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Consideration Sets as Resources for Business Model Generation

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Abstract: Business models as outcomes for entrepreneurship are increasing in prevalence in pedagogy and practice. Instructors and entrepreneurs are focusing efforts on iterating potential ideas through a process of trial and error in hopes to produce working business models. However, such practices need to be better underpinned by theory so we can develop an understanding of how to identify more valuable opportunity ideas and how to progress them towards working business models with fewer trials and errors. This conceptual paper focuses on integrating extant conceptualisations of business models as interdependent activities with research on identifying opportunities as problem-solution pairings. While integrating those literatures, the present framework also details how reliance on Constrained, Systematic Search—with its resource based view underpinnings—can help individuals with entrepreneurial aspirations identify more valuable opportunities and progress them faster and with fewer trials and errors into working business models.

Keywords: business model; recombination; entrepreneurship; systematic search; knowledge.

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INTRODUCTION

The process of opportunity identification is portrayed in a variety of competing ways. Constrained, systematic search and alertness both result in discoveries (Shane & Venkataraman, 2000). Another view contends that entrepreneurial action results in valuable problem-solution pairings (Hsieh, Nickerson, & Zenger, 2007). Further examples of entrepreneurial outcomes are creations, innovations, and new-resource combinations (Alvarez & Barney, 2007; Schumpeter, 1934; Klein, 2008). Some of these theories are at odds with one another with some outlining internal sourcing for knowledge as critical and others noting the importance of external knowledge sourcing (*cf.* Baron & Ensley, 2006; Alvarez & Barney, 2007; Ardito & Petruzzelli; Fiet, 2007; Gast, Filser, Gundolf, & Kraus, 2015).

Theories on opportunity identification, especially those focused on problem-solution pairings have largely focused on the process whereby knowledge about potential pairings are tested and shaped into their final versions, or business models (Simon, 1962; Hsieh et al., 2007). However, this heavy focus on testing and shaping problem-solution pairings has left a theoretical gap in our knowledge of how to effectively find problem-solution pairings to begin shaping in the first place (von Hippel & von Krogh, 2015). This gap is particularly important given the high adoption rate that testing, shaping, and pivoting towards business models have had in pedagogy and practice (Jackson, Scott, & Schwagler, 2015). Although there are certainly theories of opportunity discovery available—as mentioned above—extant theories in their current state largely ignore how the process of opportunity identification plays a role in the value—or lack thereof—of discovered opportunities (*cf.* Hsieh et al., 2007; Tang, Kacmer, & Busenitz, 2012). This leads to the second gap that we aim to resolve with this paper; specifically, we aim to identify factors associated with the opportunity identification process that matter to opportunity value and time costs associated with the process of business model iteration as business models are tested and formed into workable versions. Norton and Hale (2011) concisely summarise the issue in entrepreneurship education arguing that, "Students should learn how to distinguish ideas that bring value to the marketplace from ideas that do not add value." Entrepreneurs and scholars alike should certainly be interested in processes that are more likely to lead to the identification of valuable opportunities rather than opportunities without consideration for value and parsimony.

In resolving these two gaps, we utilise Systematic Search as a theoretical basis with its underpinnings in the resource-based view to articulate a process whereby more valuable opportunities can be identified and done so more efficiently. Many of the extant literatures on identification emphasise knowledge as potential sources for opportunities (Kogut & Zander, 1992; Grant, 1996; Kogut & Zander, 1996; Nahapiet & Ghoshal, 1998; Nickersen & Zenger, 2004). However, some suggest internal knowledge and others external knowledge is most critical for successful opportunity discovery (Fiet, 2002; Tang, Kacmer, & Busenitz, 2012). Here, we reconcile these competing views to offer an integrated process where the interplay of internal consideration sets and external knowledge and feedback can be utilised to pursue valuable opportunity identification by integrating problem-solving and recombination literatures in with Systematic Search. In sum, we explore two questions herein: first, what role can constrained, systematic search play in identifying valuable problem-solution pairings efficiently, and second, how can entrepreneurs progress identified problem solution pairings into working business models faster and with fewer trials and errors.

The balance of the paper proceeds by reviewing the literature on problem solution pairings as entrepreneurial outcomes. Next, we develop propositions regarding how aspiring entrepreneurs can use constrained, systematic search to effectively find problem-solution pairings, and how problem complexity influences the value of problem-solution pairings as pairings are tested by entrepreneurs. Finally, implications to future research are offered in the discussion and conclusions section.

THEORETICAL BACKGROUND OF SYSTEMATIC SEARCH AND PROBLEM-SOLUTION PAIRINGS

Although all opportunity discovery outcomes eventually point toward the aspiration of a business with a working business model, problem-solution pairings as entrepreneurial outcomes have some advantages for scholarly understanding. One advantage is that problem-solution pairings vary in complexity, which is useful when studying the process of developing an initial conceptualisation of a pairing into its final version (Simon, 1962; Hsieh et al., 2007). Austrian economists emphasise the role of the entrepreneur in economic processes; the Austrian perspective contends that neo-classical economists overlook how decision problems come into existence in the first place (Garrison, 1995). We do not intend to dissect the various views of Austrian economics here; rather, we merely provide a brief discussion of how problem-solution pairings fit into the economy. Hayek contends that the "function of competition is here precisely to teach us who will serve us well: which grocer or travel agency, which department store or hotel, which doctor or solicitor, we can expect to provide the most satisfactory *solution* for whatever personal *problem* we may have to face" (Hayek, 1948, p. 97 *emphasis added*). In short, this paper considers entrepreneurs that act as the initial providers of solutions to the economy's problems. Problem-solution pairings incorporate both those situations in which a market need is identified (problem) *ex ante* of a method to fill that need (solution), and those in which a new technology or invention is created (solution) *ex ante* of a market need (problem) (Hsieh et al., 2007). Before a solution can be tested and formed into a workable business model, entrepreneurs must decide which potential solutions they will test.

