The Problem Solving Perspective: A Strategic Approach to Understanding New Business Opportunities and Business Models

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Abstract: Any theoretical perspective that examines firm organization and performance should consider two important dimensions: first, how accurately does the proposed "unit of analysis" reflect actual firm decision making? Second, does discriminating alignment in organizational approach exist? This paper addresses these two questions via a conceptual model of discriminating alignment between problems and firm organization and performance. This problem solving perspective (PSP) suggests problems, which vary according to their structure and complexity, must be matched to organizational modes, which vary according to their abilities to support knowledge development and transfer, in order to facilitate solution search. We argue that problems represent a more robust unit of analysis to examine firm organization, in comparison to the other theoretical perspectives utilized in strategy research. We provide several applications of the problem solving perspective to the development of new business opportunities and business models.

1 INTRODUCTION

Business opportunities refer to situations where individuals and/or firms can develop new products or services that can be sold at greater than their cost of production (Hsieh *et al.*, 2007; Shane, 2003). Business models are similarly defined as "the way firms operate," or more formally as a set of choices and a set of consequences derived from those choices (Casadesus-Masanell & Ricart, 2008). The conceptual importance and practical implications of both concepts are fairly well-recognized. In many respects, firms' primary strategic objectives are to recognize and develop new business opportunities and develop and implement new business models that create or sustain competitive advantage.

In this chapter, we do not make any strong distinctions between new business opportunities and new business models. We do argue, however, that any theoretical perspective that examines the development of new business opportunities and business models must consider issues related to organization and performance. In particular, this chapter is concerned with how firms organize efficiently such that superior performance is realized in the development of new business opportunities or the implementation of new business models. The efficiency of organization, however, requires consideration of two other dimensions. The first dimension is concerned with the proper "unit of analysis" utilized. By this we mean, does the unit of analysis reflect actual firm decision making processes in practice? Moreover, can the unit of analysis be "dimensionalized" in a manner that is both sensible and measurable? The second dimension is concerned with discriminating alignment. By this we mean, can the particular dimensions or attributes of the unit of analysis not only be measured, but also compared and contrasted against the organizational modes available such that efficient organization (i.e., lower costs, improved productivity, better performance, etc.) obtains?

This chapter presents a conceptual model through which strategy research and strategy researchers may better address these questions. In particular, we link strategy research that emphasizes the different processes used to recognize, discover, and create business opportunities and business models with a simple stimulus-response-consequence framework. We argue that new business opportunities and models are better characterized as problems in need of solutions. The identification and development of a business opportunity is in reality nothing more than a matching process between different problems—which either knowingly have been identified or unknowingly have been stumbled upon—and solutions—which represent different organizational choices that individuals and/or firms must make. The development and implementation of a new business model can similarly be characterized as providing a solution to either an articulated or unarticulated problem that a given economic actor faces.

Because the knowledge, resources, and assets required for new business opportunities and business models usually do not exist completely within the firm, it must instead select particular problems to solve that, if done successfully, yield valuable knowledge. Once a problem or set of problems is selected, firms engage in a process of search for solutions over different fitness landscapes (Gavetti & Levinthal, 2000; Levinthal, 1997). Depending on the characteristics of the problems presented by the new business opportunity or business model, as well as the shape of the corresponding solution landscapes that firms must search over in finding high-value solutions, particular modes of organization are advantaged relative to other modes. We make the argument that a problem solving perspective (PSP) is particularly applicable to new business opportunities and/or new business models, given their inherent uncertainties and complexities (Fleming & Sorenson, 2004).

Our conceptual model can be used to address several theoretical implications and practical applications at the crux of strategy research, beyond the identification and development of new business opportunities and the development and implementation of new business models. In particular, how do problems—the unit of analysis within the problem solving perspective—differ from and are superior to other units of analysis? Relatedly, how does the problem solving perspective differ from other perspectives and/or theories of the firm? What organizational approaches—from market to hybrid (alliances) to hierarchy—facilitate the development of new business opportunities and business models? What characteristics of problems facilitate (as well as impede) the development and transfer of knowledge and information within and between organizations? Responses to these and similar questions promise to help strategy research and strategy researchers understand why a problem solving perspective not only is applicable to understanding how firms develop new business opportunities and new business models, but also to understanding and how firms create and capture value.

The rest of this chapter is organized as follows: Section 2 sets the theoretical context by first reviewing the strategy research literature that, either directly or indirectly, examines firm organization and performance. This section provides a brief, but comprehensive, comparison and contrast of the common "units of analysis" used in strategy research, including the resource (resource based view of the firm), knowledge (knowledge based view of the firm), the routine (evolutionary economics), the opportunity (entrepreneurship), and the transaction (transaction cost economics). Section 3 lays out the framework of the problem solving perspective (PSP). This section first characterizes problems by their degree of structure and complexity, and organizations by their support for particular methods of solution search. It then presents a discriminating alignment argument between the characteristics of problems and the instruments

available in different organizational arrangements. It concludes by suggesting that problems represent the most "appropriate" unit of analysis and the problem solving perspective the most "robust" theoretical perspective for strategy research, in comparison to the other units of analysis and theoretical perspectives. Section 4 presents several applications of the problem solving perspective, especially as it relates the identification and development of business opportunities and development and implementation of business models. This section also makes several suggestions for further research. Section 5 concludes.

