STAY THE COURSE OR PIVOT?
ANTECEDENTS OF COGNITIVE REFINEMENTS OF BUSINESS MODELS IN YOUNG FIRMS

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ABSTRACT

This paper focuses on cognitive refinements that young firms undergo as they strive to define a viable business model. Drawing from detailed data on the business model honing processes of 143 founding teams over a period of eight weeks, and in-depth fieldwork including longitudinal interviews with founding team members, we ask whether specific characteristics and search behaviors of founding teams drive business model change. Our findings show that search of market information and hypotheses-driven experimentation activate the business model honing process. Moreover, specific team characteristics, such as having an MBA on the team, have significant heterogeneous effects on the business model validation process. This paper contributes to the emerging discussion on business model change, and on understanding the difference between opportunity and strategy.

"We decided our company was a go! We have enough data supporting our hypotheses and some good feedback from potential partners." This declaration in our sample is the epitome of all young firm goals, as founding teams strive to validate their business model. Essentially, having the right business model – i.e. an effective logic through which value is created and delivered to customers – is key to firm performance (Amit and Zott, 2001; Zott, Amit and Massa, 2011). Research shows that both novelty of the business model design (Zott and Amit, 2007) and product-market readiness (Zott and Amit, 2008) are significant for the success of the business model. Scholars also find that the design of effective business models is an intrinsically cognitive activity, and that business models are learned and fine-tuned over time (McGrath, 2010; Andries, Debackere and Van Looy, 2013).

However, despite these rich insights of prior work and theories about the antecedents of business model design typologies (Amit and Zott, 2015) and business model development processes (Snihur, Reiche and Quintane, 2016), there is little empirical evidence of the process through which new business models are crafted into existence. How business model design evolves from an initial assumption about the potential business opportunity and the corresponding exploitation strategy, toward a more crystalized and validated design remains largely unexamined. More specifically, it is not clear how teams refine their business models from an initial, fuzzy perception of a *presumed* effective business model to a more crystalized understanding of an *actually* effective business model. Thus, we ask which team-level behaviors and characteristics lead to cognitive refinements of business models, as young venture teams strive to create effective business models. This is an important question because of the relevance of business model design for firm performance, and the cognitive challenges underpinning change.

To examine our research question we focus on the cognitive refinements of 143 founding teams over an 8-week period as the teams strive to create effective business models. These refinements reflect either a change in the business opportunity (value creation), a change in the exploitation strategy (value delivery), or both (Wasserman, 2012: 277; Teece, 2010). Our research setting is the *I-Corps program*, an entrepreneurship initiative launched in 2011 and sponsored by the *National Science Foundation*. I-Corps draws from the new venture opportunity hypothesis-driven experimentation methodology (a.k.a. the lean-startup method), which is being used by hundreds of thousands of young firms worldwide. The methodology draws its inspiration from discovery-driven planning (McGrath and MacMillan, 1995), and the program builds heavily on the business model canvas template popularized by Osterwalder and Pigneur (2010), which has sold over one million copies. All teams participate in the same predefined entrepreneurship workshops and are given the same instructions to gather information that may support or reject the opportunity- and strategy-logic assumptions underlying their business-models-in-progress. In other words, the teams receive the same training and tasks, but differ in changes in business models, process, team composition, and success.

There are several findings. First, we show evidence that entrepreneurship interventions, such as I-Corps, are effective at spurring young firm teams to question their initially perceived business models and refine them on the basis of information external to the firm. That is, the program appears to help young firms dislodge from an initial (presumably low-potential) trajectory that would have been tracked in the absence of the intervention. In particular, two processes that are at the core of the I-Corps methodology – i.e. gathering more market information through customer interviews, and conducting more hypothesis-based experimentation of the business model assumptions - result in more business model refinements.

We also find evidence of the relation between business model refinements and team composition. In particular, a management education background within the team is related with lower strategy-logic refinements, while team gender heterogeneity appears to have a U-shaped relation with the number of opportunity-logic refinements, such that multi-gender teams conduct fewer refinements.

This paper contributes to strategy and entrepreneurship by uncovering how young venture founding teams make cognitive changes to business models as they refine their understanding of the business opportunity and the corresponding exploitation strategy. This phenomenon is uniquely different from that of strategic change (Rajagopalan and Spreitzer, 1997), which has been analyzed extensively in the strategy literature. While strategic change unfolds over long periods of time (anywhere from months to years) (e.g, Zajac, Kraatz and Bresser, 2000; Golden and Zajac, 2001, Nadkarni and Barr, 2008), cognitive changes in the business model of young firms typically occur relatively fast (e.g., from one week to another). Moreover, while strategic change focuses on incumbent firms and their efforts to modify established structures and strategies (e.g., Barker and Duhaime, 1997; Zhang and Rajagopalan, 2010; Berends *et al.*, 2016), our focus is on the early phases of the (cognitive) exploratory process of business model emergence, absent of organizational "baggage." Therefore, rather than focusing on the protracted adaptation that occurs in incumbent firms, we focus on the swift changes that occur in young firms.

Our rich empirical data further contribute to a better understanding of business models of young firms. Prior work has been mostly conceptual (e.g., McGrath, 2010; Chesbrough, 2010; Zott and Amit, 2010; Snihur *et al.*, 2016) and qualitative (e.g., Amit and Zott, 2001; Rindova and Kotha, 2001; Demil and Lecocq, 2010; Andries *et al.*, 2013; Amit and Zott, 2015). A few

quantitative papers focus on business model revisions of incumbent firms (e.g., Zott and Amit, 2007, 2008; Brea-Solís *et al*., 2015; Kim and Min, 2015; Osiyevkyy and Dewald 2015; Gerasymenko *et al.*, 2015), but not enough attention has focused on business model honing in young firms. This paper helps fill this lacuna described by Demil et al. (2015) around the emergence of new business models–i.e. the time when founding teams are working to validate the existence of a business opportunity. Because change is particularly difficult once organizational structures and assets are in place (as has been widely studied by the strategic change literature), understanding how young firms (who are devoid of organizational "baggage") craft into existence high-potential business models is particularly important. Especially given the performance implication of discovering an effective business model early on (McDonald and Eisenhardt, 2014).

Finally, our research setting and the hand-collected dataset are particularly unique. As a widespread initiative that aims at helping inventors discover a viable business model, our focus on unraveling the effects of the I-Corps program is of interest to scholars as well as to the broader entrepreneurship policy community. Moreover, the unique, real-life longitudinal data that our setting offers is particularly valuable. We observe real-world founding teams that strive to push actual inventions into the market (rather than students engaging in class exercise). Moreover, to the best of our knowledge, the level of granularity (i.e. weekly observations of each change in the business model) is unprecedented in the literature. We have no recollection of anyone who has yet analyzed the emergence and evolution of business models with such level of detail.