In this paper, we focus on instances where entrepreneurial action leads to a solution to a problem, regardless of which comes first. Admittedly, excluding other types of entrepreneurship may limit the generalisability of the discussion section; however, there are also some benefits to narrowing our focus to problem-solution pairings. Examining only entrepreneurial actions that result in problem-solution pairings allows us to consider both the complexity of the problem and the process of shaping an initial attempt at a solution into a workable or exploitable (used interchangeably here) solution (Simon, 1962; Hsieh et al., 2007).

In order to develop propositions related to the value of problem-solution pairings as a function of their complexity, we focus on the known benefits of constrained, systematic search. We suggest that for finding valuable problem-solution pairings, there are several beneficial influences that constrained, systematic search provides to the process of shaping an initial attempt at a solution into a workable solution. We discuss each of these separately in theory subsections below.

Problem-solution pairing's value is a function of problem-complexity

Scholars formulate a problem as "a complex system…of a large number of parts that interact in a nonsimple way" (Simon, 1962, p. 468). This conceptualisation of problems allows for varying degrees of complexity. The complexity of a problem defines the breadth of the landscape of 'unseen' potential solutions (Hsieh et al., 2007). Hsieh et al. (2007) operationalise the values of solutions based on the interdependence (K) among the number of knowledge sets (N) available for solving a problem. In their formulation, K represents the complexity of the problem and complexity ranges from *nearly decomposable* parts requiring few knowledge sets to *nondecomposable* parts requiring many knowledge sets. Nearly decomposable problems are those with parts that can be easily identified, defined, and separated into independent parts (Hsieh et al., 2007). Following Hsieh et al. (2007), entrepreneurs readily see solutions to nearly decomposable problems because the interdependency among the design choices of possible solutions is low. Expressed another way, non-complex problem-solution pairings are more obvious to aspiring entrepreneurs. Problems that are very complex have high interdependency between the design choices of possible solutions and, therefore, require many more knowledge sets to see and solve them (Hsieh et al., 2007; Zott & Amit, 2011).

The fewer knowledge sets required to notice and solve a problem, the more likely it is to be noticed and solved by *many* entrepreneurs (Fiet, 2007; Patel & Fiet, 2011). We propose that when many entrepreneurs are able to notice a problem and find a suitable solution, the problem-solution is less valuable because of increased competition. Therefore, problems that are less complex—that is, problems with parts that are nearly decomposable, requiring fewer knowledge sets for their solution—will result in less valuable problem-solution pairings. On the other hand, problems that are very complex—that is, problems with parts that are highly interdependent and therefore, nondecomposable—are less likely to be noticed and solved. Consistently, scholars have found that entrepreneurs are more likely to identify ideas the more obvious similarities exist between a demand source (problem) and a supply source (solution) (Grégoire & Shepherd, 2012; Mueller & Shepherd, 2016). Here, the value of problem solution pairings is dependent on the complexity of the problem and valuable solutions are those that are not readily found; this departs from Hsieh et al.'s (2007, p. 1258) statement that "valuable solutions are readily found because the choices across decisions do not interact with one another." We agree that less complex solutions (versus valuable solutions) are readily found for decomposable problems; however, we add to scholarly understanding here by contending that the abundance of less complex solutions competes away their value. On the other hand, when an entrepreneur is able to identify, define, and find a solution to a complex problem, the problem-solution pairing will be unique, and therefore of high value. If many entrepreneurs are able to find a solution to a problem, then the problem-solution pairing would not meet the requirements of the resource-based view to be capable of creating a competitive advantage—that is, rare, inimitable, and lacking substitutes (Wernerfelt, 1984). Understanding how problem complexity influences value can help aspiring entrepreneurs filter problems that they notice and focus their attention on problems that are more likely to lead to wealth creation. This leads to proposition 1 as shown in figure 1:

> Proposition 1: Problem-solution pairings that offer a solution to a complex problem will be more valuable than problem-solution pairings that offer a solution to a non-complex problem because complex problem-solution pairings are less readily found.

Problem-solution pairings reconciliation of recombination literature and constrained, systematic search

Although the normative benefit of Systematic Search as expressed in extant literature is the effectiveness of identifying valuable entrepreneurial opportunities rather than ones that are not valuable, such search is not without failure (Fiet, 2007). Indeed, an important element of such search is the feedback signals that individuals process from selected information channels (Fiet, 2002). Future considerations sets are changed based on feedback signals such that an entrepreneur's searchable considerations set would be based on specific knowledge combined with past and on-going signals from previously searched channels. Thus, recombination of knowledge is critical (Khajeheian, 2018; Siemon & Robra-Bissantz, 2018).

To date, theoretical development on systematic search has focused on searching locally, within ones own consideration set. However, recent studies suggest that some opportunity types, particularly ones focused on product innovation, may require recombining knowledge through a process of sourcing and recombining knowledge from external sources is critical because it is unlikely that all the knowledge necessary for innovation resides locally (Ardito & Petruzzelli, 2017; Mauroner, 2017). Such work concedes that external search coupled with recombination of knowledge in pursuit of opportunity is not easy. One of the main reasons that recombination is difficult is searching for external knowledge to recombine in new ways requires searching a wide breadth of external sources and with more breadth comes more cognitive processing complexity (Ardito & Petruzzelli, 2017). Systematic Search literature also argues that such wide, external searching is undermined by the lack of rarity associated with externally available knowledge. Specifically, Systematic Search makes normative arguments against external search as that knowledge is readily available for others to search as well, making it not rare enough to meet the requirements of the resource-based view's threshold for competitive advantage (Wenerfelt, 1984). However, when such external knowledge and feedback signals are combined with unique, specific consideration sets that do reside internally, the recombined knowledge can be rare enough to meet the advantage threshold. This is an important contribution to the scholarly understanding of Systematic Search and recombination literatures. Specifically, there is a fundamental contradiction between these two extant literatures. On the one hand, Systematic Search argues against the use of external knowledge sources that are available to others because they lack uniqueness and rarity (Fiet, 2007). On the other hand, recombination literatures note the cognitive myopia that undermines search efforts when only internal sources are searched and instead suggest entrepreneurs search external knowledge sources (Levinthal & March, 1993). So, which advice should entrepreneurs follow? Here, we offer a reconciliation of these contradictions and suggest they follow both.