2 THEORETICAL BACKGROUND

Business opportunities are, perhaps not surprisingly, most often associated with the entrepreneurship literature. Business opportunities refer to situations where individuals and/or firms can develop new products or services that can be sold at greater than their cost of production (Hsieh *et al.*, 2007; Shane, 2003). Literature that examines business opportunities places emphasis on identification. In other words, the discovery of business opportunities represent the identification of valuable products or services, the identification of new customer segments or geographic markets, or the identification of new ways of organizing (Schumpeter, 1934).

The term "business model" has been a part of the business vernacular for several decades, but has gained prominence amongst academics and practitioners only recently (Casadesus-Masanell & Ricart, 2008). Despite renewed interest in business models, there is no widely accepted definition of what the term actually refers to. Moreover, a variety of factors are considered to influence the development of business models, including information and communication technologies, globalization, and deregulation, among many others. While most academics and practitioners consider a business model to be "the way the firm operates,"

Casadesus-Masanell and Ricart (2008) provide a more concrete definition by suggesting it consists of a set of choices and a set of consequences derived from those choices. Choices refer to the different policies that firms can adopt regarding their operation, the different assets that are put in place and required to operate, and the contractual arrangements (i.e., governance structures) that confer decision rights related to the policies and assets in place. Consequences refer to how the different policies, assets and governance structures in place interact in terms of (performance) outcomes realized.

We do not make strong distinctions between business opportunities and business models in this chapter,[1] but instead argue any theoretical perspective that examines the development of new business opportunities and/or business models must consider several questions related to organization and performance. In particular, how can firms organize efficiently such that superior performance is realized for a business opportunity? The performance efficiency of organization, however, entails addressing two other important dimensions. First, how accurately does the proposed "unit of analysis" reflect actual firm decision making processes in practice? By this we mean can the unit of analysis be "dimensionalized" in a manner that is both sensible and measurable? John Commons (1934: 4) suggests that "any unit of activity…must contain in itself the three principles of conflict, mutuality, and order." Williamson (1996: 12) elaborates further on Commons' argument, suggesting that "governance is the means by which order is accomplished in a relation in which potential *conflict* threatens to undo or upset opportunities to realize *mutual* gains." Second, does some type of discriminating alignment in organizational approach exist? By this we mean can the particular "attributes" of the unit of analysis not only be measured, but also be compared and contrasted against the organizational modes available such

[1] We do, however, discuss the "business opportunity" concept in more detail in our examination of the entrepreneurship literature immediately below.

that efficient organization (i.e., lower costs, improved productivity, better performance, etc.) obtains?

With these sets of questions as our theoretical and empirical backdrop, we examine a number of perspectives and frameworks that have been proposed in strategy research that purport to examine firm organization and performance. Arguably, the four most prevalent are the resource based view (RBV) of the firm, the knowledge-based view (KBV) of the firm, evolutionary economics (EE) and transaction cost economics (TCE). The RBV perspective suggests that the "resource" is the appropriate unit of analysis, while the KBV and EE consider, respectively, "knowledge" and the "routine" as the appropriate unit of analysis. By contrast, TCE argues that the "transaction" is superior, given its microanalytic foundations. Moreover, the field of entrepreneurship proposes that the "opportunity" is an appropriate unit of analysis (Shane, 2003). While entrepreneurship is not considered (as of yet) a fully developed theory of the firm, we compare and contrast it with the other strategy theories and frameworks above because of its obvious connections and relevance to the development of new business opportunities.

2.1 The Resource Based View (RBV)

The resource based view (RBV) has its origins in the work of Penrose (1959), Richardson (1972), and Nelson and Winter (1982), was developed by Barney (1986; 1991), Peteraf (1993) and Wernerfelt (1984), and has been further extended by Helfat and Peteraf (2003) and Mahoney and Pandian (1992), among others. This perspective conceptualizes firms as collections of 'sticky' and difficult-to-imitate resources that are either tangible, such as specific product designs or particular production techniques, or intangible, such as brand equity, knowledge of particular markets or user needs, or unique management practices.

For several reasons, the "resource" is not an ideal unit of analysis for several reasons. First, the processes that underpin resource creation have not been intensively analyzed. Second, empirical work within this perspective is hampered by varied (and often imprecise) definitions of 'resource' (Henderson & Cockburn, 1994). While dimensions have been suggested along which resources differ (i.e., VRIN – valuable, rare, inimitable and nonsubstitutable) and are important for sustainable competitive advantage (Barney, 1991), the actual measurement of these dimensions has proven much more difficult (Wernerfelt, 1984). Finally, the "resource" does not address central issues related to organization, whereby conflict between and among economic actors is restored through order such that "mutuality of advantage" obtains (Commons, 1934).

Progress has and is nevertheless being made within the RBV framework in understanding the organizational implications related to firms' resources and capabilities (Argyres, 1996; Barney, 1999). A discriminating alignment between the important dimensions by which resources differ and firm organization, however, has not been proposed. Moreover, contradictions within this developing part of the framework have been identified (Mayer & Salomon, 2006).

2.2 The Knowledge Based View (KBV)

The knowledge based view (KBV) suggests that rather than the resource as the appropriate unit of analysis, "knowledge" is most central to economic activity (Grant, 1996). In this perspective, the firm is conceptualized as an institution for integrating specialist knowledge. Firms develop new knowledge important to competitive advantage from novel combinations of existing and "new" knowledge.