THEORETICAL BACKGROUND

A young firm's business model articulates the opportunity logic by which it creates, and the strategy logic by which it delivers value to customers (Teece, 2010). A business model thus depicts the goods and services, the participating parties, and how the ownership of goods and services is exchanged in the exploitation of a business opportunity (Amit and Zott, 2001). Business models typically illustrate a set of interconnected organizational activities that create and deliver value, part of which is captured by the young firm (McDonald and Eisenhardt, 2014). On one hand it illustrates the means-ends nexus of the business *opportunity* by describing the value propositions and corresponding market segments (i.e., the technology-market fit). On the other hand, it illustrates the exploitation *strategy* by describing the distribution channels needed to reach customers; the activities and partners required for an adequate exploitation; the ways in which the business will achieve, maintain and grow a close relationship with customers; and the resources that will enable the exploitation of the opportunity. Thus, a business model reflects both opportunity- and strategy-logics (Teece, 2010) of young firms.

Because a business model is an abstract, cognitive representation of a business opportunity and the corresponding strategy to exploit that opportunity, it describes current or yet-to-be-implemented opportunities and exploitation strategies. In other words, business models reflect the founding team's *assumptions* about what customers need, how the organization can best organize to meet those needs, and how a profit can be made. Thus, as a business model emerges and evolves from imagination to implementation, it carries a series of unvalidated hypotheses yet to be tested. Therefore, from a risk-mitigation perspective, it can be useful to expend efforts to validate an unproven business model before committing relevant resources towards its implementation (e.g., Gruber, MacMillan and Thompson, 2008; McGrath, 2010). In fact, recent qualitative research finds that the chances of business model viability can be greatly

improved by implementing techniques that enhance the learning process, such as business model experimentation (Andries, Debackere and Van Looy, 2013; Achtenhagen, Melin and Naldi, 2013; McDonald and Eisenhardt, 2014). Experimentation helps managers discover and assess multiple alternatives, gather valuable information, make better decisions, and enact the changes that lead towards higher-performing trajectories. Committing too early on a specific business model has negative effects on long-term survival and performance (Andries *et al.*, 2013).

As noted above, novelty in business model design is key to venture performance (Zott and Amit, 2007, 2008). The challenge with novelty is, however, that by definition, until its validation, the potential for success is merely an assumption. Therefore, effective validation of the *assumptions* underlying the business model becomes significant for performance (McGrath, 2010; McDonald and Eisenhardt, 2014). These *assumptions* will evolve simultaneously with the deeper understanding by the founding team about the best fit between the solution, the young venture's unique characteristics, and the market's needs. Moreover, throughout the validation process, the original business model may become refined. New information may provide evidence against the *assumptions* underlying the original business model, inducing a refinement in the business model's opportunity-logic, its strategy-logic, or both.

However, some founding teams might decide *not* to refine their business models, despite evidence supporting the rational for change. Not conducting a proper business model validation process may be detrimental to venture performance. For example, there is a tension between committing too early on a specific business model vs. exploring alternative ones through further experimentation. Committing too soon may have short-term benefits to growth while experimenting (i.e., validating assumptions and exploring new ideas) may lead to an increase in variety of possibilities for long-term growth, and has been confirmed to be more favorable to

firm performance (Andries, Debackere and van Looy, 2013; McDonald and Eisenhardt, 2014). Therefore, as founding teams decide to start a new venture, it behooves them to develop (and choose among) a range of business models, before committing significant resources on a single alternative.

At the onset of the business model validation phase, a perceived business opportunity and its corresponding exploitation strategy may be quite fuzzy in nature. As founders gather new information that is relevant to the exploitation of the business opportunity, their perception becomes sharpened. The refinements that occur during the validation of a business model are primarily cognitive in nature, to the extent that no relevant resources have yet been devoted to its exploitation. This is significantly different from the phenomenon of strategic change,[1] which describes the modification of established methods of exploitation by incumbent firms in the face of external change or diminishing performance (Rajagopalan and Spreitzer, 1997; Zhang and Rajagopalan, 2010; Helfat and Peteraf, 2014; Zajac *et al.*, 2000; Barker and Duhaime, 1997; Golden and Zajac, 2001; Nadkarni and Barr, 2008; Mitchell, Shepherd and Sharfman, 2011). Thus, in contrast to strategic change, business model refinements reflect the process of quick, cognitive changes in the opportunity- or strategy-logics, as founding teams search for a viable opportunity and the corresponding exploitation strategy.

A more limited stream of literature examines *antecedents* of business model change, often in longer-tenured firms. For instance, research finds that refinements in the business model will be more likely if founding teams have a board member with prior experience in business model change (Gerasymenko, de Clercq and Sapienza, 2015), when founding teams have a bias towards perceiving opportunities rather than threats (Dewald and Bowen, 2010; Jackson and

[1] Consistent with George and Bock (2011), when managers describe the construct of a "business model", it is clearly distinct from the construct of "corporate strategy".

Dutton, 1988), and when team members have heterogeneous domain expertise (Furr, Cavarretta and Garg, 2012). Together, research suggests that specific founding team characteristics may facilitate business model change. However, we have limited understanding of the team-level antecedents of cognitive change during the *emergence* of young venture business models. To the best of our knowledge, very little work has focused on the antecedents of cognitive changes regarding the honing process by which a perceived opportunity and its corresponding exploitation strategy become validated. We explore this phenomenon during the purest form of business model emergence; before business model design is affected by assets and processes embedded in established organizations. We focus on business model refinement as the cognitive changes in the business models of founding teams, as they hone their understanding of a business opportunity and the best strategy to exploit it.

HYPOTHESES

In the hypotheses that follow we propose that the intensity of business model refinements may be related to three elements: 1. search behaviors (interviews) that help founding teams acquire new information; 2. experimental procedures (hypotheses) regarding the validation of the assumptions underlying the business model; and 3. founding team characteristics (experience, education, diversity). We argue that these three elements are related to refinements, i.e. the cognitive changes that occur in the early stages of the business model refinement process. We define refinements as the cognitive changes in the *components* of the business model. The components of the business model are the *value proposition* and *customer segments (opportunity-logic)*; and *exploitation activities*, *strategic partners*, *resources*, *customer*

relationships, *distribution channels*, *revenue streams*, and *cost structure (strategy-logic)*.[2] Consistent with prior literature on business models, we explore both opportunity and strategy logic refinements of business model design.

