
Opportunity Discovery, Problem Solving and a Theory of the Entrepreneurial Firm

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ABSTRACT When should an entrepreneur employ a market to help discover and exploit opportunities, and when should the entrepreneur create a firm to do so? If a firm is created, how should it be organized? In this paper we argue that opportunities equate to valuable problem-solution pairings, and that opportunity discovery relates to deliberate search or recognition over this solution space. As problem complexity increases, experiential (or ‘directional’) search via trial-and-error provides fewer benefits, and cognitive (or ‘heuristic’) search via theorizing becomes more useful. Cognitive search, however, requires knowledge sharing, when knowledge is distributed among specialists, that is plagued by a knowledge appropriation hazard and a strategic knowledge accumulation hazard. Markets, authority-based hierarchy, and consensus-based hierarchy then have differential effects on the efficiency of opportunity discovery given the complexity of the associated problem. Those entrepreneurs with exceptional capabilities of opportunity recognition can efficiently adopt authority-based governance over a wider range of complexity. We thus combine the two major modes of opportunity discovery – search and recognition – onto one framework that can explain different entrepreneurial organizational forms, resulting in an entrepreneurial theory of the firm.

INTRODUCTION

The entrepreneur’s task is to discover and exploit opportunities, defined most simply as situations in which products or services can be sold at greater than their cost of production (Casson, 1982; Shane and Venkataraman, 2000). Past literature has particularly associated opportunity discovery with identification of valuable products or services (Shane, 2003; cf. Schumpeter, 1934). However, the identification of valuable products or services is unlikely if not impossible absent the identification of valuable markets that they serve. Furthermore if opportunity discovery indeed relates to the generation of value, then valuable choices relating to design and sale of these products or services must be selected. While an entrepreneur theoretically could determine alone the precise set of choices required to create value, this is likely the exception. More likely the entrepreneur’s critical task is to efficiently govern the process of discovering opportunities. Thus,

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an aspiring entrepreneur must decide when to utilize a market to support discovery, i.e., contract out the discovery of opportunities, and when to create a firm to help facilitate discovery. And if discovery is pursued within a firm, the entrepreneur must also decide how to organize the firm.

In this paper we focus on how entrepreneurs organize to efficiently discover opportunities (cf. Shane, 2003, ch. 10) by relating opportunity discovery ultimately to problem-solving (Nickerson and Zenger, 2004). From this perspective discovering an opportunity involves two distinct activities. Entrepreneurs deliberately select or otherwise stumble upon problems to solve. Thereafter, they seek high-valued solutions – sets of valuable and complementary design and commercialization choices – which are discovered either by sheer luck or through a deliberately organized search.^[1] Sheer luck aside (Kirzner, 1979, pp. 154–81; Yu, 2001, p. 61), we thus argue that effective entrepreneurs both identify valuable problems which if solved would create value, and organize to effectuate an efficient process of solution search. Hence, a unique, valuable problem-solution pairing necessarily and sufficiently defines an opportunity.

The organizational approach optimal for opportunity discovery depends on the type of solution search required. We describe three alternative and polar types of organizational forms that the entrepreneur matches to the complexity of problems. When problems are low in complexity, the entrepreneur ideally governs the process of solution search through market contracts with outside firms. Efficient solution search for such problems has little need for the governance attributes of internal organization. When problem complexity is intermediate, the entrepreneur ideally governs solution search within the boundaries of a firm using authority or fiat to direct and delegate various aspects of search. When problem complexity is high, the entrepreneur ideally governs solution search within the boundaries of the firm but instead through a consensus-oriented organization in which socialization is used to create common communication codes by which knowledge can be economically aggregated and a shared theory of where to search on the solution landscape developed.

In our theory, when entrepreneurs organize, it's not necessarily because they are ready to exploit an opportunity they have already discovered^[2] (cf. Shane, 2003), but rather because they believe that search using particular organizational forms leads to a stronger likelihood of discovering opportunities in the first place. Furthermore our 'entrepreneurial theory of the firm' explains not only when entrepreneurs form firms, but also importantly what form these entrepreneurial firms take.

We begin by relating the situations representing opportunities to problem-solution pairings. We describe the categorization of problems by degree of complexity, the ideal search mode for solution search, and the hazards which may result thus impeding knowledge exchange and contaminating search efforts. Alternative organizational structures are comparatively assessed with respect to their ability to mitigate these hazards along with their cost for doing so. Ultimately, we predict a discriminating alignment between levels of problem complexity and organizational forms that enable efficient search, and discuss the prediction. Our theory is then extended to account for 'opportunity recognition' (Kirzner, 1979), where we argue that entrepreneurs with exceptional recognition capability can expand the range of problem complexity for which the use of authority to direct search is the efficient organizational choice.

'PROBLEM' AS ENTREPRENEURIAL UNIT OF ANALYSIS

A commonly cited unit of analysis in entrepreneurship research over the last 25 years has been the 'opportunity', most simply defined as any situation in which new products or services can be sold at greater than their cost of production (Casson, 1982; Shane and Venkataraman, 2000; Venkataraman, 1997; cf. Schumpeter, 1939). Typically, 'opportunity discovery' has been related not only to the identification of these valuable products or services, but also to the identification of new geographical markets, new raw materials, new methods of production, and new ways of organizing (Schumpeter, 1934). Throughout the literature, this process of opportunity identification has been implicitly carried out by single individuals (Shane, 2003, p. 45; see also Shaver and Scott, 1991). However, because the discovery of value and opportunity generally demands choices involving a wide range of knowledge encompassing both design and commercialization, discovery typically involves multiple actors. Only in the operations of smallest scope can a lone entrepreneur know precisely what decisions and choices to make across design, manufacturing, finance, accounting, marketing, human resources, and strategy.

While opportunity is a meaningful concept, it alone is not a useful unit of analysis if our task is to explore how organizational choices are linked to opportunity discovery. The concept of opportunity does not address central issues in organizing such as mutuality, conflict, and order (Commons, 1934). It is difficult indeed to associate the term 'opportunity' with descriptors or conditions that lead to conflict, in part because the term fundamentally presumes success and thus renders conflict irrelevant in the first place. Nothing about an opportunity per se suggests when conflict might arise among actors involved in prospective discovery. Yet, without conflict among actors, there should be no need for those mechanisms within firms that resolve conflict and restore order, or that provide 'mutuality of advantage' (Buchanan, 2001, p. 29; see also Williamson, 1985) to prevent conflict in the first place. To develop an entrepreneurial theory of the firm we need a unit of analysis that can relate to mutuality, conflict, and order.

