward the management of relationships (Shaw *et al.*, 2011; Simons and Peterson, 2000). As a result, formulation comprehensiveness is even less likely to be achieved.

Impediments resulting from heterogeneous objectives

The promise of assembling teams of individuals with differing objectives is that it provides the potential that many different interests are represented during the formulation activity and that no single interest controls the lens through which the problem is ultimately viewed—all of which should allow for greater comprehensiveness. We propose, however, that heterogeneity in objectives results in team members engaging in political maneuverings that consume scarce resources (attention, memory, time) and contaminate and constrain the exchange of information and cognitive structures, thereby further limiting and narrowing problem formulation comprehensiveness. Consistent with previous research, we define political maneuvering as 'intentional acts of influence to enhance or protect the self-interest of individuals or groups' (Allen *et al.*, 1979: 77). Previous research has documented that political behavior is a dominant and pernicious factor in problem formulation (e.g., Lyles, 1981; Lyles and Mitroff, 1980; Mason and Mitroff, 1981). Our analysis considers both the individual and joint mechanisms through which heterogeneous objectives result in political behavior that ultimately impedes comprehensiveness.

Direct effects include the tendency of team members to engage in dominance activities and to jump to solutions (see effect '3' in Figure 1). First, individuals who have high stakes are more likely to advocate strongly for solutions from which they benefit. Those individuals who have few stakes are likely to acquiesce because the cost to advocate a position exceeds the benefit of succeeding. Such dominance behavior, which arises from heterogeneity of objectives, likely leads to the narrowing of formulation comprehensiveness by focusing attention on formulations and solutions that are consistent with those members who have the most at stake.

Second, numerous scholars have observed the tendency for team members to prematurely propose solutions at the expense of investing time and energy into comprehensively formulating problems (Maier and Hoffman, 1960; Van de Ven and Delbecq, 1971). Although this tendency may in part derive from bounded rationality (abbreviating or forgoing the problem formulation activity economizes on bounded rationality), heterogeneity of objectives nevertheless creates incentives to jump to a solution. Specifically, as every solution implicitly suggests a certain problem formulation or set of formulations (e.g., Dutton and Ashford, 1993), actors who prematurely suggest a particular solution are in the unique position to limit problem formulation to such alternatives that support their objectives, as opposed to searching for and considering other relevant formulations. The tendency to jump to solutions quickly forecloses the search and evaluation of alternative formulations, which ultimately limits comprehensiveness.

In addition to these direct effects, heterogeneity in objectives can interactively as well as indirectly affect comprehensiveness. Heterogeneous objectives may interact with heterogeneous information sets and heterogeneous cognitive structures to squelch information exchange and the integration of knowledge. Individuals may be motivated to

DOI: 10.1002/smj

strategically share information and problem understandings while strategically withholding others in order to manipulate the formulation activity for personal benefit (e.g., Dutton and Ashford, 1993; Wittenbaum *et al*., 2004). These interactions are represented by effect '4' in Figure 1. In addition, heterogeneity in objectives may indirectly shape problem formulation comprehensiveness. This dynamic process is represented by effect '5' in Figure 1. Once team members observe or suspect others of engaging in political behaviors such as dominance or proposing solutions that are consistent with their self-interests, they may be inclined to engage in similar behaviors. In short, the introduction of heterogeneity in objectives is likely to amplify the impediments associated with heterogeneous information sets and cognitive structures by initiating strategic behaviors.

Ample research supports the dynamics described in the prior paragraph. For instance, Pettigrew (1973) analyzed the decision making process of a computer adoption. Different managers in the firm had conflicting preferences for outcomes. As a consequence, managers would block and slant information to favor their preferred solution. Likewise, in an experimental study of problem solving, Ferrin and Dirks (2003) observed that when the team members faced competing incentives, they perceived the other parties more negatively, trusted their partners less, and withheld and misrepresented important information. The results indicate that although team members may have insights on the problem or relevant data, they may withhold such information when it undermines their objectives, or may choose to emphasize particular elements that support their positions. These political actions further contribute to a narrowing as well as a biasing of the formulation activity as scarce resources are consumed on political posturing instead of comprehensively exploring the problem space. In addition, political maneuvering generates mistrust that dynamically and further undermines a team's willingness to expend scarce resources to create shared understandings because of the limited returns expected from doing so. As a result, unique information is even more unlikely to be shared and representational gaps are even less likely to be bridged, further undermining problem formulation comprehensiveness.