Entrepreneurs can access the exploratory and breadth benefits associated with external knowledge search while maintaining the rarity benefits that come from internal consideration sets by recombining externally accessed knowledge with internally held consideration sets. Expending only some effort externally and allowing one's internal knowledge to guide search efforts can also help overcome absorptive-capacity concerns articulated in recombination literature (Katz & Allen, Koput, 1997). In the paragraphs that follow, we articulate how Systematic Search can help in the process of identifying valuable opportunities with specific attention given to the fact that not any one person can all have all the knowledge necessary at a specific time and place. As discussed below, feedback signals and problem-solution pairings are critical components of reconciling search internally vs. search externally.

As discussed, we are exploring the question of whether constrained, systematic search is the most effective way of finding and shaping valuable problem-solution pairings or whether

there is some other way that is more effective. Before considering the benefits of constrained, systematic search in discovering valuable problem-solution pairings, we review problem-solving alternatives that are offered in the literature. Simon describes the process of human problem-solving as involving:

> "a great deal of trial and error. Various paths are tried; some are abandoned, others are pushed further. Before a solution is found, a great many paths of the maze may be explored. The more difficult and novel the problem, the greater is likely to be the amount of trial and error required to find a solution." (Simon, 1962, p. 472).

Simon's model of problem-solving is potentially very costly in that it likely expends a great amount of time and missed opportunities. The only signals that are available in Simon's model of solution search are those "indications of progress [that] spur further search in the same direction; lack of progress signals abandonment of a line of search." (Simon, 1962, p. 472). In other words, Simon's model focuses on the decision to continue to pursue or abandon a solution path that has already been forged to some degree. Therefore, this model does not provide an efficient way whereby the problem solver finds the initial attempt at a solution or accesses relevant external knowledge to combine with internal knowledge in new and innovative ways.

Hsieh et al. (2007, 2009) contribute to the discussion of searching for valuable solutions to problems; however, they emphasise finding the values of solutions rather than the solutions themselves. They offer two methods of search. The first method they offer involves exploring the values of solutions via 'trial-and-error' (Hsieh et al., 2007). That is, entrepreneurs engage in experiments whereby solutions are slightly altered and the entrepreneur observes changes in solution value; if the value increases, the changes are accepted, otherwise they are reconsidered. This method of search is useful for evaluating known-potential solutions, but does not offer instructions as to how potential solutions are identified in the first place and is likely time consuming and expensive as it relies on trial-and-error. Furthermore, this method also does not reconcile the internal vs. external search recommendations prevalent in the various streams of literature.

Another method suggested for finding opportunities is the process of identifying problem-solution pairings, called cognitive search, is based on the use of heuristics (Hsieh et al., 2007). The process involves the entrepreneur making subconscious-educated guesses, using heuristics, regarding the value of a potential solution. Hsieh et al. (2007) contend that cognitive search puts actors in the 'vicinity' of solutions that could be valuable; however, they do not specify how exactly it does so. The role of heuristics in cognitive search is to make: "educated guesses regarding values on the landscape through perfect knowledge" (Hsieh et al., 2009, p. 3). In other words, the search is again focused on the values of solutions, not *where* in the 'landscape' such solutions exist to be found. These authors make a first step toward recombination of something held internally with external landscapes; however, they do not articulate knowledge sources as a search target internally or externally. Instead, their arguments rely on the application of internal heuristics to guess where in the external environment an opportunity exists waiting to be identified and seems mostly applicable to so-called experts.

The use of heuristics is often coupled with some rational cognition in what is referred to as expertise-based intuition (Salas, Rosen, & DiazGranados, 2010). In this way, the use of heuristics might be conceived as somewhat similar to constraining search efforts to specific knowledge domains as modelled by Fiet (2004, 2007). The difference is that expert-based intuition emphasises rules of thumb; it is in essence the subconscious process of making

decisions automatically, or "knowing without knowing the reasons why" (Salas et al., 2010, p. 944). We, on the other hand, are emphasising conscious search of considerations sets to find a solution worth testing and shaping coupled with feedback signals from the external environment. That is, Hsieh et al. (2007) propose the use of heuristics, which is a subconscious based decision making technique, to estimate the value of solutions; we are proposing a conscious search method which identifies considerations sets and searches them systematically to find solutions before their value can be assessed followed by testing and couple of found solutions with external environments (Fiet, 2007). The entrepreneur's role involves more than evaluating and refining solutions to problems; entrepreneurs must also search the landscape to find problem-solution pairings worth evaluating in the first place. The feedback signals and valuation processes in Simon's and Hsieh's models likely assist the problem solver (entrepreneur) in evaluating and shaping solutions; however, they are less helpful to an aspiring entrepreneur that seeks to find an initial, potential problem-solution pairing to evaluate and shape because one cannot receive feedback signals from a solution that they do not know exists. Systematic search is more effective in helping entrepreneurs find valuable problem-solutions because of its focus on constraining search to specific knowledge (Fiet, 2004; Fiet, 2007).

An important implication from Hayek's (1948) explanation of competition is that there are differences in the specific knowledge needed to provide the most satisfactory solution for particular problems and there is not any one person that has all of the necessary knowledge available to him/her at a specific point in time and space (Hayek, 1945). Knowledge heterogeneity, then, leads to "imperfections in the market for discoveries" (Fiet, 2007, p. 598), enabling the existence of valuable opportunities, such as monopolies, at a given point in space and time (Hayek, 1945). Indeed, scholars have found that prior knowledge plays a role in the ability of entrepreneurs to achieve cognitive alignment between technologies and markets, which are akin to solutions to problems (Grégoire & Shepherd, 2012).