Without question, the knowledge based view has made important contributions to our understanding of the firm, but more research is required in understanding what "knowledge"

represents and how knowledge development opportunities are identified and efficiently organized for. For instance, “knowledge” has been dimensionalized principally according to its explicitness or tacitness, but several other dimensions are also proposed and certainly applicable. Similar to the RBV, measurement issues within the KBV remain an empirical concern. Moreover, “knowledge” does not readily lend itself to sufficiently addressing the three central organizational issues of conflict, mutuality and order (Commons, 1934).

The KBV perspective has emphasized predominantly the virtues of internal organization, but has largely ignored the role of markets in firms’ knowledge development and transfer activities. Internal organization is argued beneficial on the one hand because it avoids knowledge transfer by exercising authority and directing the actions of others (Conner & Prahalad, 1996; Demsetz, 1988), and argued beneficial on the other hand because it facilitates knowledge transfer through established communication codes, shared languages, and routines (Grant, 1996; Kogut & Zander, 1992, 1996; Monteverde, 1995). Contradictions in the role that internal organization plays in facilitating firms’ knowledge development activities therefore exist. Moreover, relatively under explored in the literature is how knowledge development and transfer might differ among organizational modes (Nickerson & Zenger, 2004). In short, the KBV perspective does not provide sufficiently a discriminating alignment argument between the attributes of knowledge and the cost and competencies of alternative organizational approaches. But just such a theoretical examination is needed in understanding the processes by which firms organize and manage “knowledge-based” activity, particularly for new business opportunities and business models.

2.3 Evolutionary Economics (EE)

Evolutionary economics suggests the "routine" is the appropriate unit of analysis for strategy research. This theoretical perspective, developed by Nelson and Winter (1982) and building on Schumpeter (1951) and Penrose (1959), explains firm behavior through a dynamic tension between adaptation and selection. Routines represent standardized patterns of action that firms implement in competition against other firms, and include such things as forms, rules, procedures, conventions, strategies and technologies. Because firms differ in their idiosyncratic routines, the products and practices implemented are different, which subsequently determines winners and losers.

Similar to the RBV, however, evolutionary economics has not yet adequately laid out the processes by which routines are created, the various levels (macro-, meso- or micro-) within the firm with which routines operate, and the important dimensions along which routines differ or are measurable. Moreover, evolutionary economics is principally a theoretical perspective that examines issues internal to the firm. Similar to the RBV and KBV frameworks, the role of markets in facilitating the development and/or transfer of routines (if at all possible) are largely ignored. Because of the current emphasis, the theory is unable to make or suggest discriminating alignment arguments.

2.4 Entrepreneurship

The entrepreneurship literature proposes that the "opportunity" is an effective unit of analysis for examining entrepreneurial activity (Shane & Venkataraman, 2000). In the most simplistic definition, the entrepreneur's task relates to discovering and exploiting opportunities. "Opportunity discovery" represents any situation in which new products or services can be

profitability sold, including the identification of new product and service concepts, new geographic markets, or cost-effective techniques.

While the "opportunity" is a useful and meaningful concept, Hsieh et al. (2007) suggest that it is limited in terms of applicability. These authors argue the process of "opportunity discovery" is actually very complex, entailing a wide range of knowledge, across multiple stages of the value chain, and among multiple actors. These factors suggest that organizational choices impact the process with which opportunity discovery can be undertaken successfully and efficiently. How individuals and/or firms address central issues of organization, including mutuality, conflict and order (Commons, 1934), become paramount.

Moreover, the concept of "opportunity" is an overly broad concept and does not address sufficiently what individual entrepreneurs and/or firms do. In particular, entrepreneurial activity first entails the identification of (high value) problems. After this initial step, individual entrepreneurs and/or firms make organizational decisions related to finding potential solutions. Opportunity discovery is instead better characterized as an organizational matching process between valuable problem-solution pairings (Hsieh *et al.*, 2007). In short, the opportunity as a unit of analysis operates at "too high" of a level to accurately and sufficiently capture entrepreneurial activity.

2.5 Transaction Cost Economics (TCE)

Perhaps not surprisingly, the first four "theories" of the firm take more of an organizational theory (OT) approach toward the unit of analysis. By contrast, transaction cost economics (TCE) is based on industrial organization (IO) economics and the new institutional economics (NIE). Following Commons (1934), Williamson (1975) recognized that how firms organize (more generally, how to govern) was more important than the actual composite goods

and/or services produced. The occurrence of a good or service transferred across a technologically separable interface results in a "transaction," which presents organizational (governance) implications. From this, a predictive theory of economic organization—whereby the transaction is made the (microanalytic) unit of analysis—that indicates exactly which "transactions" will be organized how is suggested. In particular, Williamson argues that "transactions, which differ in their attributes, are aligned with governance structures, which differ in their cost and competence, so as to effect a discriminating—mainly a transaction cost economizing—result" (1996: 12).

In several respects, TCE represents an empirical advancement over some of the theories and frameworks reviewed immediately above. The dimensions by which transactions differ—namely, asset specificity, uncertainty and frequency—are distinct and measureable. The ways in which organizational modes (governance structures) differ in terms of incentive intensity, control and communication, and dispute resolution are made clear and fairly well supported. The discriminating alignment logic proposed between transactions and governance structures is also empirically testable. Moreover, transaction cost economics is arguably an empirical success story, having branched out from its economic roots to examine empirical phenomena in a host of other social science disciplines and business areas (Macher & Richman, 2008), to a greater extent than the other theories and frameworks.