In order to explain the discovery of situations where value will be generated, we utilize the terminology of problem and solution.^[3] Problems can be as general as 'discomfort when travelling' or as specific as 'difficulty opening a soda can purchased from a public vending machine'. Solutions relate to choices including those that relate to the design of products and services, as well as subsequent commercialization. In the middle of problem and solution resides the formulation of subproblems. For instance if 'discomfort when travelling' is a problem, one subproblem might relate to the development of ergonomic but portable seats, while another subproblem might relate to the identification of the efficient corresponding manufacturing procedures. Problems (e.g. 'needs' or 'pains') are knowingly identified or unknowingly stumbled upon, after which solutions are found. Or, sets of decisions and choices (embodied or not embodied in products or services) are identified or stumbled upon, after which problems are found (cf. Sarasvathy, 2001). Thus opportunity discovery involves a matching process and opportunities relate to unique valuable problem-solution pairings. Put another way, we distinguish between opportunities with respect to the different problems that may be solved by a single set of decisions and choices, as well as with respect to different solutions that solve a particular problem. Of course, some series of steps in the matching process are probably more likely than

others; we focus on the value-generating case where (valuable) problems are first selected, whereupon potentially costly search for valuable solutions takes place.

The association between opportunity discovery and problem-solving is not new. Stevenson and Jarillo (1990, p. 23) argue 'basic entrepreneurial skills' involve accumulated knowledge that 'assist[s] in problem-solving'. Shane (2003, p. 47; see also pp. 52–3) explains that '[d]iscovery of opportunities is often like solving puzzles because a new piece of information is often the missing element necessary to see that an opportunity is present.' He also makes clear that 'establishing a new means-ends framework . . . involves identifying, defining, and structuring novel solutions to open-ended problems' (p. 56). Finally, both opportunity discovery and problem-solving relate to 'value creation' similarly in the literature (e.g. compare Alvarez and Barney, 2005; Jones and Butler, 1992; Ramirez, 1999; to Hansen and Nohria, 2004; Heiman and Nickerson, 2004; Kanter, 1989).

COMPLEX PROBLEMS AND THE ENTREPRENEUR

In the previous section we argued that opportunity discovery generally relates to problem-solving. Consistent with Simon (1962, p. 486), we view problems as complex systems each corresponding to a large number of decisions that interact in a non-simple way. Moreover, problems systematically vary in the scope of this complexity. Accompanying every problem is an unseen set of possible solution values – a solution space or solution landscape – each of which relates to a distinct combinations of choices. Problems differ in their complexity which essentially defines the topography of these landscapes. To conceptualize the structure of these landscapes, we borrow from Kauffman's NK framework,^[4] supposing N represents the number of knowledge sets available in forming potential solutions to a problem, where each knowledge set is defined by an institutionalized collection of choices and a trial or potential solution is defined as one particular recombination of choices across knowledge sets. K represents the degree of interdependence among the N knowledge sets, or in other words the degree to which individual choices interact with one another in contributing to solution value. Together, N and K determine the values of solutions depicted on a landscape. Given selection of a problem with a particular N and K , the entrepreneur's task is then to combine dispersed knowledge resources to cost-effectively search for high-valued solutions on the landscape.

Assuming N is nontrivial and holding it constant, the variable K represents the complexity of problems. Decomposable problems are those where few interdependencies exist among knowledge sets. Valuable solutions are readily found because the choices across decisions do not interact with one another, and therefore choices can be optimized and chosen independently. When multiple actors are required to cover all the (specialized) knowledge sets relevant to solving a problem, individuals can independently select choices with the expectation that in the aggregate, valuable solutions will be found and opportunities discovered. Topographically, the landscape is very smooth, with few peaks, maybe only one. Furthermore, high spatial autocorrelation suggests that high-valued solutions and opportunities can be found or discovered close to one another in the

solution space. If a valuable solution is discovered, improvement in that solution typically involves rather modest changes in one or more choices rather than wholesale change in all choices.

Nearly decomposable problems relate to those where changes made to choices begin to interact dramatically in non-monotonic ways with respect to solution value. As a result there are more peaks. Also, due to a greater degree of complementarity in choices, the highest peak grows in value, such that the most valuable (yet-to-be-discovered) opportunities are likely more valuable than in the low-interaction case. With nearly decomposable problems, patterns of interaction among choices are commonly clustered into identifiable modules such that optimization of each module leads to the optimization of the overall solution.

Problems are non-decomposable when the value of a change in any individual choice interacts with the value of many other choices. While the most valuable solution is higher than in either of the first two cases, the average value across all solutions is lower. Put differently, non-decomposable problems each yield many low-value solutions along with several high-value ones that are scattered widely across a highly-rugged landscape. Locating a high peak on a non-decomposable landscape is highly problematic given the enormous interdependence among choices across knowledge sets.

ENTREPRENEURIAL SEARCH FOR VALUABLE SOLUTIONS

Once entrepreneurs choose their problems, they must settle on how to search the solution landscape to find sufficiently valuable solutions in a cost-efficient way. If entrepreneurs explore solutions through trial-and-error (experimentation among choices, with feedback) (see, e.g. Cyert and March, 1963; March and Simon, 1958; Nelson and Winter, 1982), they are engaging in what is referred to as experiential or 'directional' search. One or more choices are altered and any change in solution value observed. If solution value improves, further changes are made. If solution value drops, the original set of choices is reconsidered, from which an alternative set of adjustments are made and tried (Gavetti and Levinthal, 2000). Most notable are the effects of interactions on the efficacy of experiential search. When problems are decomposable, experiential search is particularly useful since knowledge sets are independent of one another. However, as interactions between choices increase, the likelihood arises of finding low peaks or solutions that don't qualify as opportunities. Of course, if directional search is costless such additional interactions pose no difficulty for entrepreneurs. But when experimentation is costly (as is typically the case), increases in interactions decrease the efficacy of experiential search for valuable solutions.

Besides relying on potentially costly trial-and-error, entrepreneurs may base search on cognitive beliefs (March and Simon, 1958; Simon 1991), heuristics, or theories about the shape of these unseen solution landscapes. This cognitive search relates to hypothesizing which regions of the landscape likely encompass high-valued solutions. Such cognitive maps can be particularly useful where knowledge sets are interdependent and experiential search begins to fail. After all, an actor with unlimited cognitive capacity could theoretically absorb all knowledge sets and develop a theory relevant to a problem (albeit at some cost), thereby developing a cognitive map of the actual landscape. While the

individual human mind is severely limited in attempts to acquire, accumulate, and apply large numbers of knowledge sets (Simon, 1945, pp. 40–1), entrepreneurs nonetheless may choose to develop a cognitive map to aid in discovering opportunities.