As discussed, problems that are nearly decomposable, or not complex, are readily identifiable (Simon, 1962). In other words, problems that are nearly decomposable require less specific knowledge for solutions. Conversely, more complex problems, which are more valuable, require more specific knowledge for their solutions. Because complex problems are difficult to define and to separate into independent parts, more specific knowledge is required to solve such problems (Hsieh et al., 2007). For example, the first entrepreneurs to solve agency problems between limited partners and hedge fund managers, which is indeed a complex problem, had unique, specific knowledge, which few others held. General accounting or legal knowledge was not sufficient to be cognisant of, and solve, this problem. The entrepreneurs that eventually solved this problem were, indeed, CPAs and lawyers, but they also held specific knowledge that they gained through experience working as CFOs for hedge funds. Their solution resulted in an entirely new and lucrative industry (Hardie & MacKenzie, 2007). It is easy to imagine that the complexity of this problem made it difficult for individuals lacking relevant, specific knowledge to solve. Here, we assume that not everyone is lucky, and indeed, one cannot decide to be, nor train to be, lucky. Therefore, aspiring entrepreneurs must confront the hurdle that not everyone is equally likely to find a particular problem-solution pairing. Having specific knowledge can greatly increase the likelihood of finding a solution to a valuable problem.

It is not enough to have specific knowledge; one must also make use of it. Fiet's (2007) model of constrained, systematic search is the only known method offered that informs aspiring entrepreneurs how to make use of their specific knowledge to make discoveries. We propose that searching considerations sets made up of information channels as modelled by Fiet (2007), is

also the most effective, known way an entrepreneur can search for valuable problem-solution pairings. Constrained, systematic search emphasises limiting one's search efforts to consideration sets of information channels that are comprised of specific knowledge (Fiet, 2007). We posit that constrained, systematic search's emphasis on bounding the search domain to consideration sets comprised of information channels, which are low-cost, frequent sources of specific information and can increases one's likelihood of finding valuable problem-solution pairings to evaluate and shape.

Some scholars argue that search requires knowing of the object of search ex ante, and therefore, systematic search for entrepreneurial discoveries is not possible (*cf*. Kirzner, 1997). Constrained, systematic search, however, increases one's chances of discovering a valuable opportunity by *constraining* search efforts to one's consideration set regardless of what one is looking for (Fiet, 2007). Obviously, there is still a probability that a discovery will not be made partly because the object of search is unknown, but the entrepreneur decreases that probability by limiting one's search to the entrepreneur's information channels which are sources of specific information (Fiet, 2007). Adding to the theory of constrained, systematic search, we propose that having either an unsolved-problem (e.g. market need), or a solution that has not yet met its problem (e.g. new or unexploited technology), in mind can act as a proxy for knowing the object of search. Individuals have multiple information channels within their consideration set; the greater the variety of experiences one has, the greater the variety in their informational channels (Fiet, 2007). Having a market need in mind, for example, can inform an aspiring entrepreneur which information channels, to search first. Importantly, having either an unsolved problem (market need) or solution that has not yet met its problem (new technology) in mind also helps us reconcile the competing and contradictory arguments of internal search theories and external search theories that were outlined at the onset of this section of the paper. It is that combination of something found in the external environment, a problem or solution, coupled with internal search of consideration sets for the other half of a problem-solution pairing that is the core contribution and focus herein.

Awareness of a market need or new technology from the external environment is also helpful after information channels are selected for searching. The exact object of search (e.g. solution) is still unknown; however, one is more likely to find a solution to a known problem than to an unknown problem. Fiet's model is not intended to identify how every opportunity is discovered, or even "how the average entrepreneur actually engages in discovery" (Fiet, 2007, p. 596). Its usefulness "is to inform aspiring entrepreneurs about where to find the most relevant information to guide them in their searching" (Fiet, 2007, p. 597). That is, this model provides the signals—missing from Simon or Hsieh et al.'s model—which are needed to discover an initial problem-solution pairing. We add to Fiet's model by providing a proxy for knowing the object of search. Fiet's (2007) constrained search for opportunities in consideration sets coupled with searching for a problem-solution pairing *speeds* search in three ways: first, it minimises the domain of search to a manageable domain, focusing the attention of the aspiring entrepreneur to areas they have specific knowledge in (Fiet, 2007); second, it provides signals which change the entrepreneur's understanding of the future (Fiet, 2007); and finally, it informs entrepreneurs as to which information channels to focus on depending on the nature of the problem (solution) that they are trying to solve (find a market need for). This leads to proposition 2 as shown in figure 1:

> Proposition 2: Aspiring entrepreneurs that search consideration sets with a problem or solution in mind, thereby combining internal search with external knowledge, will find

valuable problem-solution pairings more quickly than aspiring entrepreneurs that do not search consideration sets.

The value of team-based consideration sets

Teams may have an important advantage over individual entrepreneurs when it comes to identifying valuable problem-solution pairings, which may help explain why so many observed ventures were started by teams rather than individuals. New ventures are largely observed ex post; that is, we typically describe new ventures based on observations of ventures that actual make it into existence. Scholars note that existing ventures "are commonly started by entrepreneurial teams" (Kamm, Shuman, Seeger, & Nurick, 1990, p. 7). However, it may be the case that many individuals begin to engage in entrepreneurial search as sole actors but for some reason their efforts do not result in an existing venture whereas teams who engage in such search are more likely to have a venture as a result. If that is the case, it makes sense that teams commonly start the ventures we observe ex post. The proposition developed in this section offers one potential explanation for why opportunities identified by teams might be more likely to make it to an actual venture with a working business model.

Teams access to more knowledge consideration sets coupled with their greater cognitive capacity might lead them to identify more complex, and therefore more valuable, problem-solution pairings. Recall from the theory development above, that problem-solution complexity is likely a driver of opportunity value. That, coupled with the recombination literature's articulation of knowledge breadth and organisation as a benefit to search efforts (*cf.* Natalicchio, Ardito, Savino, & Albino, 2017), suggests that if there is a way to access more knowledge with its inherent complexity, yet have sufficient cognitive capacity to make sense of that complexity, then more valuable opportunities will result. We purport that teams are a mechanism to increase the likelihood of identifying complex, and therefore valuable, problem-solution pairings, while maintaining the cognitive capacity necessary to deal with such complexity. Indeed, scholars note that the interplay between internal and external search activities in the pursuit of innovative opportunities is advantageous compared to relying on only internal or external sources alone (Ardito, Natalicchio, Petruzzelli, & Garavelli, 2018). Not only do teams aggregate to a greater number of knowledge consideration sets, but also teams bring along increased capacity to process information (Fiet, 2007; Norton & Hale, 2012). Indeed, it is established in the extant literature that just as individuals cognitive abilities are influenced by factors such as experience and education, teams' aggregated cognitive capacities are driven by the integration of individual members' experiences, education, knowledge, and the like (*cf.* Day, Gronn, & Salas, 2004; Wiersema & Bantel, 1992)

Entrepreneurs should be incentivised to work in teams as a team can expand the accessible information channels that can be utilised during search efforts. The more diverse a team is—both with respect to experiences and demographics—the more expanded its access to knowledge and consideration sets become (Fiet, 2007; Sastre, 2016). Such joint consideration sets may help explain the prevalence of team-based foundings in practice. However, the more homophilous a team is, the more overlap there will be across individual considerations sets of knowledge, undermining the prescriptive search benefits of the team (Granovetter, 1973; Fiet, 2007). Therefore, teams are advised to actively seek diversity,

especially with respect to knowledge and experience. This leads to our third proposition as shown in figure 1.

