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How Do Entrepreneurs Effectuate in Decision Making? A Prospective Sensemaking Response to Uncertainty

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Abstract

This is a qualitative study exploring the question how entrepreneurs respond to uncertainty through effectuation decision making. Effectuation as a decision-making process allows for greater organizational resilience against environmental shocks and pressures and is recommended for entrepreneurial settings of heightened uncertainty. Through the narrative analysis of four entrepreneurs' own accounts of founding activities in the biotechnology sector, we reveal three modes of effectuation, demonstrating different interaction effects between prospective sensemaking and effectuating in temporal-relational contexts. Entrepreneurs are actors temporally embedded in an evolving, multifaceted context with an uncertain future. When they attempt to satisfy their visions using effectual reasoning, their temporal orientations of framing toward the past, present and future interact, rationalizing the contexts for their actions and imagined paths to the future. The study implies that effectuation decision processes adopted by entrepreneurs in response to environmental jolts can be better understood through the lens of prospective sensemaking.

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Keywords: Entrepreneurial decision making, Effectuation, Sensemaking, Entrepreneurs, Uncertainty, Biotechnology

1. Introduction

Recent studies on entrepreneurial decision making suggest that effectuation as a decision-making mode is most appropriate for entrepreneurs whose ventures are faced with high uncertainty (Chandler et al., 2011; Chesbrough, 2010). Most notably, Sarasvathy's seminal paper and her subsequent studies with her colleagues have put forth the arguments that effectuation principles - means focus, exploitation of contingencies, affordable loss, and pre-commitment from strategic partners - are more effective than causation-based strategies in maintaining control of the ventures' future when entrepreneurs have limited resources (Dew et al., 2009; Sarasvathy, 2001; Read and Sarasvathy, 2005). The process of effectuation decision making enables the entrepreneurs to select possible paths while shaping their visions.

Empirical evidence has provided support for the principles of effectuation (Chandler et al., 2011; Perry, Chandler, and Markova. 2011). Existing studies show that the creation of new ventures and markets is associated with one or more of these principles, rather than with causation reasoning. Furthermore, effectual logic is found to better explain the behavioral difference between entrepreneurs and non-entrepreneurs, and between expert entrepreneurs and novice entrepreneurs in their decision making process and in their perception of and response to risks and uncertainty. Nonetheless, effectual reasoning is under-theorized and underdeveloped because most of these empirical studies in this line of research inquiry do not explain how entrepreneurs actually effectuate and decide to take certain actions in response to uncertainty, in particular contingencies that arise unexpectedly in the ongoing context of venture creation (see a review of effectuation studies by Perry et al., 2011). To advance the theory of effectuation, this qualitative research therefore aims to explore how entrepreneurs effectuate in decision making under uncertainty.

In effectuation decision-making mode, the attention of the entrepreneurs tends to shift to the contexts in which certain key events and encounters (or emergent contingencies) have significant influences on the formation and development of new ventures. Rather than using predictive information derived from business analytics, ‘effectuating’ entrepreneurs must identify, assess and provide meaning to these unexpected, possibly non-recurrent contingencies that may impose sudden constraints on the given means or on the possible paths (as opposed to ‘constraints on possible means’ in causation decision-making mode). Adding meaning or sensemaking is an important element of *human* decision making, and is what gives rise to the legitimacy of orders, behaviors, and actions within an organizational context (Weick, 1993). Gephart, Topal, and Zhang (2011) refer sensemaking to “the process by which people construct, interpret, and recognize meaningful features of the world.” In explaining how entrepreneurs effectuate and make decisions under uncertainty, we argue that effectuating entrepreneurs must undergo a process of sensemaking when they face unexpected contingencies with no precedent in the entrepreneurs’ repertoire of habitual activity. Given the meanings they attribute to such contingencies, the entrepreneurs arrive at their justifications of effectual choices in accordance with certain principles of effectuation. The consideration for justification of effectual actions is what absent from the current theory of effectuation.

We further propose that sensemaking in entrepreneurship is future-oriented such that individual entrepreneurs possess a conviction and an aspiration for promoting a better, albeit an ill-defined, future. As opposed to Weickian’s retrospective sensemaking, future-oriented sensemaking puts emphasis on the probable impacts that the imagined worlds might bring to the environments of the new ventures (Gioia and Chittipeddi, 1991; Wiebe, 2011). To address the research question, we identified four founders from three biotechnology ventures as our subjects

for interviews. Based on the narrative analysis, we found evidence for variation of effectuation modes, namely, cyclic effectuation, focused effectuation and constrained effectuation, which call for combinations of uncertainty-reduction mechanisms: assimilating, experimenting, enacting, and transforming. Furthermore, we find that the dynamic view of human agency proposed by Emirbayer and Mische (1998), which describes the agent-centric, temporal states of social actors' experiences relating to the past, the present and the future, a useful dimension to clarify our understanding of effectuation process from a prospective sensemaking perspective.

The overall research generates three novel contributions to entrepreneurship literature. First, the rich narratives from individual entrepreneurs demonstrate a more profound micro-level decision making behavior that differs from economic or strategic reasoning in maximizing expected returns (Gioia and Chittipedi, 1991; Sarasvathy and Dew, 2005). Second, our model explicitly incorporates the temporal dimension of sensemaking in entrepreneurial decision making process, which enable researchers to trace and construct the non-linear thinking process of the entrepreneurs and to understand the underlying rationales of entrepreneurial actions like creation and exploitation of opportunities and future options in evolving contexts (Garud and Gioliani, 2013). Finally, this qualitative research adds to the growing body of entrepreneurship studies using narrative approach (Fletcher, 2007; Larty and Hamilton, 2011), and complements the case study approach in most research on effectuation (Perry et al., 2011).

This paper is organized as follows. Section 2 presents a literature review on effectuation and sensemaking under uncertainty. Section 3 describes the research methods and section 4 presents the three modes of effectuation derived from narrative analysis. A framework of prospective sensemaking and effectuating in temporal-relational contexts is proposed and discussed in section 6, followed by the conclusion in section 7.