Search Behaviors

The bounded rationality tenet (March and Simon, 1958) describes individuals and organizations as imperfectly rational decision-makers, particularly with regards to making economically optimal choices. In essence, it is virtually impossible for economic agents to imagine an optimal business model, simply because the time and cost required to gather and process all possible information outweighs the benefits. This is particularly the case for young firms in unpredictable, fast-moving environments (Eisenhardt, 1989). Moreover, entrepreneurs' perceptions of business opportunities are largely dependent on the information immediately surrounding them (Sørensen and Sorenson, 2003), perceptions that in turn can be biased by non-economic factors, such as novelty, legitimacy, and availability about the opportunities and exploitation strategies. For example, the development of mobile device applications has been a prototypical opportunity and strategy followed by many entrepreneurs, most likely due to the fact that applications are predominant in their daily lives. Thus, a founding team's interpretation about the existence of a specific opportunity may be tainted by incomplete and biased information embedded in their environments, which makes any initial description of a business model likely to be suboptimal and potentially imprecise.

High potential business models are hard to come by. Business opportunities that have not yet been fully exploited—and hence are still worth pursuing—typically reside in cognitively

[2] Within each component, there may be one or more items that characterize the specific attributes of a business model component. For example, in a ski area business model, "skiers", "snowboarders" and "hotel guests" would be three *items* in the customer segment *component*.

distant locations (Gavetti, 2012). That is, they are non-obvious. If they were obvious, economic agents would flock towards those obvious locations and extract the value from their corresponding opportunities long before a new entrant may attempt to exploit those obvious opportunities. This suggests that the opportunities that are worth pursuing reside in the collective knowledge lacunas that have yet to be explored. As literature that focuses on the relation between distant search and firm performance has shown (Cyert and March, 1963; Katila, Chen and Piezunka, 2012; Li *et al.*, 2013), purposeful efforts to gather information that is difficult to obtain have a positive effect on firm performance. In other words, valuable business models will likely be discovered through a process that feeds entrepreneurs with new information.

Specific behaviors associated to exploring for information that is not presently available have been found to help entrepreneurs discover unexploited business opportunities. For example, gathering information through distant networks may help entrepreneurs become opportunity brokers (Dyer, *et al.*, 2008; Burt, 1992) by giving them access to information about means-ends nexus that have not yet been connected. Therefore, the process of acquiring additional information should help founding teams develop a less biased understanding of market needs, as well as expose them to the collective knowledge lacunas that have yet to be exploited. As a consequence, teams who interview more potential market stakeholders are more likely to gather information that they do not currently have, which should help them refine their original, sub-optimal and imprecise business models into better and more accurate representations of a business opportunity. We therefore hypothesize,

> *Hypothesis 1a. Teams that search for more external information are more likely to make business model refinements to the opportunity logics of the business model.*

Analogously, the exploitation strategies devised by founding teams in the absence of external information are likely to suffer from internal biases, such as limited information or knowledge. Therefore, as teams make an effort to gather external information through interviews and networking, they are likely to acquire information that informs them of potentially better strategy logics for exploiting the preconceived business opportunity. We propose,

> *Hypothesis 1b. Teams that search for more external information are more likely to make business model refinements to the strategy logics of the business model.*

Experimentation

Experimentation is about articulating our assumptions regarding the way things work, and designing ways to prove or disprove our assumptions. It is an important antecedent to business value creation. For example, in Dyer et al.'s (2008) study of individual attributes prevalent among entrepreneurs, the behavior of experimentation was one of the key characteristics that distinguished innovative entrepreneurs from non-innovative entrepreneurs. This is consistent with the behavior of bricolage (Baker and Nelson, 2005), by which entrepreneurs experiment with the resources at hand, thus increasing their likelihood of discovering novel and valuable means-ends combinations. As argued by Kerr, Nanda and Rhodes-Kropf (2014:29), "experimentation is particularly valuable in cases where initial information can be especially informative about the overall quality of the project." Thus, individuals who have a tendency towards the behavior of experimentation will probably be quicker at disproving or validating their assumptions, which should allow them to iterate faster towards the discovery of a valid business model.

Potentially valuable business models—those that are in the realms of imagination—are fraught with *assumptions* about how the business opportunity and its exploitation strategy ought

to work. Teams who articulate these assumptions and test them via hypotheses-testing mechanisms are more likely to contrast their imagination of what the business model should look like, against the reality of how a viable business model will actually look like. Contrasting imagination with reality leads to learning, and hence changes in the business model. Thus we hypothesize that:

> *Hypothesis 2a. Teams that articulate more hypotheses-to-test are more likely to make business model refinements to the opportunity logics of the business model.*

In a similar way that our imagination of what a business opportunity should look like may differ from what a business opportunity actually looks like, our imagination about what the correct exploitation strategy is may also differ from what the correct exploitation strategy should look like. Thus we hypothesize that:

> *Hypothesis 2b. Teams that articulate more hypotheses-to-test are more likely to make business model refinements to the strategy logics of the business model.*

Founding Team

Team composition is likely to have an effect on the honing of the business model. Professional and educational backgrounds influence the starting point of the business model refinement process, to the extent that the knowledge stock provided by team members will determine the cognitive representation of the business opportunity landscape (Gavetti and Levinthal, 2000), thus guiding the decision about where to start. For example, Baron and Ensley (2006) find that more experienced entrepreneurs are able to develop more focused and refined opportunity prototypes (i.e. cognitive frameworks) vis-à-vis novice entrepreneurs. That is, expert entrepreneurs craft opportunities that are clearer and richer in content, focusing more on key attributes and aspects directly related to starting and running a new venture. In contrast, novice entrepreneurs tend to focus more on the novelty of the product or service, and the potential of the

opportunity to significantly change the industry. While the business opportunities of novice entrepreneurs may be more creative on average, they are also likely to be less realistic and require more refinements.

Management education provides individuals a better understanding about how businesses work and what kinds of strategies are more effective. Thus, we may expect that individuals who self-select into MBA programs are more sensitive to business opportunities available in their cognitive opportunity landscapes, and, thus, we might expect that teams with an MBA member will be more likely to start their business models near a local peak (Gavetti and Levinthal, 2000). This, in turn, would require fewer refinements of the business opportunity. We therefore hypothesize that:

> *Hypothesis 3a. Teams with management training are less likely to make business model refinements to the opportunity logics of the business model.*

Analogously, we may expect MBAs to have a better understanding of what the optimal strategy to exploit a given opportunity may look like, thus requiring fewer rectifications. We thus hypothesize that:

> *Hypothesis 3b. Teams with management training are less likely to make business model refinements to the strategy logics of the business model.*

Everything else constant, diversity in the founding team may also be significant for the business model honing process. In particular, diverse teams are likely to supply a broader stock of knowledge compared to more homogenous teams. Thus, we may expect greater noise in the initial description of the business model, followed by more refinements as team members work to converge towards a shared model. In contrast, homogeneous teams may reinforce each member's knowledge base, quickly reaching a consensus about the business model description.