> Proposition 3: Team-based founding groups are more likely to identify problem-solution pairings that are complex than individuals are with such problem complexity increasing with the heterogeneity of the team.

Constrained, systematic search and business model innovation

Problem-solving is more of a process of related value activities than it is an event (Gurău, Lasch, & Dana, 2015; Hsieh et al., 2007; Shane, 2003; Simon, 1962; Stevenson & Jarillo, 1990). For example, the market might view a solution to a problem as merely the products or services that satisfy the market's needs. However, a solution needs to be considered from the viewpoint of the entrepreneur, which is more than the product or service to be offered. A solution from the entrepreneur's viewpoint includes not only what the product or service will be, but also how the product or service will be produced and how it will be offered, including necessary coordinating activities. Identifying all of these pieces is unlikely to occur all at once. In other words, the solution is a business model that explains how a venture will generate profits (Afuah & Tucci, 2001; Chesbrough & Rosenbloom, 2002; Hedman & Kalling, 2003; Fiet & Patel, 2008; Morris, Schindehutte, Richardson, & Allen, 2006). Zott and Amit's (2010, p. 3) formulation of a business model as activities is useful in considering problem-solution pairings:

> "Interdependency among activities is central to the concept of an activity system. Interdependencies…are created by entrepreneurs or managers who shape and design organisational activities as well as the links (transactions) that weave activities together into a system. Such purposeful design…is the essence of the business model."

The process of problem solving, then, includes finding an initial attempt at a solution and subsequently designing and shaping that solution from its initial concept into a workable business model.

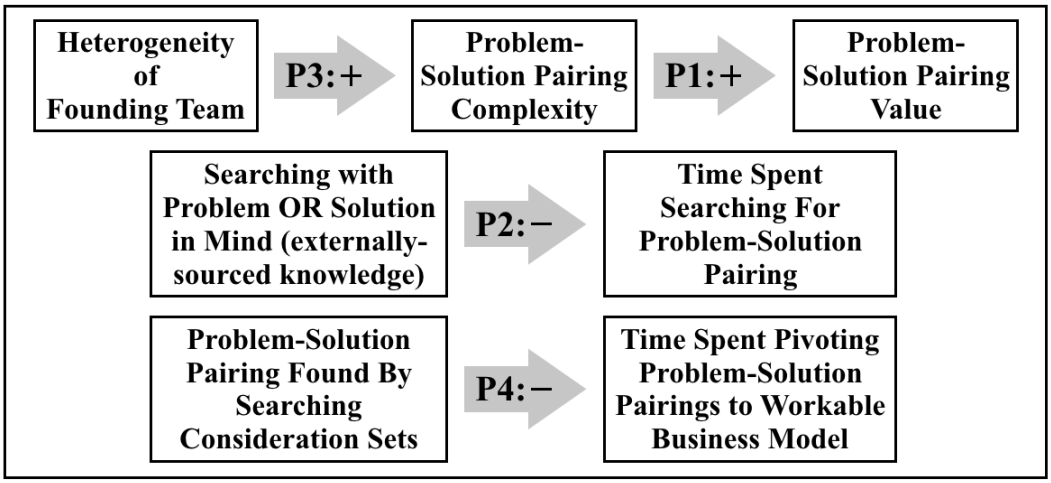
A weakness of heuristics-based cognitive search is the accuracy of the judgments it leads to because of a tendency to be biased to one's initial value. The role of heuristics in cognitive search is to make: "educated guesses regarding values on the landscape" (Hsieh et al., 2009, p. 3). Some scholars suggest cognitive heuristics results in one making estimates or judgments away from an anchoring or reference point (Fiol, O'Connor, & Aguinis, 2001). "However, subsequent judgment is strongly tied to the initial anchor and often is not sufficiently adjusted away from this value" (Fiol et al., 2001, p. 229). This suggests that Hsieh et al.'s (2007) model of cognitive search for problem-solution pairings can often result in incorrect judgments and valuations of solutions because of a bias to the initial-reference point. A bias to an initial reference point is different than Staw's (1976) escalating commitment; here, the decision is one *ex ante* of resource commitment. An incorrect value assignment to a solution ex ante of resource commitment and business model development may result in a miss-guided and inefficient development process; inefficient because biased-judgments are likely to suffer from inaccuracy and result in time and energy wasted pursuing a solution that is not as valuable as initially thought. That biased-judgments (that is, those biased to an initial reference-point) are inaccurate is based in the notion that people more easily and quickly accept things that confirm what they already believe to be true (Hinsz, Tindale, & Vollrath, 1997).

Because subconscious, heuristic-based decision methods may lead to an initial solution that is biased towards the starting-reference point (Fiol et al., 2001), we posit that heuristic-based search will lead to a less parsimonious process of shaping the solution into a workable business model than constrained, systematic search will. Moreover, Payne et al. (2008) researched the boundary conditions on unconscious decision making; they concluded that when the "magnitudes of the payoffs—not just whether the values were good or bad—mattered, [that] . . . self-paced, conscious thought led to more choice of the highest-[expected value] option than unconscious thought did" (Payne, Samper, Bettman, & Luce, 2008, p. 1123). We contend that the magnitude of expected payoffs, indeed, matters greatly to entrepreneurs.