2. Effectuation and Sensemaking Under Uncertainty

2.1 Effectuation under uncertainty

Do entrepreneurs know ahead of time whether what they develop is eventually going to be radical and successful? In the entrepreneurship literature, uncertainty is often thought of as the context within which success of new ventures is unpredictable (Shane and Venkataraman, 2000). Studies of entrepreneurship have long attempted to show information asymmetry as the root cause of uncertainty, which is said to be mitigated by information intelligence. Information asymmetry arises because information about factor prices and value of economic resources is sticky to the contexts and is disparate across the economy (Kirzner, 1997). The more severe the problems of information asymmetry in the economy, the greater the degree of uncertainty associated with entrepreneurial activities. Successful entrepreneurs are therefore identified as individuals who obtain privileged information about profit-making opportunities before others do (Shane, 2000).

Business analytical tools that generate predictions and decision making processes based on predictive information are considered as a scientific management approach towards mitigating information asymmetry problems experienced by decision makers in organizations. However, the effectiveness of these methods as applied to new venture creation has not been overwhelming. Sarasvathy (2001) explains that analytical decision-making processes depend on knowing the causal relations between choices and goals. In cases where entrepreneurial goals are constantly changing and being reconstructed, especially in nascent markets, she calls for a theory of effectuation, rather than causation, to examine the micro-level decision making processes. Because causal relations between means and goals are ambiguous and intractable in

entrepreneurial settings, effectuation as a decision-making mode focuses on exploiting unexpected events and encounters (contingencies) as experienced by the entrepreneurs. In contrast to the causation approach, effectuation processes take a set of means as given and create opportunities from the contingencies which arise unexpectedly. The set of means is a function of who the entrepreneurs are, what they know and whom they know, which are manifested in their individual personalities, abilities and social networks (Sarasvathy, 2001). As such, choosing between imagined paths or enacted opportunities, which bring about probable effects into the future, entails the “characteristics of the decision maker(s) and his or her (their) ability to identify and use contingencies over a dynamic process involving other decision makers interacting with one another” (Sarasvathy, 2001: 250).

It is in the preceding context that we ask the question: how exactly do entrepreneurs effectuate in response to uncertainty in new venture creation? Rather than focusing on predictive information, effectuation decision-making mode shifts the attention of the entrepreneurs to the contexts in which prevailing information about contingencies exists. We argue that ‘effectuating’ entrepreneurs must identify, assess and provide meaning to contingencies in the face of environments that impose constraints on the given means or on the possible paths (as opposed to ‘constraints on possible means’ in causation decision-making mode). Adding meaning or sensemaking is an important element of *human* decision making, and is what gives rise to the legitimacy of orders, behaviors, and actions within an organizational context (Weick, 1993). Consequently, the effectuation processes of the entrepreneurs to select between imminent paths should involve making sense of the present situations in relation to the chosen path of the immediate past.

In the next section, we present sensemaking as a mechanism complementary to effectuation and discuss how sensemaking interacts with effectuation to identify, assess and provide meaning to the contingencies in the face of environmental jolts and constraints.

2.2 Sensemaking under uncertainty

“Sensemaking is about contextual rationality. It is built out of vague questions, muddy answers, and negotiated agreements that attempt to reduce confusion.”

(Weick, 1993, p 636)

Sensemaking is a deliberate cognitive process by which individuals faced with ambiguity attribute meaning to ongoing actions (Weick, 1995). In the Mann Gulch tragedy, Weick attributes the collapse of sensemaking to the loss of the role structure that sustains and enriches the members' relationships in the group. Without the means to cope with rising fears, “when the temperature is approaching a lethal 140 degrees,” in face of a split-second life and death moment, “each person sees something different or nothing at all” (Weick, 1993: 636). The analysis portrays sensemaking, on the one hand, as experiencing more or less equivocality in ongoing circumstances, and on the other hand, as reconstructing more or less order into those ongoing circumstances, even in short timeframes.

In organizations, actors use their interpretive schemes (or mental frames) to rationalize their actions to turn a flow of organizational circumstances into meaningful existence (Weick, Sutcliffe, and Obstfeld, 2005). When critical events or issues emerge to disrupt the actors' previous experience or mental frames, efforts are made to extract and interpret information cues from the circumstantial context. Plausible images or paths of actions are then projected based on the meanings attributed by the actors to the evolving context. Making plausible sense retrospectively and developing plausible images out from ongoing circumstances, using

whatever means familiar to or possessed by individual actors, is essential to reducing ignorance, confusion, and uncertainty about the circumstances (Weick et al., 2005).

Key developments in sensemaking research can be found in the contexts of organizational change and crisis (Maitlis and Sonenshein, 2010). An important insight from these strands of research is that sensemaking brings about the enactment of events associated with crisis or change through shared meanings, which exert an impetus to move forward in an imagined path (Maitlis and Sonenshein, 2010). In the context of new venture creation, a few studies have called for a sensemaking approach to examining the perceptions and interpretations of entrepreneurs and of founding teams that produce shared meanings and understanding to control and shape a desirable environment for new ventures (Cornelissen and Clarke, 2010; Jelinek and Litterer, 1995) and to influence others into accepting the identity of the new ventures (Grimes, 2010).

Sarasvathy (2001) suggests that effectuation is likened to non-linear processes in Weick's sensemaking theory, in that entrepreneurs iterate between actions and frames to enact their operative environments rather than acting based on planned goals and strategies. However, sensemaking in entrepreneurship is also future-oriented, an important departure from Weickian's retrospective sensemaking. Rather than restoring the original environment or repairing the structures and roles that sustain the relations of affected actors, future-oriented sensemaking puts emphasis on the probable impacts that the imagined worlds might bring to the environments of the new ventures (Gioia and Chittipeddi, 1991; Wiebe, 2011). The liability of newness in new ventures is the biggest concern of entrepreneurs when what they create is relatively unknown to existing markets (Wiklund, Baker, and Shepherd, 2010).

We propose that our understanding of how entrepreneurs effectuate under uncertainty can be enriched from the studies of sensemaking. To examine how entrepreneurs interpret information cues from situated events with a view towards the future, we need to understand how individuals relate themselves to the contexts, connect or disconnect between existing and evolving frames, and when they intensify efforts to visualize alternative effects in “living forward”.