Nevertheless, several concerns with the TCE approach—particular to the strategy field—remain. One such concern is the role that experience and/or capabilities play in firms' boundary decisions (Barney, 1999). TCE does not examine to any great extent how firm size (Argyres & Bigelow, 2007), capabilities or experience (Bigelow & Argyres, 2008) influence outsourcing decisions and performance to a sufficient extent. Another concern is the role that opportunism

plays (or does not play) in economic exchanges. While TCE theory has emphasized mitigating the hazards of opportunism, the complexities of opportunism have not sufficiently been fully explored (Wathne & Heide, 2000). Much of the empirical literature rests on the general presumption that opportunism exists, but few studies measure opportunism directly. Another concern is the rather narrow definition of the transaction itself, which some suggest fails to capture adequately what firms do or deal with in their day-to-day operating activities. In particular, firms are more likely to recognize the benefits of organizational decisions as they relate to solving important strategic problems, in comparison to organizing in a "transaction cost economizing way." The microanalytic dimensions of transactions perhaps operate at "too low" of a level to accurately and sufficiently capture strategic activity, especially as it relates to organization and performance.

3 THE PROBLEM SOLVING PERSPECTIVE

In our approach, we build significantly on the work of Hsieh, et al. (2007), Nickerson and Zenger (2004) and Macher (2006), who propose a theory of the firm based on the problem solving and solution search efficiencies of alternative organizational modes. These authors make theoretical and empirical discriminating alignment arguments between problems, which vary according to their structure and complexity, and organizational modes, which vary according to their abilities to support knowledge development and transfer. We also emphasize firms' activities related to the development of new business opportunities and/or business models. Moreover, our view of business opportunities is inclusive—from the discovery of new technologies through their development and commercialization into new products or processes; from the identification of new customer segments through their development into lines of business; from the decision to enter a given country through the development of appropriate sales

and distribution channels; etc. The efficiency of firms in these activities typically entails the development of and/or access to information, resources and assets that exists both within and outside of the firm.

We first make the argument that business opportunities and models are more accurately represented as organizational problems, given that the concepts of "business opportunity" or "business model" must address central issues in organizing that relate to the Commons' (1934) triple of mutuality, conflict and order. We then suggest that business opportunities and models, when recast as problems, differ according to their structure and complexity. These differences subsequently determine the shape of the solution landscapes that individuals and/or firms must search over in order to find high-value solutions. We then propose a discriminating alignment between the characteristics of problems and the incentive, control and coordination aspects of different organizational modes. Our reframing has some similarities to Casadesus-Masanell and Ricart (2008), who suggest that business models represent a set of choices and a set of consequences derived from those choices, but also differs in important respects. Finally, we suggest that they types of problems that firms need to solve coupled with the choice of organization results in consequences in terms of the efficiency of solution search, and subsequently, realized performance.

3.1 Business Opportunities and Models as Problems

As mentioned above, business opportunities refer to situations where individuals and/or firms can develop new products or services that can be sold at greater than their cost of production (Hsieh *et al.*, 2007; Shane, 2003). Business models refer either to the way the firm operates, or more formally as the set of choices that firms make and the set of consequences derived from those choices (Casadesus-Masanell & Ricart, 2008). In both definitions, an implicit

assumption is made that the identification and development of the business opportunity or business model, if done successfully, has value. This is difficult, however, because the realization of value generally entails a wide range of knowledge that must be accessed, both across multiple stages of the value chain and among multiple actors (Hsieh *et al.*, 2007). Success (and failure) therefore depends on the economic actor's abilities to address sufficiently the organizational concepts of mutuality, conflict and order.

We argue instead that business opportunities and business models are better characterized as problems that are in need of solutions. In particular, the identification and subsequent development of a business opportunity is nothing more than a matching process between different problems—which either knowingly have been identified or unknowingly have been stumbled upon—and solutions—which represent different organizational choices that individuals and/or firms must make. As Hsieh et al. (2007) note, prior literature has made strong associations between (business) opportunities and problem solving. Some suggest that "basic entrepreneurial skills" involve accumulated knowledge that "assist[s] in problem-solving" (Stevenson & Jarillo, 1990: 23), while others indicate the "[d]iscovery of opportunities is often like solving puzzles…" (Shane, 2003: 52).

The development implementation of new business models is similarly characterized as providing a solution to either an articulated or unarticulated problem that an economic actor faces. For instance, Chesbrough (2007) notes a new business model represents anything from the development of an innovative value proposition, to the targeting of different customer segments, changing the management of the supply chain, or altering the revenue generation mechanism(s) employed, among others. New business models suggest the ways in which improvements can be made such that the business operates more efficiently. This too suggests that a matching process

between problems and solutions is a more appropriate approach toward unpacking this concept. Given that new business opportunities and business models are better characterized as problems, we turn our attention toward delineating the unique characteristics of problems.

3.2 Problem Characteristics – Structure and Complexity

Problems represent systems that correspond to sets of decisions that potentially interact in non-simple ways (Simon, 1962). Problems are accompanied by sets of potential solutions termed "landscapes," each of which relates to unique combinations of decisions made (Nickerson & Zenger, 2004). Kauffman's NK framework is used to conceptualize solution landscapes, whereby N represents the number of knowledge sets applicable to a problem and K represents the degree of interdependence among knowledge sets. Given a particular N and K, firms attempt to efficiently search the landscape for high-value solutions by combining (potentially disperse) knowledge resources.