So far we have suggested that (1) problem formulation is a particularly pivotal activity in addressing strategic problems, (2) comprehensiveness is the appropriate metric by which to evaluate problem formulation, (3) the formulation activity typically unfolds in the context of heterogeneous teams, and (4) the formulation of strategic problems in heterogeneous teams (along with bounded rationality and self-interest with guile) is the likely cause of a set of impediments that collectively constrain and narrow problem formulation. In the next section, we consider how our analysis can provide the basis for developing a mechanism to mitigate the impediments and thus increase comprehensiveness. Specifically, we describe why using a (structured) process based on the theoretical framework is an effective way to alleviate the impediments and illustrate how the theory can be used to design such a process.

DESIGNING A MECHANISM TO EXPAND FORMULATION COMPREHENSIVENESS

The problem formulation impediments described above might be addressed via three general approaches—selection/team composition, use of incentives, and process design (i.e., input, output, and behavior controls; see Ouchi, 1977, Thompson, 1967). Selection involves purposely composing teams to capture the gains from heterogeneity while simultaneously attenuating impediments. However, this mechanism presupposes that managers not only have the ability to verify *a priori* what individuals' interests and objectives are and how they differ in terms of their cognitive structures and informational sets but also that they have enough control over the composition of work teams to select ideal members for inclusion—both assumptions that are typically not met in organizations (Wanous and Youtz, 1986). Although some previous research has found that individuals' perceptions of heterogeneity do converge with reality to some extent, suggesting that people should be able to verify individuals' information sets, cognitive structures, or interests, these relations seem to have currency only in the case of more visible aspects of heterogeneity, such as age, sex, or race/ethnicity (e.g., Harrison *et al*., 2002). In cases where heterogeneity concerns nonvisible indicators, such as values (which has implications for individuals' objectives) or cause-effect beliefs (which has implications for individuals' cognitive

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structures), correlations tend to be nonsignificant or negative and generally too low to guide any selection decision in practice (e.g., Harrison *et al.*, 2002; Miller *et al.*, 1998). These findings suggest that it would be difficult for senior managers to assemble a team of a certain composition in terms of information sets, cognitive structures, or objectives by relying on their perceptions of relevant attributes. In fact, the general discrepancy between perceived and objective heterogeneity has lead Harrison and Klein (2007: 1216) to conclude that 'measures of perceived diversity are not likely to be construct-valid measures of "actual" diversity.' Overall, it appears that selection may be an incomplete and difficult-to-implement mechanism to overcoming the impediments.

Incentives offer another alternative mechanism. Similar to selection, however, incentives may be somewhat limited in mitigating the impediments to comprehensive problem formulation. The problems with the use of incentives largely stem from the difficulty of objectively and accurately measuring effort and performance (DeMatteo, Eby, and Sundstrom, 1998; Hall, 2002), and from the costs associated with selectively intervening in an organization by offering targeted incentive structures (Nickerson and Zenger, 2008; Williamson, 1985).

Three fundamental problems—controllability, alignment, and interdependency (Hall, 2002)—are associated with measuring performance accurately, particularly in the context of problem formulation. A range of factors affecting problem formulation comprehensiveness may not be controllable by the team and its members, making (un)controllability a concern when measuring the performance of problem formulation teams. Next, problems of alignment between what can be measured and verified easily and what actually creates value may arise. Finally, given the collective nature of problem formulation, it is difficult, if not impossible, to determine the contributions to the formulation activity of any individual team member creating difficulties due to interdependency.[8]

Given the difficulties associated with the accurate measurement of performance in the problem formulation activity and formulation comprehensiveness, one alternative may be to measure a more distal outcome of the activity, for example, the acceptance of the problem formulation by senior management or the overall success of the strategic decision making process. However, even these alternatives are flawed and limited in their ability to overcome the impediments to comprehensive problem formation. Using the acceptability of the problem formulation as the criterion carries the risk of curtailing comprehensiveness as less acceptable formulations are likely to be withheld. Using the success of the overall decision making process as the yardstick is problematic because activities other than problem formulation (e.g., solution derivation, decision implementation) are likely to impact the overall success of the process thereby providing a diluted measure of the formulation activity. The mechanisms of selection and incentives therefore appear to be difficult to implement and not sufficient to attenuate the impediments associated with SPF.