For (fully) decomposable problems, experiential or directional search rather easily leads to the discovery of the high(est)-value solutions. Cognitive search provides limited additional benefit. As interdependencies between knowledge sets increase, the marginal benefits of additional cognitive search (the capacity for experiential search held equal) rise. Put another way, for nearly decomposable problems, both experiential and cognitive search serve well to discover opportunities: cognitive search can be used to get individual actors in the vicinity of potentially high-valued solutions, after which significant spatial autocorrelation and locational clustering on the landscape makes incremental experiential search highly efficient. For non-decomposable problems, experiential search – no matter how incremental – serves little use. Entrepreneurs should then make investments that support cognitive search.

KNOWLEDGE FORMATION HAZARDS THAT CONTAMINATE ENTREPRENEURIAL SEARCH

Problems can fundamentally differ in the scope of knowledge required to solve them. The more knowledge and knowledge sets that are required to solve problems, the less likely is it that a single individual can solve them. The matter of coordinating and aggregating specialists' knowledge is easily addressed if the problem is decomposable, since experiential search is effective. However, as interdependencies among knowledge sets increase, cognitive search is prescribed. For a collection of actors to engage in cognitive search, a shared cognitive map or theory over some part of their collective knowledge must be developed (e.g. West, 2007). Collective theorizing requires knowledge sharing or exchange. Certainly, the entrepreneur could request or contract with actors to share knowledge when cognitive search is demanded and collectively agree on an optimal path. However, in the face of self-interestedness, two hazards arise that plague the entrepreneur's attempts to support the knowledge sharing required for collective cognitive search.

Knowledge Appropriation Hazard

Actors could in theory agree to share all knowledge in order to facilitate collectively cognitive search. However, actors each have private incentives to seek fair market value for the knowledge they possess. Unfortunately, establishing fair market value for knowledge is highly problematic. In order to price the value of a seller's knowledge, the seller must reveal it to the buyer, after which the buyer has already obtained it and has little need to pay for it (Arrow, 1973, p. 171). This potential extraction of value without payment poses a hazard to the entrepreneur's efforts to promote knowledge transfer or exchange. Those actors who would find certain information most valuable may never obtain it. While contracts may provide nominal protection, cognitive limits make contracts costly to draft and verifiability by the courts is difficult. To the degree that purchasers of knowledge need only to use rather than understand knowledge, sellers can embed what they know into saleable products and services. However, when valuable

solutions require recombination of disparate knowledge and thus require common understanding, knowledge sharing to support cognitive search becomes necessary. Experiential search efforts are unaffected by knowledge appropriation because knowledge sharing is not required. Collectively cognitive search however requires knowledge sharing to produce the necessary (collective) cognitive maps used for discovering opportunities.

Strategic Knowledge Accumulation Hazard

Actors naturally desire to accumulate valuable knowledge, as such knowledge provides individual actors with a platform for personal value creation and capture. These personal interests have an important bearing on efforts to collectively theorize. In particular, actors may have limited interest in developing shared cognitive maps or theories that draw from a complex or interdependent web of widely dispersed knowledge. Instead, each actor would like to see theories crafted to guide solution search which draw extensively from knowledge each possesses. The more dependent the theory is on their personal knowledge, the better able they are to appropriate personal value from any successful results of search. This self-interested view of knowledge accumulation damages incentives to share and exchange knowledge. Accepting unique or specialized knowledge diminishes the original owner's uniqueness and hence ability to capture value. Actors wish to manipulate the ordering of trials and guide the path of search in strategic ways that develop and leverage their knowledge sets. When sharing does take place, absent remedies, actors can conflict in how each wants to order subsequent trials, which increases cost and lengthens search. Again, experiential search efforts are unaffected by this strategic knowledge accumulation because knowledge sharing is not required. Effective cognitive search on the other hand requires knowledge sharing and attendant willingness to create and use shared cognitive maps to collaboratively locate regions on the landscape that have a high likelihood of encompassing high-value solutions.

THE RISE AND ORGANIZATION OF THE ENTREPRENEURIAL FIRM

In the balance of this paper, we present three prototypical governance modes among which the entrepreneur can choose in solving identified problems: markets, authority-based hierarchy, and consensus-based hierarchy (Nickerson and Zenger, 2004).^[5] Each mode, we argue, is an economizing mode of governance that supports solution search ideally matched to problems of differing complexity. Each of these modes combines the following three instruments of governance in unique and complementary ways: (1) decision rights to guide paths of search; (2) communication channels to support knowledge sharing; and (3) incentives to motivate search. Markets provide the entrepreneur with limited control, but with high-powered incentives to motivate experiential search by actors outside of the firm. Below we prescribe markets to support discovery of opportunities based on decomposable problems. Authority-based hierarchy (ABH) relies on the entrepreneur to directly coordinate search within the boundaries of the firm, primarily by defining and delegating distinctive subproblems. ABH is prescribed below to support discovery of opportunities based on nearly decomposable problems. Finally, consensus-

based hierarchy (CBH) also coordinates search internally, but achieves this by using shared language to cooperatively develop a shared heuristic or theory to guide search. CBH supports discovery of opportunities based on non-decomposable problems.

Markets

For entrepreneurs to solve decomposable problems efficiently requires experiential search, the specialty of markets. Since decomposable problems are readily solved through experiential search, decision-making can be fully decentralized. Entrepreneurs may contract with specialists who do not need to share or exchange knowledge with each other in order to solve their subproblems, who are motivated by high-powered market incentives from prices, and who can thus independently make choices, undertake trials and observe the results. As Hayek (1945) remarks, 'The most significant fact about this system is the economy of knowledge which it operates, or how little the individual participants need to know [about other actors] in order to be able to take the right action' (p. 527). In the aggregate, high-valued solutions to the overall problem can be found. And since knowledge transfer is economized, developing communication channels is not necessary. In fact, part of the efficiency of markets in solving decomposable problems derives precisely from such built-in restrictions on knowledge exchange.

As an illustration, consider the organizational approach adopted by the three sisters who launched the highly successful cosmetics firm, Jaqua Girls. They identified the basic need that women had for 'tools for a night of bonding, fun and rejuvenation' (Sanders, 1999), and focused on providing cosmetics as the structure and 'props' to guarantee the success of a social gathering among women. Having made the decision to focus on solutions involving cosmetics, the problem was quickly reformulated into a decomposable problem: designing appropriate cosmetics, designing appropriate packaging, and developing a marketing plan. In search of the solution to this decomposable problem, the sisters contracted with a Santa Barbara cosmetics lab, some graphic designers, and even bought their own paint cans. The result was cosmetic kits sold in novel-looking paint cans. The sisters 'worked in [one sister's] garage filling bottles, pasting labels, and packing cans' (Sanders, 1999). Within a couple months they had contracted with and sold through the retailer Nordstrom. Thus, Jaqua Girls had identified a problem sufficiently decomposable in structure that the subproblems of making quality cosmetics or manufacturing paint cans in the most cost-effective ways were left for their individual suppliers to solve. We highlight here that decisions and choices selected to tackle subproblems had been left up to paint can manufacturers, graphic design houses, and cosmetics firms.