Fernandes and Simon (1999) further suggest that problems differ systematically according to their structure and complexity. Problem structure represents firms' level of understanding of the K interactions among N knowledge sets for a given problem. Given this level of understanding, problems vary on a continuum from ill-structured to well-structured. These differences in firms' level of understanding result from characteristics of the problem domain on the one hand, and the availability of problem solving mechanisms on the other (Fernandes & Simon, 1999; Simon, 1973). Well-structured problems are those with well-defined initial states (N and K are unequivocal) and explicit problem solving approaches, while ill-structured problems have poorly-defined initial states (N and K are equivocal) and ambiguous problem solving approaches. Moreover, well-structured problems have well understood knowledge set interactions, while ill-structured problems have unexpected and/or unknown

knowledge set interactions (Levinthal, 1997). These types of problems might also be interdisciplinary in domain or context. The defining characteristic of ill-structured problems in comparison to well-structured problems is that there is no agreed upon or formalized process or approach for solving (Fernandes & Simon, 1999). As Simon notes, “it is not exaggerating much to say that there are no well-structured problems, only ill-structured problems that have been formalized for problems solvers” (1973:186).

Problems can also be characterized according to their complexity. Problem complexity represents the magnitude (K) or degree of interdependence among the N knowledge sets for a given technological development problem. In other words, it represents the number of issues, functions or variables involved and the degree of relationship among these properties. Given the level of knowledge set interaction, problems vary on a continuum from simple to complex. Simple problems are composed of few knowledge sets which interact in predictable ways, while complex problems have large numbers of knowledge sets that interact in intricate ways. Given the magnitude of knowledge set interactions, well- and ill-structured problems differ in their level of decomposability (Ethiraj & Levinthal, 2004). Simple (e.g., decomposable or low-interaction) problems have solutions that depend little on the interaction of knowledge sets and can readily be subdivided into sub-problems that draw on these different knowledge sets. Simple problems are also composed of fewer variables which interact in more predictable ways. By contrast, complex (e.g., non-decomposable or high-interaction) problems entail extensive knowledge set interaction (Nickerson & Zenger, 2004), have high intransparency (i.e., only some variables lend themselves to direct observation or the large number of variables requires selection of the relevant few), and have significant connectivity between variables (Funke, 1991). Complex problems require the balancing of multiple variables during problem structuring

and solution search, which places significant cognitive burdens on problem solvers (Jonassen, 2004). Examples of complex problems include the invention of the automobile and the microprocessor due to the combined number of knowledge sets that they each drew from (Fleming & Sorenson, 2004).

Ill-structured problems tend to be more complex while well-structured problems tend to be less complex, but this is not a hard and fast rule. Problem structure represents firms' level of understanding of knowledge set interactions, while problem complexity represents the magnitude of these interactions. Well-structured problems might be complex if the K interactions are known but large in number, while ill-structured problems might be simple if the K interactions are unknown but small in number.

3.3 Solution Landscapes

Solution landscapes represent all possible combinations of relevant knowledge, with the topography of the landscape defining the "value" of solutions associated with particular combinations. Complexity architectures or structures represent the interdependencies between relevant knowledge sets within the landscape. Based on the number of distinct knowledge sets and the interdependence (or coupling) among these knowledge sets, some landscapes are described as "rugged" and discontinuous but with several high value solutions, whereas other landscapes are described as smooth and continuous with single, high value solutions (Levinthal, 1997). The magnitude of the interdependencies, as well as the level of understanding of these interdependencies, influences firms' performance in realizing high value solutions. As mentioned, Kauffman's NK framework is frequently used to conceptualize solution landscapes, whereby N represents the number of knowledge sets applicable to a problem and K represents the degree of interdependence among knowledge sets.

For well-structured problems, the interactions among knowledge sets are well understood in comparison to ill-structured problems. While this characteristic does not affect the shape of the solution landscape, it does make solution search easier and certainly more transparent (Macher, 2006). As sufficient information is available and search strategies are known for these types of problems, directional search guided by feedback or experiential learning provides certain efficiency benefits in finding high-value solutions. Formalized processes can more easily be put into place as knowledge sets either do not interact or interact in predictable ways. For simple problems, the magnitude of interactions is small in comparison to complex problems, suggesting that the solution landscapes can be characterized as "smooth." Again, directional search approaches provide certain advantages to these types of problems through experiential learning and feedback. Moreover, solution search can be subdivided and decisions made independently from each other using multiple actors engaged in examining particular knowledge sets potentially relevant to problem solving.

For ill-structured problems, the knowledge interactions among knowledge sets are poorly understood in comparison to ill-structured problems. These types of problems have unexpected and sometimes unknown knowledge set interactions, and cannot easily be subdivided due to the extent of knowledge set interdependencies. For these types of problems, solution search is more difficult as important information is unknown and formalized search strategies are either untried or untested. Search strategies that evaluate the probable consequences of particular choices and rely upon developed heuristics provide certain efficiency benefits in finding high-value solutions. For complex problems, the magnitude of knowledge set interactions is large in comparison to simple problems, which suggests that solution landscapes are relatively "rugged." These types of

problems require greater evaluation of the consequences of particular search decisions for efficient problem solving.