Given the insufficiency of these two options to fully address the challenges of problem formulation, we explore the potential usefulness of a third category of mechanisms—structured processes. Van de Ven (1992) observed that the term 'process' has been used in a variety of ways in the management literature (see also Chakravarthy and White, 2002; Maritan, 2007). In this paper, we define a structured process as a specified set of rules or guidelines that direct team interaction to arrive at a desired outcome (e.g., comprehensiveness). Thus, structured processes focus on intermediary steps that cause team heterogeneity in information, knowledge, and objectives to be reliably transformed into enhanced problem formulation comprehensiveness. Our conceptualization is consistent with previous work (Eisenhardt and Martin, 2000; Maritan, 2007), which considered processes as dealing with the question of how strategies are formed, implemented, and

[8] The *controllability problem* refers to the notion that like other forms of performance, comprehensively formulating a problem is only partly under the control of the team and the efforts and skills brought to bear by its members. For example, unavailability of key individuals who hold relevant information and knowledge may constrict the team in its ability to comprehensively formulate a problem. The *alignment problem* is likely to arise because most of the value creating efforts in problem formulation—cognitive efforts related to sharing unique information and overcoming representational gaps—are not easily measured. For example, although it may be possible to measure information sharing in general, it is impossible to measure the sharing of unique information as this information, by definition, is only accessible to a few or a single member of the team and is not known *a priori*. Lastly, the *interdependency problem* describes the difficulties of measuring outcomes that are fundamentally the result of the joint, interdependent efforts of many people, not the result of the efforts of a single individual.

DOI: 10.1002/smj

changed and the identification of the routines and mechanisms that undergird this set of activities. In essence, structured processes represent mechanisms that may serve to mitigate the biases plaguing the formulation of strategic problems into value creating strategies.

Our theory provides the opportunity to identify and evaluate alternative structured processes (or process elements) for expanding problem formulation comprehensiveness. Thus, rather than relying on *ad hoc* and descriptive accounts of the effectiveness of processes, we determine the effectiveness of process elements by evaluating their ability to mitigate the previously identified impediments. By theoretically analyzing the impediments and their causes, our approach allows for flexibility in how the design goals are addressed. Put differently, there could be any number of alternative structured processes used to achieve comprehensive problem formulation as long as the process components satisfy the design goals of mitigating the specific set of impediments.

In the section below, we describe one example of a structured process that was designed in adherence with our design goals and that can be used to mitigate the previously identified impediments. The purpose of this process is to illustrate how our theory can be used to guide the design of a structured process; the example is not intended to claim superiority of this specific process vis-à-vis alternative processes or mechanisms. We begin by providing an overview of the structured process and then detail the theory underlying its design.

Collaborative structured inquiry: an example of a structured process to mitigate the impediments to comprehensive problem formulation

The process we refer to as 'collaborative structure inquiry' (CSI) involves splitting the problem formulation activity into two distinct phases, which we refer to as *framing* and *formulating* the problem. The purpose of the framing phase is to identify all empirical regularities (i.e., symptoms) that are correlated with the symptom that launched the inquiry (a symptom may be a drop in profits, a loss of market share, or some other key issue that has the concern and attention of leaders). Once the web of correlated symptoms is identified and verified through the framing phase, the next phase formulates the problem by identifying and verifying all root causes of the web of symptoms. To help accomplish this split, 'ground rules' for discussion are laid out for each phase. For example, in the framing phase, a facilitator may ask participants to refrain from discussing causes or solutions. Second, participants begin their discussion by engaging in a modified version of the nominal group technique (mNGT) (Van de Ven and Delbecq, 1971). Participants first write down individually all possible symptoms correlated with the symptom that launched the inquiry along with supporting evidence of their existence. Then, in a round robin fashion, each group member reveals one symptom he or she has written down until all symptoms are considered. Each symptom and its correlation are then discussed until the team reaches consensus on its inclusion in or exclusion from the set of correlated symptoms. Third, using results from the mNGT procedure, team members compile the web of symptoms and supporting information into a document on which the team is required to reach consensus in terms of its wording.