When problems become more complex – for example if can manufacturers need to design the can's shape or material contingent on the shape or chemical composition of the cosmetics, and cosmetics labs must consider design choices made by the can manufacturers – then market exchanges may become more problematic. Specifically, such added complexity requires cosmetics labs and can manufacturers to either have a shared understanding of how their components interact or to receive specific direction from someone who possesses this understanding. Specialists governed by the market could in theory contractually agree to particular patterns of search, but disputes over choice adaptations and performance in pursuing these uncertain search patterns would poten-

tially require the intervention of courts and contract law, which may be problematic or costly due to verification difficulties. When solutions to complex problems are sought and a search heuristic is required to enhance the probability of discovering a valuable solution, conflicts among independent actors in developing this heuristic may be intense because of both knowledge hazards discussed above. Given complex problems, markets' high-powered incentives usher in the strategic knowledge accumulation hazard described earlier.

Authority-Based Hierarchy

While markets are most ideal for discovering solutions to low-interaction problems, many have pointed out that authority can sometimes provide advantages over markets (e.g. Arrow, 1974, pp. 68–70; Milgrom and Roberts, 1990, p. 72; Simon, 1951, p. 294; Williamson, 1985). Specifically, when problems involve moderate levels of interdependencies among choices, the directional search well-supported in markets is no longer as effective. To search effectively, market specialists must now coordinate with one another, hypothesizing how their choices may interact to determine performance. Both knowledge sharing hazards immediately arise. Relying on independent contractors through a market interface is problematic because these contractors may be interested in strategically directing the particular bundles of choices so that they extend their own unique knowledge, increasing their own value at the expense of others. Moreover, they may be reluctant to share information because doing so diminishes their uniqueness and ability to capture value in the future. At some point problem complexity becomes too great and the accompanying costs from attempting knowledge sharing too substantial to warrant use of the market. Instead, the entrepreneur integrates, adopts low-powered incentives that attenuate these knowledge exchange hazards and then personally invests in developing a theory or heuristic to guide efficient search. In this manner, '[d]irection substitutes for education (that is, for the transfer of the knowledge itself)' (Demsetz, 1988; see also Arrow, 1974, p. 69). The entrepreneur invests in understanding these interdependencies, so that all actors possessing independent knowledge need not invest in costly information exchange and theory development.

The rapid development of Starbucks provides an interesting example. Starbucks was founded as a roaster of coffee beans in 1971 by three friends (Keeley, 2006). In 1982 they hired Howard Shultz as the marketing manager. On a trip to Italy to investigate new equipment to sell to consumers, he experienced the Italian coffee bar culture and wondered whether the problem of developing a related type of coffee house would be valuable in the USA. Starbucks' owners eventually rejected proposals corresponding to this problem and Shultz set out on his own. He returned to Italy and visited hundreds of espresso and coffee bars presumably to better understand how the Italian people contributed to and interacted with the coffee culture. He hired several employees and opened a coffee bar called *Il Giornale*. The problem of designing and commercializing a service based on a 'social coffee experience' was not entirely decomposable – selling coffee was only part of the solution. Creating value went beyond the sale of coffee to include equipment, service, operations, information systems, and store layout, design, and ambience, which all interact to provide the unique US-oriented social coffee

experience. In search of this solution, Shultz appears to have created his own cognitive map or mental model based on his understanding of the various interactions among choices for Italian cafes and by experimenting through his employees with many attributes of his stores in search of a highly-valued experience. With this solution in place, and after buying out the original Starbucks' owner who still underestimated the significance of the need or problem, Starbucks has grown at a torrid pace, reaching annual revenues of \$6.5 billion in 2005.

For moderate interaction problems, the entrepreneur can have advantages over markets and team-based decisions. For instance, Shultz may not have arrived at the valuable format of today's Starbucks stores if he had outsourced its design to specialists in retail or architecture. It is unlikely that any single specialist possessed all of these knowledge sets and thus it might have been less likely for specialists operating independently and stipulating different elements of the design decisions to arrive at the same outcome. Accumulating all the relevant knowledge sets and directing a search for a high value peak was effective for Shultz. However, we argue that he may have been less effective if the problem had been either more decomposable or much less so.

For low-interaction, more decomposable problems, the entrepreneur seizing control of search introduces unwarranted costs. The most obvious excess cost involves the entrepreneur unnecessarily investing in understanding all relevant knowledge to address a problem and centrally coordinating search, rather than leaving much of this to specialized experts. For instance if choices were straightforward regarding the design and operation of a coffee shop, Shultz could have come up with a design faster by outsourcing the various design decisions to specialists.

Centralizing authority over search for a decomposable problem also destroys the high-powered incentives that powerfully promote specialized knowledge development and efficient experiential search. Another cost of such integrated search is that entrepreneurs have tendencies to meddle in subordinates' decisions (Williamson, 1985). Certainly if the entrepreneur made only correct adjustments to subordinates' choices, such tendencies would not be costly. However, entrepreneurs are often overconfident in their own judgment (Bazerman, 1994), biased or simply under-informed. In these cases where 'authority does not imply expertise' (see Hammond and Miller, 1985, p. 2), well-intentioned adjustments to improve search instead become harmful meddling that contaminates search.

Non-decomposable problems with a high degree of interaction among choices quickly exhaust the managers' cognitive capacity to direct search. The entrepreneur likely cannot learn all the relevant knowledge nor understand the nature of this increasing interdependence. With such additional complexities, as Hayek asserts, 'We cannot expect that [the problem of coordinating knowledge] will be solved by first communicating all this knowledge to a central board which, after integrating *all* knowledge, issues its orders' (1945, p. 524; emphasis in original). Thus, if Shultz's problem was more complex, say of designing and distributing 'frappacino', which involves developing a 'tasty' liquid with a long shelf-life, a 'hip' package, and a way of distributing it to both baby boomers and Gen X'ers, then Shultz might have confronted his own cognitive limitations in attempting to acquire, accumulate, and apply all the knowledge sets needed to solve this complex problem.

Consensus-Based Hierarchy

With non-decomposable complex problems, often large amounts of knowledge must be shared in order to pursue an efficient search. We have already argued that authority-based hierarchy begins to fail in this regime. If due to bounded rationality the entrepreneur is unable to absorb all knowledge sets and understand all interdependencies, then crafting an effective search heuristic necessitates engaging *multiple* actors in knowledge transfer, and collectively developing a cognitive map of the solution landscape. Such extensive information sharing potentially permits actors within the firm to collectively agree on a path of search. This selected path stems from a collectively developed theory that hypothesizes the pattern by which choices interact. From this collectively developed theory, specific trials are identified. But if a theoretical consensus is to be built and *multiple* actors must define a cognitive map that approximates the actual landscape, how can the entrepreneur build an organization that extensively supports organization-wide knowledge transfer and collective theory development?