3.4 Discriminating Alignment

This distinction between ill- and well-structured problems and simple and complex problems suggests that certain solution search strategies will realize performance benefits. Because ill-structured and complex problems are neither predictable nor convergent in approach, they benefit from *ex-ante* cognitive evaluations of the probable consequences of particular solution search decisions as opposed to *ex-post* reliance on feedback from decisions already made (Simon, 1991). Established heuristics are necessary to guide and shape problem solving efforts because limited information and a general lack of understanding exists on whether different knowledge sets are (or are not) part of the solution space. Heuristic search strategies provide efficiency gains for these types of problems via a more thorough evaluation of the probable consequences of any search decision made. By contrast, well-structured and simple problems are effectively represented within a solution landscape such that all relevant knowledge sets are part of that landscape and the path to high value solutions is clear. The solution search strategies for these problems are also known, and sufficient information is available for solving these types of problems with only practical amounts of independent search (Simon, 1973). With these fitness landscapes, directional search guided by feedback or experiential learning provides efficiency gains in achieving high value solutions in comparison to heuristic search.

Markets realize performance advantages in finding solutions to well-structured and simple problems due to their superior abilities to facilitate directional search. Markets offer high powered incentives, decentralized control, and mechanisms that allow individual actors to exploit and enhance their own specialized knowledge. Price acts as a high powered incentive that

motivates actors to develop this specialized knowledge (Hayek, 1945). Markets also face more acute competitive pressures that reduce organizational slack and increase incentives to operate efficiently (D'Aveni & Ravenscraft, 1994), and are more responsiveness in adapting to technical or environmental uncertainty (Williamson, 1985). Because the fitness landscapes are smooth and the problem solving approaches are understood for well-structured and simple problems, economic actors can operate independently in search of high value solutions. Hierarchies are comparatively disadvantaged in finding high value solutions for these types of problems. These organizational modes facilitate knowledge sharing and transfer, but well-structured and simple problems neither require nor benefit from these features. Moreover, the low-powered incentives, more generic knowledge sets and bureaucratic features of hierarchies only add costs by moderating the speed and efficiency with which potential solutions can be examined.

While markets better navigate solution landscapes for well-structured and simple problems, they face challenges as problems become ill-structured or complex. Because the approach to solving these types of problems has not been fully formalized, greater control and/or coordination is necessary among economic actors to develop and prioritize search strategies that are likely to yield high-value solutions. Markets realize performance inefficiencies due to their weak support for knowledge sharing and limited protection against knowledge appropriation (Nickerson & Zenger, 2004). Organizational arrangements that facilitate knowledge sharing, where information can be freely shared without risk of appropriation or accumulation and where disputes between economic actors can be monitored and resolved in a timely matter, are instead required (Teece, 1992). Internal organization is comparatively advantaged in finding solutions for these types of problems, as their firm-specific languages, communication codes and information channels, combined with their low powered incentives and dispute resolution

mechanisms, encourage knowledge sharing and promote coordination (Grant, 1996; Kogut & Zander, 1992, 1996; Monteverde, 1995). The formation of research and development goals and the definition of research agendas are also easier under hierarchies (Armour & Teece, 1980), which are likely activities when examining ill-structured problems.

The levels of the structure and complexity of problems Problem obviously lie on respective continuums (i.e., from well-structured on one side to ill-structured on the other; from simple on one side to complex on the other). We illustratively make the argument that moderately-structured problems lie somewhere along a continuum between the poles of ill-structured and well-structured. These types of problems might be best characterized by some knowledge set interactions being well understood while others are not. Moderately complex problems similarly lie somewhere along a continuum between the poles of simple and complex. These types of problems might be considered as nearly decomposable, whereby patterns of interaction among choices are clustered into identifiable modules (Nickerson & Zenger, 2004).

For problems of moderate structure or moderate complexity, arguments can be made that certain hybrid (alliance) arrangement can be implemented that achieves efficiency benefits in finding high-value solutions, superior to either markets or internal organization given the solution search features (i.e., levels of incentive intensity, control and coordination). In other words, we suggest that particular alliance arrangements not only vary (Oxley, 1997), but also offer solution search efficiency benefits depending upon the characteristics of problems. Traditional cash- & license-based agreements arguably serve as a base case, and approximate something closest to markets. These arrangements offer relatively limited abilities to direct problem solving activity, providing limited communication and infrequent contact among alliance partners. Codevelopment agreements provide enhanced coordination through frequent

but not usually permanent interactions between human resources, but do not offer substantial control over alliance partners. Equity partnerships, by contrast, provide higher levels of authoritative control and monitoring, but coordination is often limited to interactions between professional managers and board members as opposed to line-level personnel. Finally, joint ventures provide both superior coordination and substantial knowledge transfer through negotiations between parent firms, exchange of information between board members, as well as the pooling of information amongst human resource personnel.

Given the greater control provided, equity partnerships and joint ventures provide greater authority in either directing solution search or forcing coordination between and among market specialists in ways that cash- & license-based alliances and codevelopment agreements cannot. These types of alliances might represent Nickerson and Zenger's (2004) authority-based hierarchy in a hybrid organizational form. Given the greater coordination provided, codevelopment agreements and joint ventures arguably better facilitate the development and exchange of information necessary for heuristic search in ways that cash- & license-based alliances and equity partnerships cannot. These types of alliances might represent Nickerson and Zenger's (2004) consensus-based hierarchy in a hybrid organizational form. Note that joint ventures provide both authoritative control important for directional search and communication important for heuristic search, in comparison to other alliance arrangement alternatives. These alliance types might therefore be best able to manage the knowledge set interdependencies that exist in solving increasingly ill-structured or complex or problems in comparison to markets, but perhaps not for the most ill-structured or complex problems in comparison to hierarchies.