Some prior literature has emerged to look at how team-level diversity fosters or hinders changes in the opportunity logics of business models. In particular, findings by Furr *et al.* (2012) suggest that team composition influences cognitive flexibility of firms (i.e. ability to change company's core technology). Teams in which the CEO has extra-domain industry expertise are more likely to make the cognitive and structural changes vs. teams with CEOs who have none. Similarly, Beckman (2006) finds that greater heterogeneity in the business backgrounds (i.e., prior company affiliations) of the founding team is related to the tendency to gather more diverse external information. However, prior work does not offer a clear prediction about what types of backgrounds would lead to greater levels of cognitive changes in the early phases of business model refinement, particularly regarding the degree of founding experience. We hypothesize,

Hypothesis 4a. Teams with greater educational diversity are more likely to make business model refinements to the opportunity logics of the business model.
Hypothesis 4b. Teams with greater educational diversity are more likely to make business model refinements to the strategy logics of the business model.

Hypothesis 5a. Teams with greater age diversity are more likely to make business model refinements to the opportunity logics of the business model.
Hypothesis 5b. Teams with greater age diversity are more likely to make business model refinements to the strategy logics of the business model.

Hypothesis 6a. Teams with greater gender diversity are more likely to make business model refinements to the opportunity logics of the business model.
Hypothesis 6b. Teams with greater gender diversity are more likely to make business model refinements to the strategy logics of the business model.

RESEARCH SETTING AND METHODS

Setting and Population

Because we are interested in the refinements of the business model during the early phases of a young venture's life, we chose a unique setting, *National Science Foundation's Innovation-Corps* program, that allows us to accurately observe the way in which early entrepreneurial teams hone their business models. Innovation Corps (I-Corps), an initiative launched in 2011 by the National Science Foundation in the U.S., is aimed at helping researchers and inventors discover a viable business model. Its purpose is to guide new-venture founders through the business model refinement process to validate the existence of an economically viable means-ends nexus between a specific technological solution and a corresponding market need. In other words, the initiative aims to help participants discover a fit between potential customer needs and the potential solutions provided by the venture's technologies (i.e., a viable business model). It aims to achieve the objective by having entrepreneurial teams participate in a standardized eight-week program coached by professors, investors and successful entrepreneurs. Participant teams are required to enunciate the underlying assumptions of the business model of their initially perceived opportunity and exploitation strategy, design testable hypotheses, and validate these hypotheses through weekly interviews (an average of roughly 9 per week) with potential business stakeholders.

All participant teams are required to begin the program with a preconceived business model. That is, they enter the program with a specific cognitive representation of an opportunity-logic and the corresponding strategy-logic to exploit it, which they make explicit on a business model "canvas" (Figure 1). In other words, the business model at the beginning of the program is likely to reflect the opportunity and exploitation strategy perceived by the team in an ill-defined, imprecise state, but nevertheless explicitly outlined for the team to be able to start the program.

By closely observing the detailed evolution of each team's business model over eight weeks, we are able to study business model refinements (i.e. the cognitive changes) that participating teams undergo. For example, a team may start the first week with an assumption of specific market segments that would benefit from their solution, only to remove or add market segments the following weeks after conducting interviews with potential business stakeholders. Figure 1 shows a prototypical business model canvas (components of the model) for a given team during a week of the program (week 6). Items marked with a star were added that week, while the strikethrough items (in red) reflect the ones that were removed that week.

[FIGURE 1 ABOUT HERE]

Our sample is 143 founding teams that participate in the National Science Foundation's I-Corps program across the US. We observe the teams on a weekly basis during eight weeks. The sample is 1,032 team-week observations. We complement the data by demographic information for all 350 members of these teams—including member's gender, age, level of education, and prior work and entrepreneurial background. These data are gathered from LinkedIn profiles of participants.

Team members are on average 34 years old. Seventy-six percent are male, 13% have an MBA, 34% hold a Master of Science degree, and 48% have a Ph.D. At the time of the study, 24% were university professors. On average, participants have held five previous job positions in the past, and 32% of the participants have been start-up founders in the past, and 27% had held a C-level position in an organization.

A typical team has two to three members. About 41% of the teams have a member with managerial experience, and 74% of the teams have a member with academic experience. Fifteen percent of teams have a member with an MBA, while 83% of the teams have a member with a

Ph.D. The high number of members with a Ph.D. is consistent with the focus of I-Corps on technology-based entrepreneurship. In terms of past founding experience, on average 48% of teams have a member who has been an entrepreneur in the past (before the program). Only 7% of teams are composed of women-only members. Overall, our sample closely represents the broader population of professional entrepreneurs, in contrast to using students as study subjects.

Because of the competitive nature of the I-Corps program (participants must go through an application process and commit to an intense program-related work-load), teams are highly likely to spend considerable effort on honing their business model during the eight weeks of the study. Moreover, teams are required to report their progress on a weekly basis, monitored and incited by the program's instructors. While our sample spans several cohorts, all cohorts last 8 weeks, use the same online teaching materials, apply the same supervision and feedback methods, and apply the same evaluation protocols.

All teams are required to enunciate their pre-conceived business models during the first week of the program. Each team is required to describe the details of their business models on the program's online platform called Launchpad Central. In particular, two core tasks of the business model refinement process, i.e. "hypotheses to test" and the "number of weekly interviews" were also mandatorily registered on the program's online platform. In the beginning of each program, instructors established an explicit goal for teams to interview at least 8 business stakeholders every week, a goal that was reviewed on a weekly basis. Moreover, each change in the team's business model was required to be noted on the program's online platform on a weekly basis.

Our research setting is particularly appropriate to test the hypotheses. Our sample is comprised of teams who have a preconceived perception of an entrepreneurial opportunity,

which they make explicit in the form of a business model at the onset of the window of observation. We have detailed demographic information on team members, and longitudinal detailed data on their search behaviors, and their experimental methods during an eight-week period. Overall, we observe decision-making regarding the refinements of teams' business models with high levels of granularity and in real time as the honing process unfolds.

Measures

Dependent variables

The dependent variables of interest are business model refinements, i.e. changes in the opportunity and strategy logics of the business model. We measured refinements as the *number of added and removed items in the business model every week*. For example, a given team may be under the belief that one of the market segments of their perceived opportunity is "optical fiber packaging design engineers". We count the explicit inclusion of this market segment into the business model as *one* refinement. If, at some point during the window of observation the team decides there is a different market segment that has a better fit in their means-ends framework—for example "medical device reliability engineers"—they may add that new market segment to the business model and remove the previous one. In that case, we count the inclusion and exclusion of the two items in the business model as *two* refinements.

Counting both inclusion and exclusion activity is important for proper accounting. While changing one market segment for another could arguably be considered a single refinement, we count both included and excluded items in order to distinguish cases in which only a new market segment was included in the list of market segments, from cases in which a new market segment was included concurrently with the exclusion of an existing market segment. Under the same logic, we count the exclusion of an item in the business model as *one* refinement.