The answer lies in an alternative form of internal organization in which the entrepreneur does not personally invest in developing the search heuristic, but instead invests in building an organizational environment that facilitates extensive knowledge sharing among internal experts and promotes the formation of a collective heuristic or shared theory (Felin and Zenger, 2007). Kogut and Zander (1992, 1996) describe precisely this type of firm – a firm that promotes a shared identity and facilitates the formation of a common language. Arrow (1974) has also commented that substituting consensus (or education) for authority requires that actors within the group have ‘a sufficiently overriding commonly valued purpose . . .’ (pp. 69–70). In his treatise *The Limits of Organization*, he recognizes the distinct advantages of hierarchy in facilitating knowledge transfer through firm-specific language and identity. He contends that a primary component of firm-specific capital formation is ‘learning the information channels within a firm and the codes for transmitting information through them’ (Arrow, 1974, p. 56). He further notes that such investments are not only individually specific, but that they in aggregate represent ‘irreversible capital accumulation for the organization’ that leads to organizations having ‘distinct identities’ (pp. 55–6). Kogut and Zander similarly argue that communication costs are lower within the firm due to the presence of ‘higher order organizing principles’ that ‘[establish] the context of discourse and coordination among individuals with disparate expertise’ (Kogut and Zander, 1996, p. 503). In their view the boundaries of the firm define qualitative differences in the scope of social knowledge available to individuals. The shared identity that exists within a firm lowers the cost of communication and establishes ‘rules of coordination and influences the direction of search and learning’ (Kogut and Zander, 1996, p. 503). Incentives and dispute resolution mechanisms within consensus-based hierarchy are also configured to support knowledge transfer and consensus decision making. Very low-powered incentives are essential to consensus, because such incentives encourage (or more accurately do not discourage) knowledge sharing. High-powered incentives within the firm would encourage knowledge hoarding and strategic manipulation of the theories developed to direct search.

Dispute resolution in consensus-based hierarchies also differs from authority-based hierarchy. While forbearance by the courts remains the central characteristic of hierar-

chy compared to markets, dispute resolution in consensus-based hierarchy involves individual actors collectively deciding this path. Such group decision processes equate to Williamson's (1985, pp. 246–7) relational team and approximate Ouchi's (1980) clan form of organization. In this case, the firm 'will engage in considerable social conditioning to help insure that employees understand and are dedicated to the purposes of the firm and employees be provided with considerable job security, which gives them assurance against exploitation' (Williamson, 1985, p. 247). Such efforts build relationships among agents and facilitate the formation of a common identity. These relationships and shared identity in turn ease knowledge transfer, facilitate agreement, and discourage the exploitation by other agents of knowledge transferred into the firm (Allen, 1967; Tushman, 1978). Thus, the entrepreneur's task involving a consensus-based hierarchy is to assemble actors with the relevant knowledge sets, invest in socializing these actors with respect to a common goal, and invest in social structures that create common communication channels and codes.

Consider the case of OXO International. Sam Farber observed his wife's difficulty managing kitchen utensils with arthritis and saw a clear problem to solve – developing ergonomically designed utensils that not only abided by the general principles outlined by the Americans with Disabilities Act, but would also satisfy tastes and the budget constraint of the general population. He joined forces with design consultants Smart Design to come up with the first product, the OXO GoodGrips peeler, which combined all elements of a peeler into one ergonomically superior and easily manufacturable – yet seamlessly integrated – tool. Because the issues of ergonomics can be difficult to express and interact with material selection, aesthetics, manufacturability, marketing, and distribution of the peeler, the solution space was complex and at least to some extent non-decomposable. To search for a solution, Sam Farber created an organization with a design firm called Smart Design. The new entity was structured as an equity partnership (Cagan and Vogel, 2002, p. 16) called OXO. OXO invested in sharing and understanding a shared language called the Universal Design framework developed by the ADA, as well as other codes as the designers interacted with Sam, his wife, potential customers and others. The ultimate design was delivered by a team that searched together based on shared decision making. This organization is akin to our consensus-based hierarchy.

Consensus-based hierarchy as an organizational solution for the entrepreneur begins to fail as problems diminish in complexity. The costs associated with supporting extreme levels of knowledge transfer are substantial and become unwarranted as problems diminish in complexity. In particular, investment in culture is unnecessarily costly. Further, the low-powered incentives that accompany this organizational form constrain the motivation to develop specialized knowledge or actually engage in solution search. If OXO's problems were more decomposable, OXO might have fared better under hierarchy by authority or even via markets. The scope of investment in shared language and socialization and the efforts involved in the transfer of knowledge can be excessive when problems are only moderately complex. Such investments and effort slow the accumulation of specialized knowledge necessary for effective directional search. Moreover, social attachments and idiosyncratic language that accompany consensus-based hierarchy can increase the cost of search by generating search

heuristics that are limited in the knowledge sets that they incorporate. While firm-specific language and social attachments lower the cost of communication among coworkers, they encourage actors to oversearch their channels for knowledge rather than searching out knowledge not contained within the firm. Thus, not only are such social attachments costly to maintain (Hansen et al., 2001), but they also may misguide the process of search. Such over-socialization may reduce the infusion of new ideas and result in 'parochialism and inertia' (Adler and Kwon, 2002), or as Powell and Smith-Doerr (1994, p. 393) argue, the 'ties that bind may become the ties that blind'. Individual choices of search trajectory may become increasingly determined by the knowledge that workers and their close friends possess. Thus, social attachments may bias decisions toward continuing patterns of search that extensively utilize existing knowledge sets within the firm and may limit the firm's capacity to search and absorb new forms of knowledge.

DISCRIMINATING ALIGNMENT: ORGANIZING THE ENTREPRENEURIAL FIRM

Based on the above discussion we hypothesize an alignment between problem complexity and the search costs of discovering valuable opportunities which we depict in Figure 1a. Entrepreneurs use markets to efficiently govern solution search for decomposable problems, authority-based hierarchy to efficiently govern solution search for nearly decomposable problems, and consensus-based hierarchy to efficiently govern solution search for non-decomposable problems.

With decomposable, low-interaction problems, markets promote specialization and directional search. However, knowledge-exchange hazards ensure that the cost of the market (indicated by $M(K)$) accelerates rapidly as the degree of interaction among choices increases and knowledge sharing becomes required in discovering opportunity. An authority-based hierarchy incurs upfront costs from hiring and providing preliminary education to the entrepreneur. This enables an entrepreneur to invest in understanding actors' knowledge sets and interdependencies and puts together a cognitive map capable of managing steadily increasing, but still-moderate levels of interdependencies that would otherwise begin to debilitate market governance. However, the entrepreneur's ability to help solve decomposable and non-decomposable problems and discover high-value opportunities is more costly because of predilections to meddle and restrictions in bounded rationality, respectively. The cost of authority-based hierarchy (indicated by $ABH(K)$) thus makes the authoritarian entrepreneur the efficient governance choice for problems with a moderate level of interaction, between K_1 and K_2 .