Table 1 provides an overview of our discriminating alignment argument related to problems, solution search and performance. This table suggests that problems, which vary

according to their structure and complexity, should be matched to appropriate organizational modes, which vary according to their abilities to effectively support solution search, in order for firms to efficiently realize high value solutions. We now turn to applications of the problem solving perspective, placing emphasis on how these applications represent either new business opportunities or new business models.

4 APPLICATIONS

4.1 Internal vs. External Sourcing (Integration) Decisions

A fundamental question in strategic management is how firm organization affects performance. Two approaches that have been examined intently are internal versus external sourcing (e.g., vertical integration) decisions and alliance arrangements. We argue that both organizational approaches can usefully be thought of as a new business model, given each addresses "the way the firm operates." Moreover, both approaches can and have been usefully addressed through the problem solving perspective (PSP). We examine outsourcing decisions the former in this sub-section and alliance arrangements in the next.

Macher (2006) utilizes the PSP in an examination of how semiconductor firms organize efficiently to solve complex and ill-structured problems related to new manufacturing process development. Problem structure is operationalized according to the semiconductor product manufactured,[2] while problem complexity is operationalized according to the proximity of the semiconductor manufacturing process to the leading-edge.[3] Distinct performance differences in

[2] The development of manufacturing processes for analog and memory products are often described as activities based more on art than on science, given the incomplete understanding of the parameter interdependencies between product design and process manufacturing.

[3] Leading-edge manufacturing processes typically introduce new materials and new manufacturing process steps, increasing the number of relevant knowledge sets in the development effort. The tasks of learning the physical limits of the manufacturing process are compounded by the need to understand the functional limits of the product design, as well as how these factors interact.

problem solving important for technological development are found between firms specialized in semiconductor manufacturing and those integrated in product design and semiconductor manufacturing. Integrated device manufacturers (IDMs) achieve performance advantages in terms of the speed and effectiveness of new manufacturing process development when development entails complex problem solving. Integrated firms are more effective in solving these types of problems because their communication structures and organizational mechanisms facilitate heuristic search through authority or consensus-building. At the same time, specialized manufacturers (so-called foundries) realize performance advantages when technological development involves well-structured and simple problems. Market modes of organization improve both the speed and quality of problem solving through directional search due to their high-powered incentives and specialized expertise.

Macher and Boerner (2008) utilize the PSP in a similar examination of how pharmaceutical firms organize efficiently to solve ill-structured and complex problems in drug development. The performance of pharmaceutical firms integrated in drug discovery and drug development are compared against pharmaceutical firms concentrated in drug development (so-called contract research organizations, or CROs). The calendar time required for a drug compound to complete the clinical trial process (i.e., from Investigational New Drug (IND) submission through New Drug Application (NDA) submission) serves as the performance measure. Problem structure represents the degree to which clinical information of a drug compound is disseminated across the industry,[4] while problem complexity represents a measure of the magnitude to which information sources necessary in conducting clinical trials are spread

[4] This variable is a measure of the number of other drug compounds under development or approved within the same drug indication (a subset of a therapeutic area) as the focal drug compound. With less pre-existing knowledge and information regarding the therapeutic characteristics of new drug compounds, firms' understanding of the knowledge sets and interactions applicable to a new drug compound are limited.

across the clinical trial.[5] The empirical results indicate that firms improve performance from outsourcing when technological development entails well-structured and simple problems—given the benefits of specialized knowledge development resources available in the market and the ease of knowledge transfer—and improve performance via internal approaches when development entails ill-structured and complex problems—given the knowledge integration resources within firms and the difficulty of knowledge transfer. Moreover, pharmaceutical firms' technological area experience is also found to improve knowledge development within firms through experiential learning-by-doing, and facilitates knowledge transfer between firms through improved selection, monitoring and communication. Arguably the most interesting finding, however, is the interplay found among the structure of problems, the choice of organization, and the depth of technological area experience. While technological area experience improves performance regardless of organizational approach, the difficulties associated with developing and integrating knowledge across firm boundaries rather than within firm boundaries become especially acute when technological development problems are sufficiently ill-structured.

4.2 Alliance Arrangement Decisions

Alliances are another important organizational approach that many firms utilize toward creating and sustaining competitive advantage. These organizational approaches can also be usefully thought of as the development and implementation of a new business model, in that they suggest ways in which improvements can be made to firms such that they operate more efficiently.

5 This variable measures complexity along two dimensions: first, the size, scale and location of the patient and clinical site population participating in the clinical trial; and second, the administrative and scientific complexity in conducting the clinical trial. A larger number of geographically disperse patients or clinical research sites participating in the clinical trial creates greater complexity. Clinical trials management include scientific activities (i.e., performed procedures, required observations, endpoint and protocol setting, etc.), and administrative activities (i.e., human subject protection, site management, trial quality and data integrity).