2.3 Prospective sensemaking in ongoing effectuation

“Human imagination and human aspirations influence each other and reshape one another continually, both directly and through economic artifacts.”

(Sarasvathy, 2001 p 262)

The criteria to evaluate future impacts of effectual actions do not rest on economic rationalization, but on the entrepreneur, who possesses convictions and aspirations for the future. Sensemaking with an imagination towards a promising future, also called prospective sensemaking, underpins activities associated with producing new product designs (Stigliani and Ravasi, 2012), initiating organizational change (Gioia et al., 1994), founding new firms and creating new markets (Sarasvathy and Dew, 2005). Entrepreneurs constantly face a flow of unexpected contingencies, which may impose or be perceived as constraints and ambiguity hindering the progression of their ventures on the one hand, and as challenges and opportunities for creative enactment on the other hand (Cornelissen and Clarke, 2010; Jelinek and Litterer, 1995). Sarasvathy and Kotha (2001) indicate that, in the face of Knightian uncertainty about the environment, entrepreneurs are more likely to exploit contingencies through experimenting and to deploy available means within their control to create imagined paths to the future. In our view, effectual actions projecting some imagined worlds arise from prospective sensemaking, in conjunction with a capacity to arrive at creative combinations of accessible resources and

flexible organizational arrangements, and a willingness to experiment with alternative paths to future.

The above conceptualization of effectuation processes from a prospective sensemaking perspective puts entrepreneurs as the central human agency, temporally embedded in evolving contexts, and “informed by the past (in its “iterational” or habitual aspect), but also oriented toward the future (as a “projective” capacity to imagine alternative possibilities) and toward the present (as a “practical-evaluative” capacity to contextualize past habits and future projects within the contingencies of the moment)” (Emirbayer and Mische, 1998: 962). Faced with unexpected contingencies, actors can be oriented towards and shifting between one or more temporal dimensions at any given moment (Emirbayer and Mische, 1998). This view suggests that understanding how entrepreneurs relate themselves temporally to the contexts and evolve along these different contexts, even as the entrepreneurs try to ascribe meaning to them, will shed light on the micro-level behavior of effectuating entrepreneurs.

3. Research Methods

3.1 Data Sources

This qualitative study uses narrative analysis to examine how individual entrepreneurs make sense of their decision making process. We identified four founders from three biotechnology ventures as our subjects for interviews. These ventures were all located in biotechnology clusters: two in Canada and one in the US. A description of the ventures, the entrepreneurs interviewed, and the number and timing of interviews is provided in Table 1.

Our criteria for selecting the entrepreneurs were: i) their firms belonged to a sector that is characterized as facing high uncertainty, ii) they had developed a similar type of platform

technology, and iii) the ventures remained a privately held company at the time of our research. We felt that science-based business in the biotechnology sector would provide an excellent context for our study because new firms in this sector are known to face sustained high levels of uncertainty in drug commercialization (Pisano, 2010; DiMasi et al, 2001). We selected entrepreneurs commercializing platform technologies in order to increase their commercialization path decisions. Further, there has been very little entrepreneurship research examining the decision making process of entrepreneurs in science-based business (Maine, Soh, and dos Santos, 2012). Existing studies on scientist-entrepreneurs have focused largely on the impact of their social psychological profiles, human capital and social capital on their commercialization activities associated with academic discoveries (e.g. Audretsch and Aldridge, 2012; Ding and Choi, 2011; Jain, George, and Maltarich, 2009; Lam, 2011; Murray, 2004). Finally, we expected the founders of privately held firms play a significant role in decision making. All the founders had been involved in the development of novel biotechnology platforms aimed at applications in the bio-medical market.

After we invited the founders to participate in our research study through emails and follow-up phone calls, we conducted face-to-face interviews. Two of the four founders were interviewed twice 18 months apart; a second interview with the third founder was pending at the time of the report while the fourth founder had no comments beyond the time he left the firm. The six interviews took place from 2011 to 2012; our first interviews ranged from an hour to an hour and 30 minutes in length and subsequent interviews were about 40 minutes. All interviews were audio recorded and professionally transcribed. In our first interview of each founder, we asked the entrepreneurs to describe the history of company founding, research activities, funding

situations, human capital development, the role of scientific advisory board and strategic partnerships.

Besides interview transcripts, we had a research assistant and a doctoral student who currently work in the scientific research and pharmaceutical areas to help gather archival data since firm founding, which include all press releases, science publications, and patent data from company websites and the United States Patent and Trademark Office (USPTO) website. In addition, we reviewed both trade and scholarly articles relevant to the evolution of biotechnology commercialization to establish a better understanding of the period in the 1990s and early 2000 during which drug delivery platforms were developed (e.g. DiMasi, Hansen, Grabowski, 2003; Greenwood, 2010; Kaplan and Murray, 2010; Pisano, 2006). To get alternative accounts of the same key events we interviewed 2 additional informants (table 1). The use of multiple sources was helpful for identifying and verifying the contexts pertinent to the emergent contingencies that the interviewed entrepreneurs had identified as having significant influences on their decisions. This method of triangulating the data has been widely used in qualitative research to help researchers to obtain a variety of perspectives about key events, to enrich case studies, and to mitigate potential biases in the data (e.g. Santos and Eisenhardt, 2009).

3.2 Analyzing the narrative interviews and materials

Many recent qualitative studies have taken a narrative approach towards entrepreneurship inquiry (Larty and Hamilton, 2011). Narrative research materials can come in variety of forms, like written text, oral narratives and interviews, ethnographical notes, and fictional drama scripts (Fletcher, 2007; Larty and Hamilton, 2011; Riessman, 2008). The interview transcripts from the four entrepreneurs and both internal and external sources of materials pertinent to the entrepreneurs' ventures and the biotechnology contexts became the primary narrative text for our

analysis. The unit of analysis in our study is an event or an encounter that would prompt for effectual rather than strategic responses. We used narrative analysis to discover dimensions and nuances associated with effectuation.