As noted above, the business model description used by the I-Corps program includes nine conceptual blocks that represent the different components of a business model. The value proposition and customer segment components represent the *opportunity*-logic of the business model. Customer relationships, channels, key activities, key resources and key partners represent the *strategy*-logic of the business model. We measured refinements of the opportunity logics of the business model as the sum of the refinements in the value proposition and market segment components. This is consistent with prior literature describing an entrepreneurial opportunity as a means-ends nexus between a specific solution and its corresponding problem (Dyer, Gregersen, and Christensen, 2008; Eckhardt and Shane, 2003; Felin and Zenger, 2009; Kirzner, 1997). That is, while the market segment implicitly describes the protagonist (customer) of the problem to be solved, the value proposition implicitly describes the solution to be offered. Similarly, we measured refinements of the strategy logics of the business model as the sum of the refinements in customer relationships, channels, key activities, key resources and key partner components. This is consistent with the strategic principles of young firms (Bingham and Eisenhardt, 2008). We explicitly exclude the revenue stream and cost structure components of the business plan from the opportunity or strategy logics refinement count, because they describe revenues and costs which implicitly reflect the economic magnitude of the business opportunity. We also conducted robustness tests by including these two components, with no change to our results.

Table 1 reflects the business model refinement activity for each of the individual business model components, as well as the compiled opportunity-logic and strategy-logic refinements. Most of the business model refinement activity at the single-component level occurs in the value proposition and market segments of the business models. On average, teams make about 11 refinements in each of these two components during the program. The average number of

refinements regarding the opportunity-logics of the business model during the observation window is approximately 23, and represents 38% of the total business model refinement activity. In contrast, teams make an average of 27 strategy-logic refinements, representing 47% of all business model refinement activity.

[TABLE 1 ABOUT HERE]

Independent variables

Our first independent variable focuses on the search behavior of teams. Because we are interested in exploring the extent to which the process of gathering external information has an effect on business model refinement (hypothesis 1), we construct a count variable labeled *count of interviews* that records the number of stakeholder interviews conducted by a given team on a given week. The number of interviews a given team reports to have conducted is an accurate proxy for search because participants are held accountable for the quality of the interviews, which are assessed through the detailed minutes of the meeting uploaded to the program's platform and supervised by the program's instructors.

Our second independent variable is the level of experimentation a given team conducts (hypothesis 2). To measure experimentation, we construct a count variable labeled *hypotheses-to-test* that records the number of new business model hypotheses articulated by teams on a given week. These hypotheses-to-test are recorded on the program's platform and represent a key aspect of the program—instructors supervise the extent to which teams articulate and test business model hypotheses.

Our third independent variable is each team member's management education training background (hypothesis 3). This is a binary variable labeled *MBA on Team* that takes the value of one if the team has at least one member with an MBA degree.

Our remaining independent variables focus on team diversity, measured following Harrison and Klein (2007). *Education Diversity* is measured using a Blau index (zero if all members have the same degree), based on the classification of team members into MBA, Ph.D., Bachelor's, Doctor of Law, Doctor of Medicine, Master of Science, and MBA+Ph.D categories. *Age Diversity* is measured by standard deviation of the ages of team members. Finally, *Gender Diversity* is measured as a linear function of gender, such that a full female team takes the value of 1 and a full male team takes the value of 2. Because the two extremes of this function represent gender homogeneity, we construct *Gender Diversity Squared* to explore the effect of multi-gender teams on business model refinements.

Controls

An important potential source of confounding could be the heterogeneity in the characteristics of each of the 14 independent cohorts in our sample that participate in the same training but during different time periods in 2014-2016. While each cohort shares the same curriculum, online material and methodology, each cohort may still differ idiosyncratically. Thus, we control for *cohort fixed effects*. We also include *team fixed effects* to account for heterogeneity between teams, as well as *week fixed effects* to account for systematic program-level differences during the course of the program.

In order to account for team-level demographic heterogeneity, we construct a set of team-specific controls. Because bigger teams may be able to conduct more interviews, we control for team size. Prior literature has also found a relationship between past experience and the recognition of entrepreneurial opportunities (Shane, 2000), suggesting that individuals with more experience may have a larger reserve of knowledge from which to build plausible means-ends nexus, or, more experienced individuals may in contrast experience lower cognitive flexibility

because they develop more rigid cognitive prototypes of what a valid opportunity should look like (Baron and Ensley, 2006). Therefore, we control for the ratio of team members with prior entrepreneurial experience, and the mean age of members in each team.

Statistical Analysis

The data consists of a panel of observations on team-weeks. Our sample includes 1,032 team-weeks and was used to test models with both opportunity-logic and strategy-logic business model refinements as the dependent variables. Because the dependent variables consisted of counts of refinements and had many zero values, we used a negative binomial regression. To control for repeated observations for the same team, we employed both team fixed effects, and the Generalized Estimating Equations (GEE) regression method (in robustness tests), which accounts for autocorrelation that may arise because each team is measured repeatedly across multiple weeks (Liang and Zeger, 1986). To further ensure that unobserved heterogeneity did not affect the results, we included earlier (lagged) values of the dependent variables in the regressions (Heckman and Borjas, 1980). Additionally, to account for any overdispersion in the data, we report all results with robust standard errors.

Table 2 shows the descriptive statistics and correlations for all variables. All independent variables are lagged by one week. The average number of weekly opportunity-logic refinements was 2.82, while the number of strategy-logic refinements was 4.52. On average teams conducted more than 9 interviews and stated 3.59 hypotheses-to-test per week. The Blau index for educational background heterogeneity is 0.39, and the team-members age standard deviation is over 7 years on average. In general, the correlation matrix suggests that the risk of collinearity among predictor variables is low.

[TABLE 2 ABOUT HERE]

RESULTS

Tables 3 and 4 report the fixed effects negative binomial regression model results of opportunity-logic and strategy-logic refinements, operationalized as changes in the corresponding compounded components of the business model. All models include cohort, team and week fixed effects to control for unobserved heterogeneity. Furthermore, the models include the dependent variables lagged by one week as a control for team heterogeneity (Heckman and Borjas, 1980).

Model 1 in tables 3 and 4 include only the control variables. We find that larger teams conduct fewer strategy-logic refinements, and that teams that have older team-members (on average) conduct more strategy-logic refinements.

[TABLE 3 AND TABLE 4 ABOUT HERE]

Model 2 in tables 3 and 4 test the effect of searching for external information on opportunity-logic and strategy-logic business model refinements, respectively. We find that a greater number of weekly interviews are related to more opportunity-logic and strategy-logic refinements, providing support for hypotheses 1a and 1b.

Model 3 in tables 3 and 4 focuses on the relation between experimentation and business model refinements. We find that articulating a greater number of hypotheses about how the business model should work is positively related to business model refinements in both the opportunity and strategy logics of the business model, providing support for hypothesis 2a and 2b.