Major expenditure upfront to build shared firm identity makes consensus-based hierarchy costs (indicated by $CBH(K)$) unnecessarily high for problems with low and moderate levels of interaction. However, the costs of consensus do not accelerate until it is used to organize problems with high levels of interaction, which makes it the economic choice for discovering opportunities given the selection of problems with levels of interaction greater than K_2 .

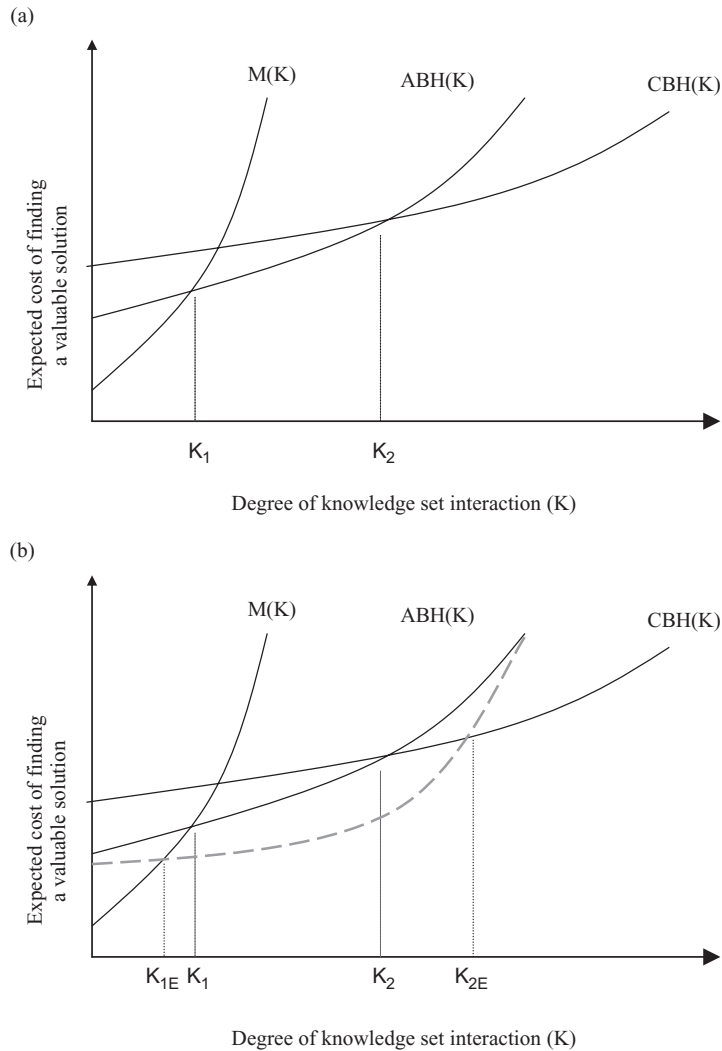


Figure 1. (a) The top figure shows the discriminating alignment between governance form and problem complexity, derived in Nickerson and Zenger (2004). (b) The bottom figure shows the discriminating alignment when entrepreneurs have superior memory capacity. Authority-based hierarchy becomes optimal over a wider range of complexity.

DIFFERENTIAL LEARNING ABILITY, OPPORTUNITY RECOGNITION, AND EFFECTS ON GOVERNANCE CHOICE

Thus far, our theory has presumed that all entrepreneurs have the same enduring learning ability. Yet, as with all actors entrepreneurs can have different levels of learning ability (Corbett, 2005; Mitchell et al., 2000; Roberts, 1991). In the context of searching to find valuable solutions to a given valuable problem thus discovering an opportunity, we argue that learning ability can be usefully separated out into the abilities of entrepreneurs to acquire, accumulate, and apply knowledge.

First, an entrepreneur must have the ability to acquire knowledge either through formal education or through accumulated experience (Cohen and Levinthal, 1990). Limits in the number and extent of knowledge sets acquired constrain an actor's ability to theorize about the topography of solution landscapes. With a limited number of knowledge sets, entrepreneurs may develop beliefs that the solution landscape is less complex than it may actually be. Without relevant and complete knowledge sets, identification of valuable regions on the landscape to search is far less likely.

Second, each entrepreneur must be able to accumulate the knowledge they acquire, which depends on a (long-term) memory capacity. Without memory, knowledge cannot be accumulated. Constraints on the number and extensiveness of knowledge sets accumulated in memory also narrow the ability of an actor to identify potentially valuable topographies of solution landscapes.

Third, entrepreneurs must be able to apply the knowledge acquired and accumulated, which depends on how well they can recall knowledge from memory and recombine knowledge sets to develop heuristics and theories about the solution landscape. Without adequate recall or heuristic development, potentially valuable topographical features of the solution landscape will be missed. Entrepreneurs who excel in these three abilities are better able to identify regions of the solution landscape to search.

We argue that the abilities of an entrepreneur to acquire, accumulate, and apply knowledge has little impact on the comparative costs and benefits of organizing via markets or consensus-based hierarchy. In the market case, entrepreneurs simply contract with actors who engage in their directional search for which the entrepreneur's overall learning ability offers no additional value in searching solution landscapes. In the consensus-based hierarchy case, entrepreneurs organize specialists under a firm culture and identity that supports knowledge-sharing and heuristic search. Here again the entrepreneur's overall learning ability offers no additional value in searching solution landscapes.

In contrast, the costs and benefits of using authority-based hierarchy depend very much on the entrepreneur's abilities to acquire, accumulate, and apply knowledge. In this organizational mode solution search is orchestrated by the entrepreneur. With limited overall learning ability, the entrepreneur has a lower probability of identifying valuable regions of the solution landscape to search. In contrast, entrepreneurs with superior overall learning ability are better able to identify valuable regions to search and therefore more quickly identify highly valuable solutions. These improvements arise because superior learning ability enhances both cognitive search and experiential search. Such ability increases the range of problem complexity over which an authority-based hierarchy offers an efficient organizational structure for engaging in solution search, with shifts from K_1 to K_{1E} and from K_2 to K_{2E} shown in Figure 1b.

With respect to cognitive search, recall that the entrepreneur's process in authority-based hierarchy is to receive all actors' choices, after which he develops a theory, thereby identifying a cognitive map which informs how to manage the interdependencies involved. The entrepreneur then selects the theoretically optimal trial, and guides experiential search by decree until a peak is reached, whereby he once again queries actors for their choices and the process repeats. As interdependencies increase, entrepreneurs with superior learning ability will be better able to accumulate these cognitive maps.