Several steps and internal documentations were taken to support the narrative analysis in this study. First, each of the authors reflected on and shared individual research notes immediately after each interview, identifying the various, interesting aspects of the accounts provided by the entrepreneurs. Second, using the typed transcripts, the authors attempted to interpret and understand a more complete story from the perspective of each entrepreneur, focusing on some prominent events and encounters that would help form the initial structure of analytical dimensions. Third, we identified the descriptions leading up to the events or encounters and the decisions of the entrepreneurs reflecting on those contingencies. We created events tables to capture the descriptions chronologically, and identified key events and contingencies. The overall accounts narrated by each entrepreneur were originally fragmented, messy and non-linear, but through follow-up interviews and further analysis, we were able to connect descriptions and make a better comparison by themes across the individual entrepreneurs.

Finally, we identified the cues from the stories that implied a certain temporal dimension affecting the thinking process of the entrepreneurs at that 'present' moment of their experience as they recalled. Hence, we adopted the temporal-relational contexts proposed by Emirbayer and Mische (1998) in order to categorize quotations from the narratives of each entrepreneur. Given the above structure, we identified three modes of effectuation in different temporal-relational contexts. Explanations and quotations from the entrepreneurs are provided in the next section to support our analytical framework.

4. Modes of Effectuation From a Prospective Sensemaking Perspective

Based on the temporality of framing in evolving contexts, we found evidence that effectuating entrepreneurs situate themselves in one of the three temporal processes, namely, *iterational-projective*, *projective*, and *practical-evaluative*. The conditions that determine the framing depends on the patterns of emergent events as perceived by the entrepreneurs, i.e. continuous change, no change, or episodic change, along with the information cues presented in the evolving contexts. Figure 1 illustrates the three distinct processes of effectuation from a temporal sensemaking perspective.

Insert Figure 1 here

4.1 Cyclical effectuation

Cyclical effectuation refers to an iterational-projective process by which effectuating entrepreneurs repeatedly exploit contingencies and redeploy existing means at their disposal to reinforce or shift the directions of their ventures. The entrepreneurs habitually draw on patterns of past experience and assess the present moment of experience to make sense of ongoing contexts (the iterational element) and to imagine plausible actions that may address their hopes or fears (the projective element). In the face of perceived uncertainty, they act to stabilize their organizations and control an unpredictable future by either avoiding a negative plausibility or pursuing meaningful opportunities arising from their enacted environments.

While broader entrepreneurial visions might change over time as a result of new meanings attributed to unexpected contingencies, emerging experiences that are analogous to those in the past (like those influenced by prior jobs, social relations, achievements as well as setbacks) and formative experiences (like those shaped by original founding environment, prior

knowledge and skill sets of the founding members) are the primary factors contributing to the stability and recurrence of entrepreneurial activities. Effectuating entrepreneurs in this iterative-projective mode of framing tend to engage in a high level of reflectivity, actively identifying familiar patterns and assimilating new experiences to reproduce certain social relations and structures, as well as cognitive structures to ensure organizational continuity.

Entrepreneur A (EA) has educational background in chemical and mechanical engineering disciplines, which were “not absolutely essential but they were helpful” to the founding of the biotechnology venture in 1993. The new venture “was really a merger with a predecessor company” in the energy engineering sector, which EA founded 13 years ago. For almost 6 years prior to incorporating the biotech company, EA had been planning to develop some enabling technology platforms to improve the discovery, delivery and manufacturing of drugs based on chemical engineering principles. The contemplation of switching from energy to biotechnology was made as EA was evaluating the future impact of ongoing economic situations and experimenting with future possibilities in the biotechnology sector.

“At that time the oil industry was going through a lot of difficulties, and the price of oil had dropped rapidly, you know, from between the Arab embargo in 74 to 84, there was a run up in terms of the energy market and this had fallen off, and my perception that it was going to take about 20 years [for the market] to recover. We had to go through two decades of recovery and I didn’t want to basically wait around in a declining industry.”

“I was doing a market analysis and evaluated three areas: the energy, the environment area, and the biotechnology area, and decided environmental area was not a good fit, even though I had technical skills to work in it, ... And, the biotechnology industry, which is quite new, looked quite exciting. And I thought that there was a need for my skillset because so many of the scientists did their research in test tubes but didn’t know how to scale it up to commercial levels.”

“We started looking at how we can better improve the recovery of recombinant proteins. ... These were all white papers. And, between those two ideas we got funding from the National Science Foundation for the recovery for intra-cellular proteins and enzymes, using [our technology], and we got funding from [a large pharmaceutical

company]. So with those two, sort of affirmation of white paper approaches, I decided to shut down my oil and gas company.”

“I definitely decided I wanted to get into an area where I can establish intellectual property, so that I can utilize and develop products, so it will be helpful in terms of creating the value, and providing the retirement. And, part of the reason I chose biotechnology was I really wanted to make a contribution to healthcare, I, you know, I was getting older and I wanted to make a contribution to the healthcare. And I said, well this is one good way to do it.”

Over the years of managing the biotech company, EA had been observing the evolving contexts and reviewing his business propositions in relation to his original vision and experiences. Upon realizing the plausible effects of the present state, EA reclaimed resources from prior commitments and created alternative paths to commercialization from the emergent contingencies. The consequence of placing himself in the flow of time from the past through the present to the future had continued to refine his vision for the company, shape the business model and commercialization value of particular research and development (R&D) projects. EA repeatedly explored new ideas and reassessed the conditions of the markets, and on several occasions, EA abandoned projects and redeployed resources to other uses. According to EA, “we [the company] were always evaluated on the metrics of what we are doing and what we have done.” Below are additional narratives corresponding to the iterational-projective process, demonstrating the assimilating and experimenting mechanisms that reconstruct the means-ends relationships.

“What has changed in the last 18 years, no longer do we have ambitions to become a FIPCO [a fully integrated pharmaceutical company]. So the idea of running a virtual or a semi-virtual company is more into play now. ... what I call a semi-virtual model because we have extensive facilities here, but we bring in people on a contract basis when we need them, or a consulting basis.”

“About six or seven years ago, a researcher approached me from a research institution and asked if I was interested in working with him on [Y] disease because we had in our possession one of the molecules that he wanted to work with. So that’s how that evolved and I said well I’m very interested in [Y] disease because my mother-in-law died of [Y]

disease. It became very personal, and I said well, listen, I'm very interested in doing that. So we've been working on that area for the last seven years.