Model 4 focuses on the relation between educational training and business model refinements. Having a team member with business education does not appear to influence opportunity-logic refinements (Table 3). However, it significantly decreases the likelihood of conducting strategy-logic refinements (Table 4). Thus, hypothesis 3b is supported. A plausible

explanation may be that the strategic training provided by members with an MBA helps teams identify a viable business model strategy early-on in the honing process, precluding them from having to further refine the strategy-logics of the business model.

Next we focus on team diversity. Our models reveal a quadratic relation between gender heterogeneity and opportunity-logic refinements. Contrary to the expectation of finding an inverted U-shaped relation, the negative coefficient on the linear term suggests an average marginally decreasing effect on opportunity-logic refinements as the ratio of female founders increases, and the quadratic term reveals a convex (U-shaped) relation such that gender diversity induces fewer opportunity-logic refinements.

Our full model (7) results are consistent. The interpretation of the regression coefficients suggests that teams that interview 10 additional stakeholders will increase their likelihood of making opportunity-logic and strategy-logic refinements by 28% on a given week. With regard to the effect of hypotheses testing on refinements, an additional hypothesis increases the likelihood of making an opportunity-logic refinement by about 7% on a given week, while increasing the likelihood of strategy-logic refinements by about 15%.

Robustness Tests

Tables 5 and 6 report the main regression models using a generalized estimating equations specification for opportunity- and strategy-logic refinements respectively. Tables 7 and 8 report the Poisson regression results. Unreported regressions mirror regression models in tables 3 through 8, excluding the lagged dependent variable. Results remain consistent throughout.

DISCUSSION

Novel business models are key to firm performance (Amit and Zott, 2001; Zott and Amit, 2007; Kim and Min, 2015). However, discovering a viable business model is a non-trivial exercise that

requires the ability to learn and to make the corresponding business model refinements that incorporate the new information (McGrath, 2010; Gavetti, 2012). Little is known about the process through which new business models are refined from an initial assumption of a business opportunity, to a more realistic understanding of a viable business model. We explored three antecedents of business model design: search and experimentation behaviors, and characteristics of the founding team.

Key Findings

There are several key findings. First, search for new information is useful. Teams that interviewed external stakeholders (especially customers) were more likely to refine their business models. That is, the process of gathering external information by interviewing potential business stakeholders drove teams to question their existing opportunity and strategy logics, and make refinements in the business model. While the act of reaching out to strangers does not come natural to many people (McPherson, Smith-Lovin and Cook, 2001), teams who were able to breach the homophily barrier were able to shake the existing status quo and were more likely to gather new information, which in turn educated them about the existence of better business opportunities and corresponding exploitation strategies.

Second, experimentation proved useful for refinements in both the opportunity- and strategy-logics of business models. This finding is consistent with the conceptual arguments that the discovery of viable business opportunities and their corresponding exploitation strategies is a learning process that is enhanced through experimentation (McGrath, 2010). Experimentation elicits teams to think about—and articulate—assumptions that underlie their belief of the optimal business model. By establishing hypotheses-to-test, teams build the foundations for experimentation. That is, they craft ways in which they can work towards confirming or denying

their subjective understanding of the optimal business model. While prior literature has suggested that experimentation is an antecedent for the discovery of viable business models, to the best of our knowledge this is the first study that empirically finds a relation between experimentation and business model change.

Third, prior experience also influences the likelihood of conducting business model refinements. We find evidence that teams with managerial (MBA) education make fewer refinements in the strategy-logics of the business model. This may be because business education helps teams elicit a starting-point strategy that is closer to the optimal one, thus requiring fewer refinements to reach a local peak in the opportunity landscape (Gavetti and Levinthal, 2000). However, an alternative explanation cannot be ruled out: If the opportunity side of the business model changes sufficiently to warrant a change in the strategy side of the business model, perhaps our results reflect resistance to change due to self-confidence or hubris (Hayward and Hambrick, 1997). Future research will need to untangle this conundrum.

Finally, gender composition of the team is related to opportunity-logic refinements, such that mixed-gender teams conduct fewer refinements than single-gender teams. However, we find no evidence that age or educational diversity affects business model refinement activity.

Implications for Business Model Research

In this study we speculated that business model refinements are correlated with making useful progress towards a novel business model, because novel, high-value business models are likely to be cognitively distant and non-obvious (Gavetti, 2012). An easy confirmation of the business model assumptions during the early stages of the honing process (and thus no need for refinements of the business model) is likely to indicate a low-value, conventional business model already exploited by an incumbent. In contrast, when assumptions are not confirmed, or

hypotheses are rejected, people feel surprised because they encounter something that is counterintuitive, or non-obvious. When teams make business model refinements based on hypotheses that have been rejected, they are forced to think beyond the obvious and into the realm of innovative, high-value business models.

The implications of business model refinements (and the related cognitive flexibility) as a managerial dynamic capability can be profound. Assuming that business model refinements are an action that is beneficial for the process of discovering a viable business model, that is, each refinement takes founding teams one step closer towards a business model that is better than the one they started with, the mechanisms that we identified in this study underlying business model refinements become an important antecedent for firm performance. Under this assumption, teams that make more refinements may be more likely to hone their business models towards a higher performance-potential business model. In other words, insufficient business model refinements prior to launching a company could put young venture teams on a path-dependent trajectory that would limit their potential growth, by bounding it to the business model they prematurely decided to bank on.

Practical Implications

Our findings are also relevant for practice. First, our results show that gathering external information is useful for making refinements to both the opportunity- and strategy-logics of the business model. To the extent that the behavior of gathering external information does not come naturally to all founding teams, programs such as I-Corps that encourage gathering such information will be beneficial for founding teams during the business model honing process. Because the future performance of firms depends so heavily on the business model foundations

established early on, it behooves entrepreneurship policies to expend resources to help breach the barriers to search.

Second, we show that experimentation accelerates the learning process. That is, a thoughtful reflection and articulation of the key assumptions underlying a team's belief of the business model facilitates the development of ways to test these assumptions. Therefore, it behooves young venture teams to embed in their day-to-day business creation activities the principles of experimentation.

Third, we show that cognitive flexibility regarding business model change depends on the founding team idiosyncrasies. This implies that the decision regarding who will comprise the founding team has relevant (and potentially long-lasting) effects on the business model that a nascent organization will pursue. Having a founding team member with an MBA will influence the refinements of the strategy-logics of the business model. Bigger teams will cause more refinements in both opportunity- and strategy-logics of the business model, while gender composition will have heterogeneous effects on business model refinements. That is, the dynamic capabilities of founding teams regarding the business model honing process will be contingent on who becomes a member of the team.