The formulation phase immediately follows the completion of the framing phase and relies on an approach similar to the one used during the latter, with a few exceptions. First, the ground rules now focus the team members specifically on the formulation of the problem thereby prohibiting the discussion of potential solutions. Second, during the mNGT, instead of identifying the web of symptoms, the team now lists and discusses all causes that could potentially explain one or more of the previously identified symptoms. It is each of these causes that represent alternative formulations. The end product of this phase is a document that offers a set of formulations that represent plausible and relevant causes of the previously identified symptoms. The formulation document and problem framing document are then distributed to relevant stakeholders outside the group for review and input. These individuals are asked to add missing symptoms or causes and to provide evidence supporting their inclusion.

A crucial point of the paper is that the CSI process is not designed in an *ad hoc* manner, but each element is intended to address one or more of the impediments identified by our theoretical analysis. Following, we explain how the combination and sequence of elements were intended to mitigate the theoretically derived impediments.

DOI: 10.1002/smj

Structuring CSI into distinct stages is expected to be beneficial given past research documenting the value of distinguishing between problem formulation and solution generation (Lipshitz and Bar-Ilan, 1996; Maier and Hoffman, 1960). Segmentation is targeted at two impediments. First, it is intended to mitigate being 'solution minded' (Maier and Hoffman, 1960). Specifically, in the framing and formulation phases members are focused on identifying symptoms or causes, as opposed to prematurely leaping to solutions. Second, the sequential structuring of segments is designed to limit political or strategic behavior. For example, one way that managers may engage in political behavior is by providing solutions that are advantageous to themselves or their department (Pettigrew, 1973). By first focusing on identifying relevant symptoms and prohibiting solutions prior to formulating the problem, CSI is designed to limit strategic behavior within the team. For instance, it is unlikely that discussions of symptoms will trigger political reactions the way that deriving solutions can (discussing symptoms has fewer direct implications for which actions need to be taken and whom such actions may benefit). Although it provides no guarantee that political maneuverings are completely eliminated, we expect that the sequential structuring of segments fosters a context in which team members come to slowly agree on the goal of eliminating the symptoms. Such convergent expectations can then attenuate impediments that derive from heterogeneous motivations.

The modified NGT is intended to attenuate the impediments of information sampling and representational gaps, as well as the related problem of dominance by a few members (Van de Ven and Delbeq, 1971). Specifically, the mNGT forces individuals to identify and commit to their information or cognitive structures before being influenced by their fellow team members; this can reduce the tendency for teams to engage in narrow sampling. In addition, by requiring team members to individually reveal their information (which prevents low stakes individuals from engaging in 'social loafing') and specifying rules for discussing and evaluating ideas (which prevents high stakes individuals from dominating), each individual has an equal chance at participation. By requiring that every listed symptom and cause must be discussed and evaluated, the conversations may reduce representational gaps by causing individuals to share their knowledge and understand others' mental models.

The *unanimity decision rule* is used to address two impediments: representational gaps and diversity in objectives. Majority and unanimity are the most common decision rules used by teams (Mohammed and Ringeis, 2001). In contrast to unanimity, majority rule is considered to be less time consuming and more likely to avoid impasses, and less likely to produce post-decision entrapment (Castore and Murnighan, 1978; Hare, 1976; Kameda and Sugimori, 1993; Kerr *et al.*, 1976; Miller, 1989). Most benefits of majority rule, however, are only likely to materialize in teams that are either purely cooperative (here, majority rule should be more efficient than unanimity at reaching a decision) or purely competitive (here, majority rule should be more likely to avoid an impasse and to produce an agreement that is acceptable to the largest number of team members) (Thompson, Mannix, and Bazerman, 1988). In contrast, when team members share some objectives but not others (a likely characteristic of the types of heterogeneous teams involved in the formulation of strategic problems), majority rule may produce dysfunctional outcomes related to problem formulation. Specifically, in teams with heterogeneous objectives, majority rule may cause members to compromise early rather than to search for more integrative understandings and solutions (Mohammed and Ringeis, 2001; Thompson *et al.*, 1988). When teams compromise prematurely, it is unlikely that all information is revealed and unlikely that team members invest in the communication codes and channels needed to understand and integrate different information and cognitive structures. Thus, the unanimity rule should help teams with heterogeneous objectives mitigate narrow sampling and representational gaps.