“We've had many failures, for example, or areas that that we did not want to put a lot of energy in. For example, when we did a reverse micellar purification of [Z], we did it from both organic solvents and with [our technology]. Part of the rationale for not pushing it further is our technology that we developed was locked into [a large pharmaceutical company]. And they decided that they didn't want to move forward on it so we couldn't do anything on it. We had to basically abandon that technology.”

These quotations demonstrate the sensemaking of an entrepreneur through gathering information about unexpected contingencies, applying lessons from past experience, and imagining future plausible actions. Thus, as depicted in the uppermost portion of figure 1, the entrepreneur's decision making is guided by an iterational-projective process, repeatedly linking the imagined future to the present contingencies and past experiences. Next, we turn to a mode of effectuation oriented more towards generating novel possible futures.

4.2 Focused effectuation

Focused effectuation refers to a projective process by which effectuating entrepreneurs attempt to shift away from an iterational process and create new options to overcome environmental constraints on their business ventures. They engage in a low level of reflectivity against the backdrop of ongoing contexts, assume little change in their vision world and continue to exploit contingencies through flexibility and experimentation without abandoning their original inventive concept. They primarily orientate themselves toward the future and deliberately turn contingency situations and challenges into imagined worlds based on their understanding of the conditions of their present context. In response to unexpected contingencies, effectuating entrepreneurs are capable of generating possible future paths of action in accordance with the plausible effects of means-ends relationships conditioned by the temporal-relational contexts (Embiyer and Mische, 1998). Entrepreneurs in projective mode are different from those

in iterational-projective mode in two ways. First, they can act as dreamers and inventors of new possibilities for the future. Second, they can distance themselves from habitual patterns and thoughts and reconstruct experiences based on evolving desires.

Entrepreneur B (EB) founded the company based on an interest that he had developed since his undergraduate studies. He was fascinated with a new hormone discovered by his professor, who later became a founding member of his company, and was further inspired by the concept of gene therapy when he was attending a graduate school elsewhere. So EB decided to pursue the novel idea of delivering the gene expression of the hormonal cell to treat a disease that was caused by auto-immune disorder. In order to develop the idea fully, he collaborated with a post-doc fellow who used to work in his former professor's lab. He and his new partner, however, foresaw the problem of disclosing the idea to the respective universities of their graduate studies and post-doctoral research then. Nonetheless, they were able to turn the situations to their advantages and commit existing resources to developing their novel idea.

“And we know, if we start disclosing this to the universities, they are going to, not only take over, it's just complete, you know, battling between the two of who owns what and things like that. So we decided not to start at that time and just by thinking, collecting [agents] and what not, and that's what we did.”

“He got his first faculty position at [T] University. [Two years after] when I graduated I went to [T] University. [So at that time] The government had a lot of grant funding to fund small companies, so we come in and set up this company. We got a decent-sized grant from them and we could use the grant to do all kind of patent filing. So we used that to finance that on the side and got [T] University out of the pot so we completely owned the patents. So that's what we did and then we focused on getting the science.”

“So it was like a 30 or 40 years old problem that nobody can solve and we solved it by proving it. So we got published in a very nice journal, a lot of media attention and what not. And the next step that we needed to do, the grant funding is going to be pretty tough to get the level of grant funding that we need to push it to commercialization stage, because at that time, you know, there is not a lot funding in the [market].”

EB was extremely focused on his original scientific idea [delivering gene expression into a specific human organ platform] and the company had relied on mostly angel funding to carry out research and development. He recognized the ongoing challenges of pursuing science-based business that is highly uncertain with limited resources and appreciated the pre-commitments from angel investors. Referring to angel investors, EB said they “take the better valuations” from people who understand “what we’re working on.” On one particular angel, EB was grateful for “having him around allowed us to have the flexibility to do a lot of the tinkering, which is part of science.” Going forward EB and his partner relocated their R&D lab out from [T] University to their hometown where many of their angel investors came from.

“At the time the money was available, we raised about, you know, a small seed, around \$2 million bucks. And that allowed us to take the technology out completely, put it into a company, it’s really mostly angel investors. ... In fact we got a lot of money from people that actually read the stuff and disease [X] is something that affect a lot of people, ... we have a couple of very deep pocket families that wanted to fund this thing and push it out.”

“That money really helped us to stop thinking about the process of how to push this thing into a product. You know? What is it like? You know, you think less about the mechanism how this thing [commercialization] works. ...So we came over here and did a lot of those development work here.”

Realizing that existing healthcare and medicinal establishments would not easily accept a relatively unknown science-based business proposition, EB began to imagine plausible worlds moving forward by exploring options in which the original inventive idea can be repackaged. EB experimented with several novel scientific concepts with limited resources while enacting a legitimate context that protects the interests of those who invested earlier in the venture. The narratives below reflected on the ways EB made prospective sense of emergent events that created challenges and opportunities to experiment with alternative paths to future.

“We were playing around with these things, and viruses was what we were betting on the first four to five years. Heavily betting on this thing and it looks like it’s going to work, but one thing based on partly inexperience, it is, you know, never underestimate, you know, the impact of [changes]. You know, sometimes things change and it has nothing to do with you. Then the winds start to blow in the other direction. You’ve got to take that, you’ve got to see ahead of time what this is.”

“Two things that blew against us ... First, the group in Europe that was using virus to treat kids with a bubble boy syndrome, start to have, see toxicity, because the virus randomly insert the gene into the genome. You start to have mutation and cause cancer. ...Second, economically it’s just not possible. We do this exotic way of making viruses, it’s something that drug companies don’t even understand how to make these things.”

“So in the background I push all the scientists here to do not just venturing into a specific disease, ... we also adapted our system to do [something else that became increasingly feasible], ... I did [all these] more in skunk projects, you know. ... we need to make sure that we have this strategic option, I couldn’t get the message through the board ... But if you don’t have, you know, ways to allow yourself to have the strategic options, you’re basically, you know, hanging your hats all on one hook.”

“...FDA¹ is, at that time, decided to take a very, very conservative approach to the disease because there is a couple of very, very high profile failure that led to millions and billions of dollars of [losses]. ... we calculated that it’s about four years before we even can try humans.”