Thus superior learning ability expands the complexity regime over which authority-based hierarchy offers superior performance to market and consensus-based hierarchy modes of organization.

Given a capacity for memory, the efficiency of experiential search is affected similarly. With a decomposable solution space, entrepreneurs with superior learning ability would be better able to recall successful paths of search thereby avoiding intermediate steps of trial-and-error. For instance entrepreneurs as authorities might recall moderately involved changes that were tested in the past. Put another way memory could inform search paths that not only alter one policy choice at a time, but those that alter two or three policy choices at a time thereby saving time and trials in experiential search. These two effects of learning ability – due to improved cognitive search and experiential search – lower costs on the margin of authority-based hierarchy in relation to markets and consensus-based hierarchy to discover valuable opportunities.

Superior learning ability ultimately has its limits. As interdependencies become great, knowledge acquisition, accumulation, and application become constrained by an individual's cognitive limits. Actors are limited in the rate at which they can acquire knowledge. Memory capacity can be reached. The complexity of solution landscapes may be too great for a single individual to recombine knowledge to develop sufficient search heuristics. Put differently, beyond some point there are diminishing returns to increased learning ability. There may also be limits with respect to low levels of interdependencies. In this case, cognitive limitations from the acquisition and accumulation of knowledge may be reached at the lower end of complexity. If too many knowledge sets need to be acquired and accumulated to search on a solution landscape then an entrepreneur may face increasing time and costs for searching.

Besides improving deliberate search, greater learning ability also relates to the process of opportunity recognition, an unconscious process of discovery (e.g. Baron, 2006; Gaglio and Katz, 2001; Kirzner, 1979, 1997; Lumpkin and Lichtenstein, 2005). Kirzner (1997) describes opportunity recognition as 'undeliberate but motivated':

Without knowing what to look for, without deploying any deliberate search technique, the entrepreneur is at all times scanning the horizon, as it were, ready to make discoveries. Each such discovery will be accompanied by a sense of surprise (at one's earlier unaccountable ignorance). An entrepreneurial attitude is one which is always ready to be surprised, always ready to take the steps needed to profit by such surprises. The notion of [recognition], midway between that of the deliberately produced information in standard search theory, and that of sheer windfall gain generated by pure chance, is central to the Austrian approach.

Recognition has been a focal point of entrepreneurship research (e.g. Kirzner, 1997) and therefore needs to be assessed in the context of our theory. In what manner and to what extent does an entrepreneur's recognition capability influence the choice of governance?

We argue that opportunity recognition is strictly based on the randomness by which knowledge is applied (e.g. information is recalled) from memory. Insofar that design-oriented or commercialization-oriented choices were selected together for a past trial,

one of the choices may help to recall any of the others in a future trial. The variety of those other choices dictates the randomness by which any one of those choices is recalled. Application of knowledge may also simply be based on the recollection of a choice from memory due to the success associated with that choice in the past. We add two notes here. First, the recall for a specific choice is delimited by the number of choices used from that knowledge set in the past, and thus whether a choice is recognized does not depend on sheer luck, but rather is based on finite probabilities dependent on historical paths of search. Second, since human memory is not perfect, recall will not be perfectly efficient.

DISCUSSION

Our paper derives a theory of entrepreneurial firm boundaries by equating opportunity discovery to problem identification and solving. While the entrepreneur may believe that opportunities are potentially discoverable enough to take actions (e.g. as with founding a firm), it still often takes a set of actors to discover the precise set of decisions and choices that lead to profit. Search for opportunities and any subsequent discovery is fundamentally an organizational process, and we contend that opportunity discovery merits examination at the organizational level. We extend the analysis to account for entrepreneurs with different levels of learning ability, and describe within our framework Kirzner's opportunity recognition.

In our theory, opportunities are inherently valuable, and opportunity discovery necessarily relates to both solution and problem. After all, the products and services underlying opportunities do not 'sell themselves'. In all but the most fortuitous of cases, choices must be made to design or at least commercialize products and services before they can be sold. These design choices and commercialization choices make up solutions. Also, products and services do not 'buy themselves'. That is, products and services can be sold at greater than their cost precisely because they have a greater value to others: Luck aside, markets and the problems underlying these markets must be identifiable for an opportunity to exist or be identified.

We crafted our theory as part of a very general approach to entrepreneurship (cf. Ucbasaran et al., 2001), where the relevant phenomena are largely delimited by opportunity discovery and opportunity exploitation as well as by individuals or collections of individuals. In our theory entrepreneurship does not relate exclusively to resource-endowed firms such as those considered in the resource-based view of the firm (e.g. compare Ahuja and Lampert, 2001 with Stevenson and Jarillo, 1990). Neither does it singularly relate to pre-firm activities (i.e. 'nascent entrepreneurship' (see Shaver et al., 2001)), post-firm activities (i.e. decision-making in new ventures (see Kamm et al., 1990)), or the individual or the organizational context (Davidsson and Wiklund, 2001). Our theory accommodates both Casson's definition of opportunity, as well as Schumpeter's (1934) typology of opportunities, where either novel problems are identified (e.g. as with different geographic markets) or novel solutions are found (e.g. as with innovative production processes and organizational forms). As a result, this accommodation provides for a more general entrepreneurial theory of the firm than prior literature. Finally, a firm's founding and an individual's decision to become self-employed do not sufficiently represent opportunity exploitation. Firm founding and choice to become self-employed could

merely indicate that an aspiring entrepreneur perceives that an opportunity could be discovered.

Our paper explicitly integrates the literature in a few major ways. First, we argue that search and recognition can co-exist on the same theoretical framework. As long as entrepreneurs expect that opportunities generally can exist, there indeed can be search. (Certainly one cannot search for 'the' specific opportunity insofar that this requires perfect identification a priori.) Furthermore, we relate recognition as a phenomenon that can serve as an indeliberate mechanism for searching for solutions. We highlight the differential effects of human cognition on different governance forms, thus revealing differences between a theory of the managerial firm, and a theory of the entrepreneurial firm.

Second, we provide a link between the two more recent major theories taking shape in the entrepreneurship literature: economics of entrepreneurship, where judgment distinguishes the entrepreneur (e.g. Foss et al., 2007); and the nexus of opportunities approach, which argues that entrepreneurship results from the match between opportunity and individual prior knowledge (e.g. Kirzner 1997; Shane, 2003). Certainly, by placing both search and recognition on a solution space or landscape defined by complexity across knowledge sets, and by differentiating between experiential search and cognitive search, we have managed to allow for both theories.