Heiman and Nickerson (2004) examine empirically the effects that problem complexity has on alliance arrangement decisions, using the Cooperative Agreements and Technology Indicators (CATI) database. Their sample frame represents the population of all publicly-announced alliances between 1977 and 1989. The decision by firms to use joint-equity ownership via joint ventures is compared against the use of unilateral non-equity arrangements via customer-supplier partnerships, licensing, and other contracting arrangements. Problem complexity is measured as an indicator of whether new, valuable and strategic knowledge is expected to result from combining the distinct collaborator-contributed knowledge of the alliance partners. The empirical results indicate that equity alliances are more likely as problem-solving complexity increases.

Leiblein and Macher (2007) utilize the problem solving perspective in an examination of how ownership and colocation in different alliance arrangements aid firms in meeting desired technological performance objectives. Alliance arrangements that increase common ownership help align incentives, increase monitoring and improve managerial control, while alliance arrangements that co-locate personnel improve coordination and communication between partner firms. Utilizing both transaction cost economics and the problem solving perspective, the authors identify four distinct alliance arrangements and propose that the influence of these arrangements on performance is dependent on the nature of problem solving related to technological development. Problems are measured according to their "difficulty," which represents a composite measure of structure and complexity related to the technological development effort. The empirical setting consists of a sample of 664 alliances around production sourcing in the semiconductor industry. A polychotomous two-stage analysis is used to disentangle decisions to utilize a given alliance arrangement from the performance of that alliance arrangement. The

authors find that the difficulty of technological development problems determines both the selection and technological performance of alliances.

4.3 Entrepreneurial Activities

A fundamental issue in the entrepreneurship literature is the process by which opportunities are discovered and exploited. Hsieh et al. (2007) utilize the problem solving perspective (PSP) to examine when entrepreneurs should employ markets to help discover and exploit opportunities, and when entrepreneurs should create firms to do so. The authors argue that opportunities equate to valuable problem-solution pairings, and that opportunity discovery relates to searching over this solution space. As problem complexity increases, experiential search via trial-and-error provides fewer benefits, relative to heuristic search via theorizing. Heuristic search nevertheless requires greater knowledge sharing than experiential search when knowledge is distributed among specialists, however, and is plagued by knowledge appropriation strategic knowledge accumulation hazards. The authors argue that different organizational modes (markets, authority-based hierarchy, and consensus-based hierarchy) have differential effects on the efficiency of opportunity discovery given the complexity of the associated opportunity discovery problem. Hsieh et al. (2007) utilize a number of qualitative entrepreneurial case studies, including the cosmetics firm Jaqua Girls, the coffee retailer Starbucks, and the kitchen utensil firm OXO International, as illustrations of their argument.

5 DISCUSSION AND CONCLUSION

Our chapter helps derive a theory of new business opportunities and new business models by equating these concepts to problem identification and solution search. As Hsieh et al. (2007) indicate, the identification and development of new opportunities is fundamentally an organizational process. Because new opportunities have value and generally entail a wide range

of knowledge that must be accessed across multiple stages of the value chain and among multiple actors, they introduce organizational problems and that necessitate organizational solutions. The development and implementation of new business models is similarly defined as an organizational process. As new business models entail solutions to articulated or unarticulated problems, they too require organizational solutions.

We argue that the problem solving perspective has much to offer in aiding the development of a theoretical approach to new business opportunities and business models. How firms organize efficiently such that superior performance is realized in the development of new business opportunities or the implementation of new business models is central to understanding competitive advantage. This perspective also redefines the unit of analysis to one that is arguably superior to those used by other organizational theories and perspectives of the firm. In particular, firms attempt to solve problems in their day-to-day business operations. Problems can further be characterized according to particular dimensions that are measurable. Moreover, this unit of analysis supports Commons (1934: 4) view that "any unit of activity…must contain in itself the three principles of conflict, mutuality, and order." Finally, the "problem" more closely reflects actual decision making processes in practice by firms. The problem solving perspective also provides a discriminating alignment approach, whereby the particular "attributes" of the unit of analysis can not only be measured, but also be compared and contrasted against the organizational modes available such that efficient organization (i.e., lower costs, improved productivity, better performance, etc.) obtains.

We also suggest that the problem solving perspective can also be used to address several theoretical implications and practical applications at the crux of strategy research, beyond the identification and development of new business opportunities and the development and

implementation of new business models. For instance, efforts to develop new business strategies, commercialize new product and process innovations, implement new supply chain configurations, or introduce new manufacturing processes generally require the solving of problems. Some of these problems might be considered well-structured and simple, while others considered more ill-structured and complex.

We encourage strategy researchers to look critically their proposed theory of the firm, and instead consider a problem solving approach. Many avenues of future research within the problem solving perspective present themselves. For instance, a theoretical perspective of the initial phases of the problem solving process—the strategic problem formulation—is under development (Baer *et al.*, 2008), but requires empirical evaluation and validation of the proposed structured process. This chapter proposes that hybrid organizational arrangements falling between the polar modes of market and internal organization offer unique solution search characteristics. While efforts are underway to develop and empirically test how well the problem solving costs and competencies of different hybrid organizational arrangements vary, much more research is warranted.

Table 1 – Problems and Alternative Organizational Modes

	Market	Hybrid (Alliance)	Internal Organization
INSTRUMENTS			
Incentive Intensity	++	+	0
Control	0	+	++
Coordination	0	+	++
SEARCH			
Directional Search	++	+	0
Heuristic Search	0	+	++
PERFORMANCE			
Well-structured Problems	++	+	0
Ill-Structured Problems	0	+	++
Simple Problems	++	+	0
Complex Problems	0	+	++

++ Strong; + Semi-strong; 0 Weak

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