EB justified his effectual actions based on plausible effects of alternative means-ends relationships in a negotiated environment of contingencies emerging from the science, the regulatory, and the appropriability regimes. In satisfying the changing demands from multiple constituencies, EB believed that “the only way to maintain survival in this business, this business that’s so high risk, is just making more bets, allow yourself to have more shots on goals. ... I’m constantly thinking about what is the other way of applying this system for the [platform].” Thus, as depicted in the middle portion of figure 1, the entrepreneur’s decision making is guided by a

¹ U.S. Food and Drug Administration, also known as FDA, is responsible for protecting the public health by assuring that foods are safe, wholesome, sanitary and properly labeled; human and veterinary drugs, and vaccines and other biological products and medical devices intended for human use are safe and effective.
<http://www.fda.gov>

projective process, creatively imagining future possibilities given present means and contingencies.

4.3 Constrained effectuation

We observed one further mode of effectuation that is oriented more to the present. Constrained effectuation refers to a practical-evaluative process by which entrepreneurs take deliberate actions to address their problematic circumstances that contradict their past principles, past experiences, and past cognitive frames. Entrepreneurs in this temporal sensemaking mode tend to respond to the demands and contingencies of the present context and to critically determine the potential, practical choices that will render the given situation settled and resolved. At times, problematic situations are created by the unintended consequence of prior choices or by the difficulties arising from executing the actions as the context evolves.

Effectuating entrepreneurs in this process exercise their judgement in accordance to the practicality of the situational contexts, in which others actors could pose challenges and constraints on the entrepreneurs' lived experiences. The entrepreneurs deliberately pursue prudent actions that may compromise their own will and satisfy the demands of stakeholders in diverse relational contexts (like the regulatory, venture capital, and pharmaceutical markets). The critical judgement component featured in the practical-evaluative process by Emirbayer and Miche (1998: 996) is built on Kantian reflective judgement of an "enlarged mentality" and Arendt's notion of "representative thinking," which requires a decision maker to abstract from one's own limited experience (or habitual activity) to consciously see things from the broader perspective of others, and to communicate situated reasoning that justifies possible effects of implementing alternative actions, including habitual activity, in the present context. In managing conflicting expectations from the stakeholders with whom the entrepreneurs must interact, the

effectiveness and appropriateness of intended actions and their ultimate ends will be deliberated based on the contingent situations along with the reasoning of those stakeholders involved.

Effectuating entrepreneurs in a practical-evaluative process act differently from when they situate themselves in two other temporal sensemaking modes. First, they are less able to maneuver through the sequences of contingent actions even as they recognize the alternative scenarios and possible effects that meet their desired objectives. Second, they often aim to arrive at a decision to meet a clear goal, if this would mean resolving the problematic situations without incurring more costs. Whereas effectuating entrepreneurs in an iterational-projective process have more flexibility to redeploy routines from the practical repertoires of habitual activity, in a practical-evaluative process effectuating entrepreneurs are more constrained in their selection and maneuverability of actions by the conditions of the present context.

In the narratives below, two co-founders had separately given the accounts of the emergent contexts that posed problems and difficulties to the founding of their biotech company. The problems were brought by regulatory changes in the institutional environment that governs clinical trials, and both founders with no experience in fund raising had faced challenges in attracting venture capital funding for the company. They had clear objectives to pursue the clinical trials of two cancer drugs, which were deliberately chosen for the delivery platform which they had created, and to secure financing for the company from venture capitalists. The process of practical-evaluative framing in the evolving contexts was evidently reflected in their narratives.

Prior to founding the biotech venture, Entrepreneurs M (EM) and N (EN) had been involved in two startups in the biotech sector and were later ex-colleagues in a public cancer research institute. At the institute, they shared similar interests and decided to “spin some of the

things [they] were working on internally.” They were able to raise very good seed capital through friends and family round. The company started with an idea of developing a platform technology for delivering drug combinations using free, existing drug cocktails that were already standard of care, which EM called “a clear path to registration.” However, after advancing into Phase 2 clinical trial, an unanticipated change in the standard of care had required one of the drug combinations (d1) to be used in conjunction with a newly approved biological agent. The company then encountered a predicament, adding a new biological in the drug combination means repeating Phase I clinical trials that would cost \$4 or 5 million dollars over another one and a half year, and then a Phase 2 randomized trial that would cost \$13 million. Beside the costly clinical trials, the future of the standard of care remains highly unpredictable. Meanwhile, they started doing Phase 1 trial with a different drug combination (d2) for a different disease, which by comparison, had a clear path to registration since the standard of care has not changed for 30 years. And then, they brought in a new CEO whom they knew from prior relations.

(EM) “... Even with [d1] that we’ve had remarkable activity in our Phase 1 trial and really outstanding results in our Phase 2 trial, there’s still skepticism within potential partners that this is eventually going to make it because they’ve seen it all before, where promising results and then Phase 3 trial, now you’re talking 10 years down the road, hundreds and hundreds of millions of dollars have been spent on this drug and in the end it doesn’t work quite well enough to get approved. And, that’s because just having something else that works is no longer good enough.”

(EM) “I had done a lot of drug development and getting drugs into clinical trials. I was pretty familiar with the business side of running a biotech, but I realized I didn’t have a lot of street credibility, like in terms of raising the next level of player cash. But I also wanted to be in control of that. So, I asked this fellow to get involved with the company and he started out as chairman and then we went out and raised the series A. So if I wouldn’t have gotten him involved I doubt that I would have been able to raise the series A because it was at that point kind of the nuclear winter had settled in. ... We raised about \$10 million, that was the largest raised, so we were fortunate.

(EN) “... at that stage [pre-fund raising, pre-CEO period], it became necessary to really look for a CEO to come in here. And we knew a person that was working at company E. I knew him really well, not as well as I should have known him, and brought him in. And

that was a striking change to the organization when he came in. He started coming in and, really bossing everybody around. He really came in and structuring things. He was very aggressive and, it was just what the VCs wanted to see, we brought somebody in, which had significant CEO credentials in the States, and just talked like he owned everybody and boom, then all of a sudden we started getting financing, and he was made CEO [in the company].”