Conclusion

This paper contributes to entrepreneurship and strategy by focusing on the phenomenon of cognitive refinements as teams go through the process of honing their business model. To the best of our knowledge, this paper is the first to empirically tease apart the opportunity- and strategy-logics of business models (Teece, 2010). Not only are we able to test each logic separately, we find that they are distinct constructs that respond heterogeneously to specific antecedents. Our findings indicate that business model refinements are a consequence of search,

experimentation, and team characteristics. These procedures, behaviors and characteristics may be considered as managerial dynamic capabilities that, presumably, help in the discovery of viable, high-value business models. Overall, our findings contribute to a more granular understanding of young-firm business models, managerial cognition, and dynamic capabilities.

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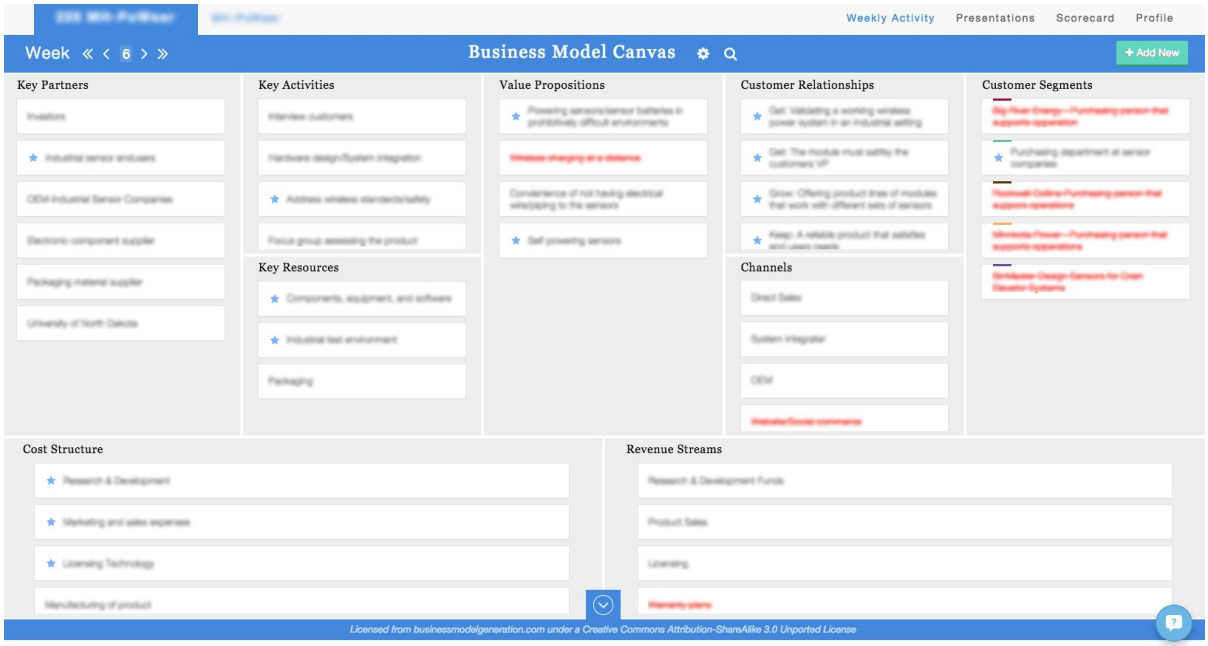
FIGURES

Figure 1: Prototypical Business Model Canvas



TABLES

Table 1: Refinement Activity For Each BMC Component

	Mean	S.D.	Min	Max	Perc.
Opportunity-logic	*22.6*	*12.1*	*4*	*75*	*39%*
Value Propositions	11.1	6.8	2	37	19%
Customer Segments	11.5	6.9	0	47	20%
Strategy-logic	*27.3*	*12.2*	*9*	*73*	*47%*
Key Partners	7.1	5.2	1	39	12%
Channels	5.1	3.5	1	17	9%
Customer Relationships	5.2	3.3	0	22	9%
Key Activities	5.0	2.7	1	16	9%
Key Resources	4.4	2.3	0	13	8%
Cost Structure	4.4	2.1	0	11	7%
Revenue Streams	4.9	2.7	1	16	8%
Total Refinements	**58.7**	**23.23**	**23**	**160**	**100%**

Table 2: Descriptive Statistics and Correlations

Variable		Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10
1	Opportunity-logic Refinements	2.82	3.96	0	32	-									
2	Strategy-logic Refinements	4.52	7.31	0	52	.59	-								
3	Team Size	2.45	.99	1	5	.02	.05	-							
4	Member Mean Age	34.28	7.61	19	64	.00	-.01	-.29	-						
5	Ratio of Entrepreneurs on Team	.28	.34	0	1	-.03	.01	-.05	-.01	-					
6	Count of Interviews	9.66	7.30	0	64	.16	.02	.03	.08	-.03	-				
7	Hypotheses to Test	3.59	6.22	0	49	.52	.85	-.02	.00	.02	.00	-			
8	MBA on Team	.15	.35	0	1	.00	.02	.51	-.26	.04	-.04	-.01	-		
9	Education Heterogeneity	.39	.31	0	1	.03	.04	.28	-.25	-.03	-.03	-.01	.20	-	
10	Age Standard Deviation of Team	7.11	5.37	0	23.33	.02	-.01	-.23	.48	.04	.07	.00	-.23	-.08	-
11	Gender Composition (female=1; male=2)	1.78	.31	1	2	.04	-.03	-.07	.03	.17	.01	-.01	-.22	.00	.20

Table 3: Negative Binomial Regression Analysis on Number of Opportunity-logic Refinements

Opportunity-logic Refinements	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Interviews		0.028***					0.028**
		(0.000)					(0.005)
Hypotheses-to-test			0.082***				0.073***
			(0.000)				(0.000)
MBA on Team				-0.233			0.361
				(0.501)			(0.458)
Education Diversity					-0.240	-0.206	-0.419
					(0.633)	(0.638)	(0.451)
Age Diversity					-0.022	-0.042	-0.039
					(0.470)	(0.118)	(0.267)
Gender Diversity					-0.127	-11.547*	-19.451*
					(0.822)	(0.041)	(0.017)
Gender Diversity Sqrd.						3.467*	5.927*
						(0.041)	(0.014)
Team Size	-0.007	-0.021	-0.072	0.014	-0.107	-0.023	-0.193
	(0.965)	(0.901)	(0.688)	(0.935)	(0.630)	(0.908)	(0.433)
Average Member Age	-0.003	-0.004	-0.006	-0.004	0.005	0.012	0.007
	(0.846)	(0.811)	(0.699)	(0.778)	(0.861)	(0.598)	(0.814)
Entrepreneurs Ratio	-0.108	-0.158	-0.081	-0.152	-0.352	-0.211	-0.183
	(0.747)	(0.638)	(0.822)	(0.655)	(0.450)	(0.600)	(0.731)
Lagged DV	-0.039***	-0.034**	-0.011	-0.039***	-0.053***	0.006	-0.018
	(0.001)	(0.003)	(0.342)	(0.001)	(0.001)	(0.638)	(0.219)
Constant	-0.370	-0.447	-0.392	-0.196	0.501	8.057+	15.326*
	(0.680)	(0.620)	(0.685)	(0.833)	(0.754)	(0.088)	(0.027)
Chi-squared	220	237	372	221	150	24	254

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.