Constrained, systematic search, on the other hand, focuses search efforts to consideration sets, which are sources of the entrepreneur's specific knowledge (Fiet, 2007). The specific knowledge is found in an entrepreneur's previous experience that constitutes a consideration set on the basis of this specific knowledge, which consists of a grouping of information channels, in which already-held specific knowledge is likely to coincide with the discovery and exploitation of a problem-solution set. The effectiveness of this search model has been demonstrated through experimental treatments in which constrained systematic search was taught to subjects (*c.f.* Fiet, Norton Jr, & Clouse, 2007). Constrained, systematic search, can act as a filter when screening potential solutions, increasing the likelihood of finding a solution that fits with the entrepreneur's specific knowledge and skills; this, in essence, increases the quality of the initial attempt at a solution. We argue that a higher quality initial solution—a solution for which the aspiring entrepreneur holds relevant, specific knowledge and skills—will require less effort to refine the idea to its final version. Here, final version refers to a solution that is in a business model form that the entrepreneur perceives is ready to be exploited. We are not offering a new theory of how problem-solution pairings are developed from their initial stage to a workable stage. Rather, we posit that the use of constrained, systematic search to find the initial problem-solution pairing shortens the subsequent process of testing and shaping a solution into a workable business model by increasing the likelihood that the initial problem-solution pairing fits with the entrepreneur's specific knowledge and skill sets. That is, when constrained, systematic search is used to find the initial problem-solution pairing, the costly shaping process will be shortened because pairings are more likely to fit with the entrepreneur's specific knowledge and subsequent adjustments are less biased toward the initial reference point. This leads to our fourth proposition as shown in figure 1:

> Proposition 4: Problem-solution pairings that are found using constrained, systematic search of internal consideration sets will result in a more parsimonious business model development process than those found using other methods.

Figure 1 A Model of Parsimonious Business Model Ideation



DISCUSSION

As discussed, the special cases of entrepreneurial outcomes that we focus on in this paper are problem-solution pairings and the potential business models that can result from such pairings. Specifically, we propose that problem-solution complexity is positively correlated with problem-solution value with more heterogeneous team based founding groups more likely to find such valuable ideas; constrained, systematic search methods are negatively correlated with the time spent searching for a testable solution; and constrained, systematic search methods are negatively associated with the time expended to shape a solution concept into a business model. Scholars note the importance of exploring diverse dependent constructs beyond the traditional outcomes produced only by small or new firms (Mattingly, 2015). Further, Mattingly (2015) articulates the importance of exploring processes that lead to new economic activity, specifically noting the importance of exploring how business models are generated, as this paper does.

Although the stream of research emerging on problem-solution pairings is growing, there have not been theoretically-driven considerations for how problem-solutions might vary in their complexity and why that complexity is important. Here, we integrate problem-solution complexity into the current understanding of business model formation through identifying and testing problem solution pairings. Specifically, we explain that because more complex problem-solution pairings are less decomposable into parts, they require a greater level or prior knowledge to reach cognitive alignment, and are, therefore, more rare and valuable than less complex—and more easily decomposed—problem solution pairings. This richer scholarly understanding may also help explain the prevalence of team-founded ventures with teams broader base of knowledge consideration sets and cognitive capacity.

This manuscript also contributes back to the Theory of Systematic Search by articulating a surrogate for unknown objects of search. Indeed, the primary argument against Systematic Search is the argument that one cannot search for something unknown (Kirzner, 1997; Patel & Fiet, 2008). Here, we suggest that one side of a problem-solution pairing can guide search efforts and act as a surrogate object of search within a consideration set. Information about problem-complexity can also aid aspiring entrepreneurs in their search for a solution (Hsieh et al., 2007). Problem-solution pairings can also help guide the search process because an aspiring entrepreneur faces less uncertainty in searching for a solution to a known problem than searching

for a completely unknown discovery. Research shows that constrained, systematic search is the most effective way to make discoveries which are fit, valuable, rare and inimitable (Fiet, Clouse, & Norton Jr., 2004; Fiet, 2007; Fiet, Norton, & Clouse, 2013). In addition to addressing concerns about Systematic Search, the important contribution of utilising half of a pairing (problem or solution) helps to reconcile the competing views of various theories of opportunity identification. Specifically, having an externally sourced problem or solution provides an object of search and provides a broader base for entrepreneurs to find opportunity ideas without undermining their importance of utilising internal consideration sets to maintain rareness.

There is a growing body of research on business models and business model testing. Similarly, practice and teaching are growing in the prevalence of focusing on business model iteration and development (Jackson, Scott, & Schwagler, 2015; Simon & Kim, 2017; Wrigley, Bucolo, & Straker, 2016). Hsieh et al. (2007) articulate how such experimental testing of business models plays a role in opportunity discovery itself as entrepreneurs try to nail down if a problem-solution pairing they have identified is indeed an opportunity. Pedagogy and practice are leading the way rather than research and theory driving pedagogy and practice as one might expect (Asvoll & Jacobsen, 2012). As a result, scholars noting the importance of establishing theoretical underpinnings for how problem-solution pairings develop into business models and a theoretical basis for business model generation (DaSilva & Trkman, 2014). What little theoretical underpinnings we have are primarily rooted in the resource-based view of the firm (DaSilva & Trkman, 2014). Indeed the resource-based view provides a strong theoretical and logical basis for business models. However, recently, scholars note that "entrepreneurial ventures might require different resources, or use these resources differently" than more established firms and subsequently question if the resource-based view is even applicable to entrepreneurial ventures (*cf*., Kellermanns, Walker, Crook, Kemmerer & Narayana, 2016). When we break down entrepreneurship into temporal phases, the process of opportunity discovery and experimenting towards a business model may even be less appropriately studied with a resource-based view lens as resources are limited, absent, or not-known to be relevant yet. However, entrepreneurs do have some resources. Indeed, scholars note that resources related to information, customer relationships, understanding of markets, and the like are core to the transaction aspects of business models and therefore play an important role in shaping business models, such as how innovative a business model will be (Brannon & Wiklund, 2016). In this paper, we offer a conceptual framework for how Systematic Search can help along in the process of entrepreneurs identifying more valuable opportunities and progressing them towards a workable business model with faster and with fewer trial and error iterations as shown in figure 2. Specifically, we address some of the concerns outlined above about limited theoretical underpinnings for business model generation and limited applicability of the resource-based view by identifying a process by which entrepreneurs can use resources they actually have—consideration sets—as the basis for opportunity discovery and ultimately, business model generation.