(EN) “People were let go at that stage, they weren’t performing according to the new CEO’s standard. [Those were the friends and ex-colleagues we brought in]. He cleared out people that he was having difficulties working with.”

(EN) “So, I am a die-hard scientist and you know there were flaws in our plan, ..., I felt within the organization, within the company, that we should freely be able to discuss that data, and that was not allowed. And so, he brought me the story that had to go out of the company, I’ll agree with that. ... If we met with the advisory board, if the stories shifted a little bit, if the data had changed a little bit, it was just unacceptable. You know, so it was you had no opportunity to sort of present a different side of the equation. There is no other possible interpretation.”

(EN) “The reason why the company is still here today is because of the CEO, I mean, he was able to get those initial rounds of financing. In the end, he couldn’t get anybody else to buy the technology from a pharmaceutical company perspective. But he got the company organized and focused and moving forward. He did what he needed to do.”

In dealing with changing regulatory criteria and the newly appointed CEO, the founders had taken steps to focus on developing only one drug, restructure the then less-than-10-persons company as well as the executive board, redeploy resources, and talk with many potential investors and pharmaceutical partners. Although with the help of the CEO the company had gained a credible scientific advisory board (SAB) and series A funding, these adaptations did not reduce the uncertainty ahead. Albeit meeting the contingent expectations from earlier situations, EM continued to face new challenges from the FDA and the pharmaceutical partners.

(EM) “We were hoping that we would have [d1] and [d2], ... a product pipeline within an IP portfolio, that someone would want to come in and do an acquisition. [The market] sort of changed, but still, [d1] is, I still think, a registrable, demonstrable product. It’s just finding someone who, you know, can put the extra cash in to get those to the next stage. ... [Now,] number one priority for everybody in the company is [d2].”

(EM) "... what we've even found with our lead product [d2], we have tremendous randomized phase 2 data, and everybody we talked to, like over the past 18 months ... there's a lot of interest, but now the economics are such that a lot of these companies won't even look at anything less than a sort of market sales, net sales of greater than a billion. ... so when the pharma companies were looking at it, well, that's kind of a small market."

(EM) "We had some offers and some term sheets. They were insufficiently attractive ... there wasn't much upfront ... We would have left ourselves open to a risk of licensing it to a company who takes 10 years to develop it. ... And so we decided, You know what? We're just going to figure out a way to raise the financing, we're planning on moving towards a publicly traded company and carrying this out on our own."

On several occasions, both entrepreneurs had ceded to the expectations of the CEO, the investors, the regulatory agency, and the broader pharmaceutical market. They had made decisions with consideration of the present circumstances to resolve the problem in hand, believing in what is appropriate and best at that time. However, certain decisions had led to unanticipated consequences which in turn constrained their ability to engage in ongoing effectuation. In their narratives, they had expressed in retrospect both approval and disapproval towards these decisions. Thus, as depicted in the lower portion of figure 1, the entrepreneur's decisionmaking is guided by a practical-evaluative process, constrained in their commercialization path, where rationalization of the past and the future is linked to the present contingencies that occur intermittently.

5. Discussion

Prospective sensemaking in ongoing effectuation can be conceived as a process of interpreting, imagining, assimilating, experimenting, enacting, and transforming. Effectuation decision making is thus a non-linear process of applying prospective sensemaking and effectual logic to justifying the actions of exploiting contingencies and selecting between the possible effects of

the imagined paths with a given set of means. Based on narrative analysis, we propose a framework of three effectuation modes to illustrate the interactions between prospective sensemaking and effectuating in temporal-relational contexts (see Table 2).

In cyclical effectuation, EA continually assessed the emergent contexts and defined his desired paths by experimenting and projecting the probable effects of the future, which signifies the element of prospective sensemaking in an iterational-projective process. He would ‘navigate’ through sequences of actions in response to declining economic conditions in the oil and gas industry, weak appropriability conditions of certain inventive ideas, undue clinical trials, and even personal health conditions. EA learned that a traditional business model for a fully-integrated pharmaceutical company could not adapt to a rapidly changing therapeutic technological environment (a perception of continuous change). Instead, he embraced a ‘semi-virtual company’ that enabled him to experiment with new active compounds and “do work for other virtual companies because we have labs and manufacturing and facilities that we can do that.” He gave a few examples of meetings with individual professors and scientists who had interesting ideas and compounds. EA ended the interview with a story of how he reacted to a scientist’s proposal, “I thought it was great but we didn’t have the bandwidth. To deal with it at that time, we didn’t have the time or money, financial resources.” EA would exploit the contingencies and partnerships only with existing means at his disposal, rather than applying strategic reasoning to maximize expected returns from among the possible paths.

In focused effectuation, EB seemed to possess the characteristic and capability of a ‘creator’ and ‘negotiator’ who can identify and turn the flows of contingency encountered into meaningful opportunities and test new ideas with resources emerged from unexpected situations. Through ‘skunk projects’ hidden from the company’s board, he avoided ‘hanging your hats all

on one hook' and enacted a negotiated environment to pursue several scientific possibilities that intersect across the regimes of science, intellectual property, FDA and pharmaceutical business practices. "I'm running around like a headless chicken most of the time," chuckled EB, but "we were pretty focused on getting the ball to the end zone, and we did, and then we find out that there are bigger hurdles beyond that point. So we had to readjust at that point. So, it's not that we're just bumming around and all of a sudden things just drop on our lap and then we go pursue it, right? You know, we actually walked to the end and then felt that we need to redefine ourselves such that we can survive and keep going."

In constrained effectuation, EM and EN had taken a mediating role towards resolving the conflicting projected and actual worlds. They acted to seek for feedback from the prominent stakeholders at that present moment so that they could find reasons to act or not to act further. They faced difficulties in maneuvering through the regimented demands of a CEO, the sentiments of the investors, the conditions of changing regulatory criteria and an unpredictable drug market. Reflecting on the practical-evaluative process [18 months had lapsed since the first interview], EM felt that "we were focused more on trying to identify what we thought externally would value things [or what investors thought would provide the best returns], and now we're looking a little bit more at what, because we think, well, we're going to carry it out ourselves."