Table 4: Negative Binomial Regression Analysis on Number of Strategy-logic Refinements

Strategy-logic Refinements	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Interviews		0.029***					0.028**
		(0.000)					(0.003)
Hypotheses-to-test			0.160***				0.155***
			(0.000)				(0.000)
MBA on Team				-1.064**			-1.138+
				(0.003)			(0.051)
Education Diversity					0.056	0.081	-0.827
					(0.892)	(0.844)	(0.232)
Age Diversity					0.004	0.005	-0.047
					(0.862)	(0.820)	(0.321)
Gender Diversity					-0.278	2.374	-2.253
					(0.557)	(0.633)	(0.765)
Gender Diversity Sqrd.						-0.804	0.576
						(0.592)	(0.802)
Team Size	-0.328*	-0.325*	-0.374+	-0.274+	-0.767***	-0.780***	-0.675*
	(0.032)	(0.036)	(0.080)	(0.082)	(0.000)	(0.000)	(0.028)
Average Member Age	0.009	0.006	0.036+	0.005	-0.004	-0.004	0.117*
	(0.505)	(0.662)	(0.060)	(0.718)	(0.834)	(0.816)	(0.024)
Entrepreneurs Ratio	-0.255	-0.278	0.159	-0.414	0.035	0.011	-0.049
	(0.370)	(0.331)	(0.673)	(0.154)	(0.926)	(0.977)	(0.939)
Lagged DV	-0.029***	-0.027***	0.005	-0.029***	-0.005	-0.005	0.008
	(0.000)	(0.000)	(0.356)	(0.000)	(0.505)	(0.498)	(0.231)
Constant	-0.077	-0.173	-2.157*	0.709	1.936	-0.137	-0.021
	(0.926)	(0.834)	(0.043)	(0.418)	(0.146)	(0.973)	(0.997)
Chi-squared	133	152	624	140	38	38	486

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.

Table 5: Generalized Estimating Equations Regression Models on Opportunity-logic Refinements

Opportunity-logic Refinements	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Interviews		0.005***					0.012***
		(0.000)					(0.000)
Hypotheses-to-test			0.027***				0.018***
			(0.000)				(0.000)
MBA on Team				0.021			0.103**
				(0.581)			(0.010)
Education Diversity					-0.007	-0.016	-0.008
					(0.920)	(0.800)	(0.863)
Age Diversity					0.001	0.000	0.002
					(0.730)	(0.943)	(0.343)
Gender Diversity					0.118	-1.119+	0.019
					(0.110)	(0.071)	(0.959)
Gender Diversity Sqrd.						0.375+	0.041
						(0.056)	(0.729)
Team Size	0.005	0.009	0.005	0.004	0.002	0.009	-0.021
	(0.855)	(0.747)	(0.823)	(0.882)	(0.902)	(0.608)	(0.122)
Average Member Age	-0.002	-0.001	0.001	-0.002	0.000	0.000	-0.005+
	(0.274)	(0.278)	(0.441)	(0.302)	(0.882)	(0.863)	(0.058)
Entrepreneurs Ratio	0.014	0.006	0.029	0.019	-0.035	-0.028	-0.089**
	(0.661)	(0.834)	(0.243)	(0.557)	(0.434)	(0.534)	(0.003)
Lagged DV	0.004*	0.005**	0.014***	0.004*	0.006+	0.005	0.014***
	(0.022)	(0.002)	(0.000)	(0.033)	(0.088)	(0.110)	(0.000)
Constant	-0.482***	-0.548***	-0.717***	-0.500***	-0.455**	0.518	-0.557+
	(0.000)	(0.000)	(0.000)	(0.001)	(0.004)	(0.277)	(0.063)
Chi-squared	281	382	639	283	152	156	297

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.

Table 6: Generalized Estimating Equations Regression Models on Strategy-logic Refinements

Strategy-logic Refinements	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Interviews		0.009***					0.012***
		(0.000)					(0.000)
Hypotheses-to-test			0.034***				0.025***
			(0.000)				(0.000)
MBA on Team				-0.113*			-0.066
				(0.049)			(0.133)
Education Diversity					0.073	0.070	0.102+
					(0.265)	(0.283)	(0.050)
Age Diversity					0.001	0.001	0.003
					(0.648)	(0.765)	(0.358)
Gender Diversity					0.016	-0.730	0.671
					(0.834)	(0.240)	(0.115)
Gender Diversity Sqrd.						0.226	-0.246+
						(0.239)	(0.067)
Team Size	0.029	0.042	0.070+	0.036	0.009	0.013	0.053**
	(0.309)	(0.157)	(0.056)	(0.192)	(0.582)	(0.438)	(0.001)
Average Member Age	-0.001	-0.001	0.002	-0.001	0.003	0.003	0.004
	(0.396)	(0.324)	(0.291)	(0.236)	(0.225)	(0.197)	(0.239)
Entrepreneurs Ratio	-0.005	0.010	-0.061	-0.021	0.047	0.051	0.093**
	(0.881)	(0.702)	(0.312)	(0.486)	(0.287)	(0.252)	(0.001)
Lagged DV	-0.003+	-0.003*	0.004*	-0.003+	-0.004	-0.004	0.003*
	(0.062)	(0.048)	(0.017)	(0.081)	(0.133)	(0.132)	(0.029)
Constant	-0.430*	-0.578**	-0.947***	-0.357*	-0.326+	0.258	-1.562***
	(0.020)	(0.001)	(0.000)	(0.048)	(0.067)	(0.596)	(0.000)
Chi-squared	465	447	1096	1312	51	52	305

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.

Table 7: Poisson Regression Models on Opportunity-logic Refinements

Opportunity-logic Refinements	Model 1	Model 2	Model 3
Interviews	0.023***		0.021***
	(0.000)		(0.000)
Hypotheses-to-test		0.093***	0.092***
		(0.000)	(0.000)
Lagged DV	-0.028***	-0.009+	-0.005
	(0.000)	(0.068)	(0.370)
Chi-squared	.	.	.

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.

Table 8: Poisson Regression Models on Strategy-logic Refinements

Strategy-logic Refinements	Model 1	Model 2	Model 3
Interviews	0.028***		0.026***
	(0.000)		(0.000)
Hypotheses-to-test		0.176***	0.175***
		(0.000)	(0.000)
Lagged DV	-0.031***	-0.003	-0.000
	(0.000)	(0.348)	(0.911)
Chi-squared	.	.	.

p-values in parentheses
two-tailed tests: + p<.10 * p<.05 ** p<.01 *** p<.001
Team, cohort and week fixed effects included.