Third, we begin to unify three major strands of entrepreneurship literature that tend to unnecessarily confuse the definition of entrepreneurship. While certainly each of the literatures on self-employment (e.g. Hamilton, 2000), small business (cf. Carland et al., 1984), and corporate entrepreneurship (Guth and Ginsberg, 1990) reveal and emphasize unique business phenomena, they also serve to constitute entrepreneurship research today as 'some aspect of the setting (e.g. small businesses or new firms), rather than a unique conceptual domain' (Shane and Venkataraman, 2000). We certainly agree with Shane and Venkataraman (2000) that a unit of analysis like opportunity is fundamental to rigorous theory-building, but we diverge from Eckhardt and Shane's (2003, p. 347) assertion that opportunity-related phenomena like discovery take place strictly at the individual level. Instead, we point out how opportunity discovery relates to problem-solving, the exploration for solutions, which can be either deliberate or indeliberate. By highlighting problem-solving as searching over a set of choices that can benefit from knowledge sharing, we reveal how interorganizational considerations are fundamental to opportunity discovery and entrepreneurship.

Fourth, we highlight alignment between the complexity opportunity discovery and 'entrepreneurial governance forms'. Although many management scholars have regarded bureaucracy as the antithesis of entrepreneurship, some highly bureaucratic firms have been shown to achieve high rates of new product introduction (Sathe, 1985). By differentiating between entrepreneurial firms where knowledge transfer is avoided (authority-based hierarchies) and those where knowledge transfer is facilitated (consensus-based hierarchies) (see Conner and Prahalad, 1996; Demsetz, 1988 versus Arrow, 1973; Kogut and Zander, 1996) our theory provides some insight into why bureaucracy may sometimes be valuable. Furthermore, this theory points out when entrepreneurs may be prematurely spending to develop an ineffective culture that contributes to organizational failure.

Our theory can also be operationalized. Testing our theory requires data on entrepreneurial firms, the problems they solve, and their organization of solution search. Complexity of problems might be measured through survey data, or through content analysis of the quality and quantity of communication channels. Organizational forms also can be identified by survey or through interviews. To estimate the effects of human memory and recognition on governance form would likely require experimental data.

We envision several future extensions to our theory. First, entrepreneurial firms may confront problem attributes in addition to *N* and *K*. The extent to which a problem is structured versus unstructured may impact the efficiency of different modes of search (Macher, 2006). The extent to which knowledge is distributed and the extent to which knowledge contains tested components impact the costs of knowledge exchange (Heiman and Nickerson, 2002, 2004). These attributes if incorporated into our theory may differentially impact the costs of consensus-based hierarchy compared to the alternatives. Second, we also envision our theory being extended to assess alternative hybrid structures (Williamson, 1991). Contracting based on equity versus non-equity relationships will likely differ in the degree to which effective experiential and cognitive search are supported. Future research might also investigate situations where multiple modes of governance support solution search. Third, our theory has implications for understanding knowledge expropriation by partners. We suspect that expropriation hazards decline when moving from market solutions, and more importantly from authority-based to consensus-based hierarchy. Finally, our theory takes a deliberately normative stance, and we suggest future work continue to document and explain the knowledge-based biases or inefficiencies found in entrepreneurship (e.g. Busenitz and Barney, 1997). For example, aspiring entrepreneurs may very well inaccurately assess complexity, and thereby select inefficient governance forms.

CONCLUSION

This paper began by arguing that opportunities boil down to valuable problem-solution pairings, and that opportunity discovery relates to deliberate search or recognition over the solution space that ultimately corresponds to a problem. As problem complexity increases, experiential search via trial-and-error provides fewer benefits and cognitive search via theorizing becomes more useful. Cognitive search, however, requires knowledge sharing that is plagued by a knowledge appropriation hazard and a strategic knowledge accumulation hazard. Different governance forms can be used to mitigate the effects of these hazards, according to a discriminating alignment; specifically, authority-based hierarchy that avoids knowledge transfer is efficient for moderately complex problem-solving and consensus-based hierarchy that facilitates knowledge transfer is efficient for highly complex problem-solving. Markets remain the efficient governance form for opportunities based on simple problems that can be solved satisfactorily with experiential or directional search.

In our theory we also account for entrepreneurial recognition. Specifically, we argue that recognition is an indeliberate mechanism available for searching, based on human cognition. Those entrepreneurs with exceptional abilities to acquire, accumulate, and

apply knowledge are also most likely to benefit from recognition, and can also afford to widen the range of complexity over which they retain authority-based governance. Ultimately, the reconceptualization of opportunity discovery as problem-solving, a logic linking problem complexity to three distinct organizational forms, and the convenience of combining search and recognition onto one framework, lead to this entrepreneurial theory of the firm.

NOTES

- [1] By 'design choice' we refer to those product- or service-oriented choices related to what the end customer directly perceives or experiences (e.g. the choice of lengths, the choice of pitch of tones, the types of materials used). By 'commercialization choice' we refer to those choices that the end customer does not perceive or experience (e.g. what kind of accounting rules were followed, what supplier was chosen for a material, whether financing was through banks or venture capital). In relatively few cases there might be confusion in distinguishing between these types of choices (e.g. when a consumer experience could be related to either product or a more general 'experience'; and when choices affect both the design and commercialization of a product, as with marketing).
- [2] Opportunity exploitation traditionally relates to both the identification of relevant sales markets (Shane, 2000) as well as the decision-making over commercialization-oriented functions such as manufacturing and marketing (Shane, 2003), for which organizing is considered central.
- [3] Our terminology of problem and solution relates to Casson's (1982) terminology of a new means–end framework. The means–end framework provides a way of thinking about the relationship between actions and outcomes. In particular, his framework 'can result from formulation of new means, ends, or means–end relationships about products, the materials, markets, or production or organizing methods' (Shane, 2003). Our terminology utilizes the metaphor of landscapes generated by the recombinations of knowledge and thus allows us to discuss the metaphor of searching over these landscapes. A means–end framework does not imply a knowledge landscape over which search takes place.
- [4] We readily acknowledge that problems and their contexts may have additional dimensions. For instance, Macher (2006) builds on Simon to identify structured versus unstructured problems. Heiman and Nickerson (2002, 2004) identify attributes of the context for solving problems such as knowledge dispersion – in how many individuals does the relevant knowledge sets reside – and tacit knowledge, which impacts the costs of sharing knowledge. Both of these factors can influence the cost of alternative organizational structures. We set these issues aside for the purpose of initial theory development.
- [5] Although we offer only three prototypes, other hybrid forms do exist. For instance, Heiman and Nickerson (2002, 2004) examine through a problem-solving lens myriad interfirm relations involving various forms of equity and non-equity complex contracts. We do not offer in this paper a comprehensive comparative contractual framework for these intermediate modes of organization and await research that does so.

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