Although all four entrepreneurs had typified the challenges of running a science-based business against the backdrop of broader pharmaceutical practices (the reflective element), they each had employed a different approach toward controlling the future of the company.

6. Conclusion

Using narrative analysis, we found evidence that depending on their temporal orientation, entrepreneurs play different roles in interpreting and responding to unexpected contingencies. Even though the entrepreneurs in this study had over 10 years of founding experience, the individuals seemed to persist in their temporal orientation within the flows of contingencies. Nonetheless, we can anticipate that entrepreneurs who shift between effectuation modes are more capable of generating creative actions. Therefore, future research can be designed to identify cases of entrepreneurs who possess such capabilities and test their temporal orientation.

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Figure 1. A Prospective Sensemaking Perspective of Effectuating Processes in Temporal Contexts

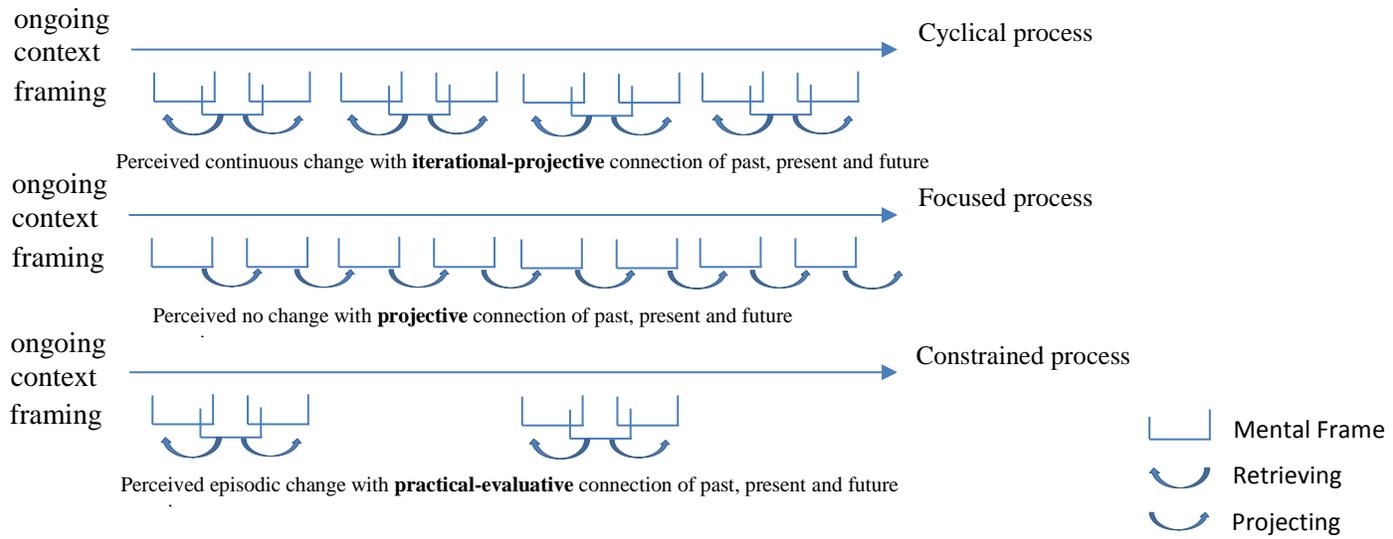


Table 1. Descriptions of Interviewed Entrepreneurial Firms and Entrepreneurs

	Firm A	Firm B	Firm C
Firm Age in 2011	18 years (1993)	12 years (1999)	11 years (2000)
Key Events	<ul style="list-style-type: none"> • Merged experience from oil & gas sector into biotech sector • Abandoned FIPCO and assimilated neutraceutical development • Experimented with and subsequently abandoned alternative drugs 	<ul style="list-style-type: none"> • Improved from viral-based to non-viral delivery platform • Improved from 6 months treatment model to 6 weeks treatment model • Enacted possibilities of new drugs on the same platform 	<ul style="list-style-type: none"> • Suspended drug 1 development despite successful phase II trials • Put priority on drug 2 that has a clearer path to market • Transformed from scientific inquiries into rigid product development & organizational culture
Entrepreneurs Interviewed (between 2011 and 2012)	Founding CEO/Chief Scientist (1 interview), with one prior founding experience	Founding CEO/Chief Scientist (2 interviews), with no prior founding experience	Founding CEO (2 interviews), Co-Founder/Chief Scientist (1 interview), both had two prior experience in two startups
Additional Informants Interviewed (between 2011 and 2012)		2 nd CEO (1 interview) with no founding experience but considerable business development experience. Had been CEO at Firm B during some key events.	Venture capital investor who had invested in Firm C. Had closely tracked Firm C during some key events.

Table 2. A Framework of Prospective Sensemaking and Effectuating in Temporal-Relational Contexts

Perceptions of Ongoing Contexts	Agent-centric Prospective Sensemaking	Effectuating in Temporal-relational Contexts	Modes and Mechanisms	Roles of Entrepreneurs
Perceive continuous change in temporal context	Iterational-projective orientation; reactivated by actor's past patterns of thought and action	Routinely incorporate new experiences to enhance stability	Cyclical effectuation; experimenting and assimilating	Role of entrepreneurs as <u>navigator</u> ; engage in high levels of reflectivity and maneuverability, either reinforce or shift direction to avoid disruptions to the organization
Perceive no change in temporal context	Projective orientation; proactive towards opportunities and uncertainties	Respond to hopes, surprises, fears and challenges for the future	Focused effectuation; experimenting and enacting	Role of entrepreneurs as <u>creator and negotiator</u> ; engage in a low level of reflectivity but a high level of inventiveness, capable of constructing new possibilities, and distancing themselves from situations that constrain their actions
Perceive episodic change in temporal context	Practical-evaluative orientation; triggered by conflicts of the present	Respond to the demands and contingencies of the present	Constrained effectuation; assimilating and Transforming	Role of entrepreneurs as <u>pragmatic mediator</u> interacting with stakeholders; engage in low levels of maneuverability and inventiveness, tend to choose the most effective means to satisfy stakeholders' demands