Contextual and Opportunity Construct Considerations

Although the view that entrepreneurship is a process through which new economic activities and organizations come into existence has grown in consensus (e,g., Davidsson, 2003; Davidsson, 2015; Gartner, 1988; McMullen and Dimov, 2013; Shane and Venkataraman, 2000), there is less consensus surrounding the opportunity construct itself. Scholars note the importance of considering contextual considerations and opportunity characteristics, for which a unitary

construct or context is impossible given the reality of heterogeneity in the action paths that entrepreneurs follow when developing theory about entrepreneurial processes (Davidsson, 2015). The concept of opportunities varying across context or action path is well established (*cf.* Dana, 2009). Such heterogeneity is multilevel in nature with variance in contexts, cultures, individuals, and even the formation process versus the objective existence of opportunities; for example, scholars note that: opportunities are culturally influenced (Dana, 1995; Dana, 1996; Dana, 2009), entrepreneurs engaged in creating opportunities learn as opportunities form (Alvarez & Barney, 2007), individuals vary in their evaluations and confidence of what is being cognised as an opportunity or new venture idea, sometimes referred to as opportunity seeking (Dana, 1996; Davidsson, 2015; McMullen & Shepherd, 2006), and opportunities can vary from focused ideas that are planned for and pursued to resource considerations that are adapted to one of many possible outcomes, sometimes referred to as opportunity reacting (Dana, 1996; Sarasvathy, 2001). Indeed such variance in context and action paths associated with entrepreneurial process has led to approximately 80% of entrepreneurship articles not offering a definition of the opportunity construct that they theorise about and about a dozen variations of opportunity specification for those articles that do define the construct (Davidsson, 2015). Although all contexts and opportunity constructs to some degree have considerations for supply and demand pairings, which is our broad focus herein (with variation in temporal order and source of changes for each side of such pairings), our focus is primarily on 'opportunity identification' or what Davidsson (2015) refers to as "New Venture Ideas". In short, we are focused on the construct of a manifest venture or business model that involves pairing some product/service/technology/know-how (solution) to some market/demand/inefficiency (problem). Knowing the delineation of the type of opportunity construct that we are theorizing about is useful for understanding our propositions and the situations to which they have external validity. Additionally, knowing the definition of opportunity that we are theorizing about can guide future research into moderators. For example, scholars researching the same construct as we do here, note that as novelty increases, the information processing requirements on teams change correspondingly (Amason, Shrader & Thompson, 2006). This idea is consistent with our conceptualization of problem-solution pairings that are 'complex' being more likely to be recognised by teams (more processing requirements) and, therefore, probably more rare and valuable, which future research could examine.

Opportunity construct type and definition are not the only other considerations for discussing the applicability of our propositions; we also need context/culture considerations. Eckhardt and Shane (2003) insist that one of the more pressing issues for our field is to increase scholarly understanding of how opportunities are identified given the stylised constraints of various contextual issues. Some work in this area has already begun; indeed, scholars find support for contextual and cultural components playing a role in the identification of, evaluations of, and responses to business opportunities (e.g., Dana; 1996; Dana, 2009; Ma, Mattingly, Kushev, Ahuja & Manikas, 2019). One particularly relevant implication of culture to opportunity identification processes is the variance in cultures from collectivist to individualist (Baughn & Neupert, 2003; Dana, 1996). Specifically, cultures that are more collectivist exhibit individuals conforming to values such as close social frameworks, family members' and other-in group members' loyalty and social exchanges, and higher degrees of integration of work and private life (Gambrel & Cianci, 2003). Dana (1996) explains that the importance of social status, social recognition, and social exchanges to a culture partially drives entrepreneurial actions. Indeed, it may be the case that actions driven by collectivist culture values might increase the likelihood

that entrepreneurial processes are pursued by teams whereas they might be more likely to be pursued by individuals in individualistic cultures. Such a relationship, coupled with the theory developed herein, would suggest that collectivist cultures would be more likely to identify valuable opportunities, given the greater access to informational consideration sets within their groups. This may help explain why close in-groups, such as families, are so prevalent in entrepreneurial activities that scholars identify such groups as "the oxygen that feeds the fire of entrepreneurship" (Rogoff & Heck, 2003, p.559). On the flip side, individuals that do not conform to in-group and cultural norms are more likely to engage in entrepreneurial activities as they learn that their purpose and values are not well respected by the larger groups (Dana 1996; Hagen, 1962). Future research, therefore, could apply the process of accessing consideration sets in the business model development process to these, and other, cultures to increase scholarly understanding of how entrepreneurial processes might be more desirable for some peoples and how such processes can be more parsimonious.