Finally, CSI involves *external stakeholders*. Although the mNGT is intended to maximize information exchange within the team, it is possible that team members may not have the full set of information necessary to comprehensively formulate the problem and/or may fail to reveal all unshared information. To address the impediment, a step is included to allow external stakeholders to comment on the symptoms or their underlying causes. As Ancona and Caldwell (1992) found in the study of new product development teams, reaching out to external teams can partially

DOI: 10.1002/smj

address the bounded rationality of the group. Thus, involving external parties by circulating symptoms and problem formulations can expand problem formulation comprehensiveness.

DISCUSSION

The goal of this paper was to build theory-based microfoundations for SPF. Although problem formulation has been discussed in literatures that span several academic disciplines including business strategy, organizational behavior, psychology, sociology, and operational management, and despite earlier work having provided important insights into the problem formulation activity, these largely descriptive accounts are scattered across fields and have failed to provide a theoretical approach, let alone lead to the development of microfoundations for this important activity. Perhaps as a consequence, research on problem formulation has made little progress over the last several decades.

As a first step toward establishing the microfoundations of SPF, we identified a criterion by which to evaluate the success of the formulation activity. Next, using a relatively common set of assumptions in strategic management, we systematically and theoretically identified a critical set of challenges that teams comprising heterogeneous members are likely to face when formulating strategic problems. While these and other individual impediments have been described in the literature on group and individual decision making, we developed a theory that not only identifies which impediments are likely to impact formulation comprehensiveness but also describes how they interact to jointly impact problem formation. With the set of impediments identified, we considered how a mechanism could be designed to mitigate them. Highlighting the limitations of the mechanisms of selection and incentives in attenuating the impediments associated with SPF, we suggested that the appropriate mechanism could be a structured process. Based on our theory of impediments, we developed one version of a structured process, CSI, for mitigating the impediments to comprehensive problem formulation. Although we borrowed individual elements from processes previously identified in the literature, the novelty of CSI derives from the particular combination and sequencing of these elements. Put differently, adopting only some of the structured process elements proffered would unlikely satisfy all of our design goals and therefore not mitigate the identified problem formulation impediments. Our theory therefore led to specific guidance for managers interested in implementing a process to enhance the formulation of complex, ill-structured problems. Although not reported in this manuscript, CSI has been applied in a number of organizations with preliminary evidence of its success in improving SPF. Empirical research that examines the effectiveness this or other structured processes intended to improve problem formulation is now needed in order to advance the science and practice of SPF.

Our effort to build the microfoundations for SPF is predicated on several assumptions that deserve attention. For example, we assumed that the members of the team in aggregate possess sufficient information and knowledge to span the space of the problem. One direction for future theory development is to relax this assumption and explore mechanisms to increase the likelihood of encompassing relevant information and knowledge. This may be particularly important when it comes to exploring new opportunities, as it is difficult to predict *a priori* what expertise is required in such circumstances. Another direction is to consider problem contexts that are less complex and more structured. We envision that our analytical approach is flexible enough to accommodate such variation in assumptions. These variations may then lead to the discovery of new processes that are particularly suitable for particular situations. Ultimately, we hope to launch the beginnings of a process-design paradigm by establishing the microfoundations of a firm's ability to discover, develop, and formulate strategic challenges in a range of different circumstances.[9]

Finally, within the strategy literature, our analysis has important implications for the dynamic capability perspective and the microfoundations that undergird the various capabilities (Eisenhardt and Martin, 2000; Helfat *et al*., 2007; Teece *et al*. 1997). According to Teece (2007: 1333), regularly applying procedures to overcome impediments to strategic decision making is 'not a well-distributed

[9] The prior paradigm for a process-based view of strategy formulation dates back to Allison (1971) and Bower (1970). In contrast to this earlier paradigm, our approach focuses on identifying cognitive, social, and motivational impediments to strategy formulation and developing mechanisms to overcome them.

skill and may not be for decades to come' and, thus, competitive advantage can be gained by early adopters of any technique designed to systematically and reliably overcome biases in strategic decision making. The theory outlined in this manuscript and operationalized as a structured process constitutes such a technique and, as a result, may offer firms the possibility to achieve competitive advantage for some time to come. As such, the insights developed here may constitute the beginnings of an effort to concretize the foundations upon which dynamic capabilities in the areas of sensing and seizing opportunities are built (Teece, 2007).

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