CONCLUSION AND PRACTICAL SUGGESTIONS FOR ENTREPRENUERS

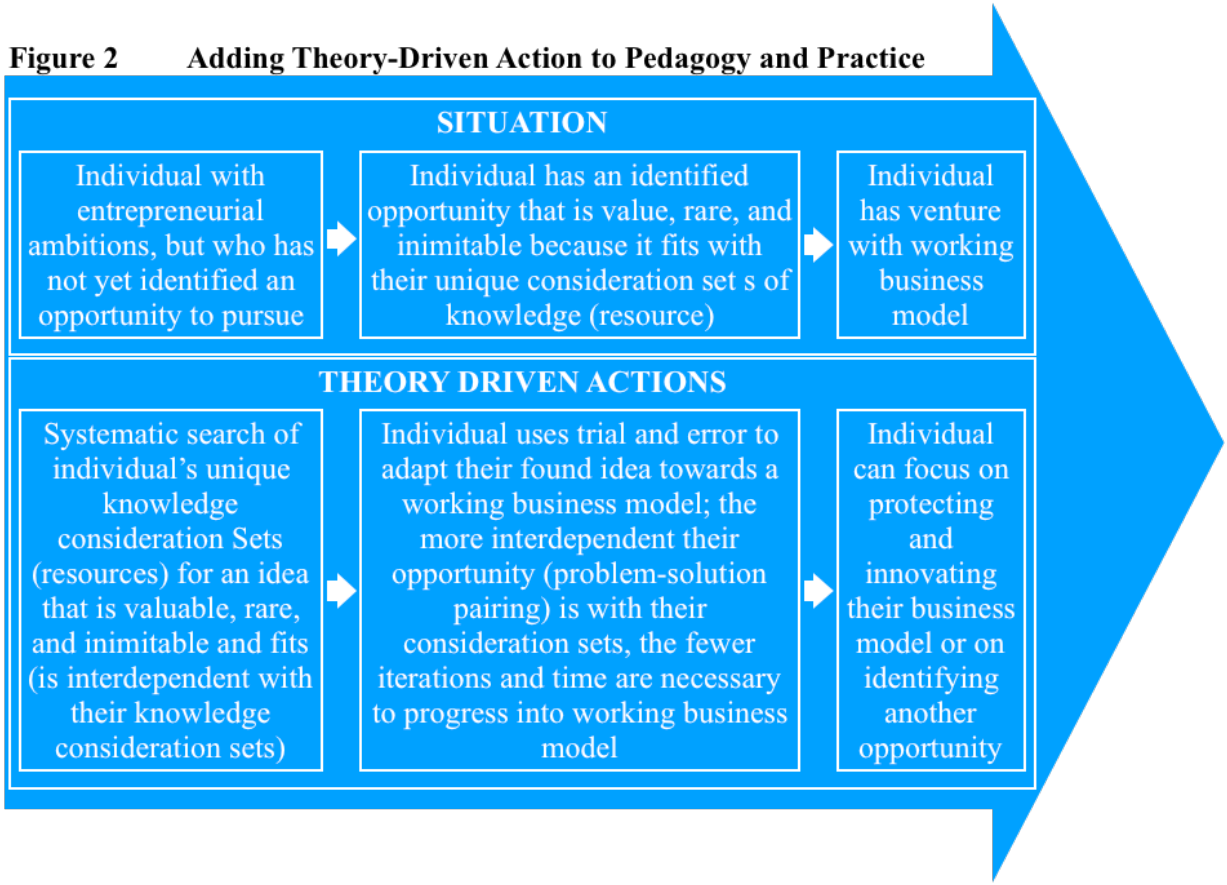
If we are going to continue to rely on business model generation, cognitive alignment of problems and solutions, and pivoting through trial and error for pedagogy in entrepreneurship, then it is critical that we develop some theoretical underpinnings for how such process work and how we can improve on such processes. Here, we try to outline, not only a theoretical basis for problem solving pairings and pivoting such pairings towards business models, but focus on a logical basis for how entrepreneurs might find more valuable ideas and progress them faster, relying on fewer trials, and therefore fewer errors.

A few practical recommendations for entrepreneurs, managers with responsibilities associated with corporate venturing, product line managers, and corporate entrepreneurs naturally follow the theoretical contributions herein. First, individuals aspiring to identify valuable opportunities should try to make the process of identification as parsimonious as possible. As outlined, having an externally generated problem or solution in mind at the onset is a good place to start as it will likely reduce the time spent searching for an appropriate pairing. This means that individuals should search externally first for either, but not both, a problem (unmet market need) or solution (new technology with little to no commercial application) first. Then, individuals should utilise that half of a problem-solution pairing as the object of their search to guide an internal search of their own specific, consideration sets (knowledge, past experiences, and unique memories) for the missing half of the pairing in hopes of finding a match with cognitive alignment.

Other practical recommendations for individuals to consider as they endeavour on this process are to intentionally embrace those pairings that are complex, especially ones whose complexity is well understood because the complexity lies in the half of the pairing from one's own consideration set or specific knowledge. Such complexity is desirable because it is likely associated with value. One way to access more complex (and probably more valuable) pairings without compromising ones ability to process that complexity given humankind's cognitive capacity is to engage in this process with a team rather than alone. Although teams certainly come with their own set of problems and complexities (*cf.* Leonard-Barton, 1992; Van de Ven, 1986), those complexities must be weighed against the breadth of knowledge and increased cognitive capacity benefits that come from teams, especially heterogeneous ones. Above, we articulate how the complexity of problem-solution pairings plays a role in driving these attractive

attributes of new ideas or business models, which may make utilising heterogeneous teams during entrepreneurial search efforts advantageous over going it alone. As a final comment on why the outlined search process should be considered by practitioners, consider the benefits such search can offer to the process of adjusting that problem-solution pairing into a business model after it is identified. Consistent with pedagogy and practice, more and more prevalent use of business model generation practices (pivoting, trial and error, fail fast and often, etc.) suggests we need to be better at identifying how to improve such processes. Herein, we outline theory-driven rational for why the steps we outline above for searching one's consideration sets with a problem-solution pairing in mind will likely lead to a more parsimonious business model development process with respect to time and number of pivots required. Aspects of these practical suggestions along with the theoretical logic underpinning them are provided in figure 2.

Figure 2 Adding Theory-Driven Action to Pedagogy and Practice



Future research that empirically examines the relationships proposed in this framework can inquire about the time it takes for individuals to progress from idea to working business model as well as the number of iterations an idea went through to get at one of the dependent construct of interest. For more nuanced examination, empirical work could study the number of hours spent identifying and iterating a problem and examine the mitigating effects of teams. Empirical work could also examine the value of problem-solution pairings retrospectively or via raters judging the fit, value, rarity, inimitability of problem-solution pairings, consistent with the resource-based views conceptualisation of what constitutes a competitive advantage. It remains to be seen which of the relationships proposed will hold up to empirical scrutiny, thus we propose that these relationships be examined by monitoring and surveying individuals who want to be entrepreneurs, but still need an idea as they progress from aspirational to an idea in hand, to

iterating towards a workable business model. Importantly, such work will almost certainly lead to a refining of the framework proposed and further increase our theoretically-driven understanding of how individuals can find valuable ideas and progress them as quickly as possible into working business models.

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