Entrepreneurship and Industry 4.0

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Balancing Entrepreneurial Exploration and Exploitation

By

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Cambridge Scholars Publishing

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FOREWORD

The inequality narratives and the implications for capitalism, communism, and socialism, are the primary precursor of modern economics. However, Posner and Weyl (2018) still believe in markets to bring fairness and prosperity for all. The rationale behind this idea is not to abandon the free-market system but to think of new ways to organize markets for everyone's good. Though I appreciate the argument brought by the book, I argue that entrepreneurial exploration (e.g. innovation to solve social and environmental problems) and exploitation (reaping profits while keeping society and environment healthy and sustainable respectfully) might be a better approach. We assert that entrepreneurship and green-social entrepreneurship, usually called the Social Business Model, suggested by Nobel Laureate Professor Muhammad Yunus, may change at a pace that society can absorb. Even though 'Radical Markets' bring new hope for change and reconciliatory mechanisms for failing capitalism, to operationalize it and make it happen, societies must also have the absorptive capacity.

To build this absorptive capacity, one needs to start with the Social Business Model, but the goal may be to reach the Radical Markets-based mechanism. In the war against inequality, if I have been able to bring a slow but sustainable means to achieve equality for all, I am highly grateful for the society full of poverty, which triggered my thoughts to ask how we can eradicate inequality from the face of the earth. If we can work on this challenge, we may restore the individual dignity which has been destroyed by wars and conflicts around the world. If an individual is not at peace within himself, he will inflict death and sorrow on the world, and for himself. My assertion is to bring equal entrepreneurial opportunity and make it accessible to all. Having access itself does not make each successful; we need to make sure that schools and colleges need to build the entrepreneurial curriculum, implement it, and change the job-seekers' culture to that of job-creators; the latter must be celebrated in society as sportspeople are. Everyone is planning to emulate a hundred years of Silicon Valley's entrepreneurial success; however, it may become just a wish, unless and until, societies can build a culture of learning from failure as a norm, rather than an exception.

The entrepreneurial drive, and the culture to foster it, may seem friendly. Still, the pain points one has to reflect in hundreds of failures to understand new sutra for success has a proven process. It is becoming critical to revisit the same to bring about the changes triggered by new waves of industry 4.0 technologies. The earlier notions of Lean Startups, Customer Development, and Business Model Canvas need to be brought under the umbrella of March's (1991) idea of balancing exploration and exploitation for sustainable competitive advantage. Though the literature has captured this notion for large corporations, using a similar balancing act in entrepreneurial ventures is scant. This book answers many readers' requests to expand the book chapter I wrote a year ago with the title "Balancing Exploration and Exploitation Through the Customer Development Model: Leveraging Industry 4.0 for Sustainable Performance". The model and outline developed in this chapter have been extended to greater details in this book.

The time was ripe a year ago to think about the emerging wave, but the time is even better now, as Silicon Valley is emerging as a hub for long-term thinking with the Long-Term Stock Exchange brought about by Eric Ries and his colleagues. This gives hope for the entrepreneurs to think for sustainable businesses rather than rent-seeking parasites. However, we need to be skeptical in raising high hopes, as it takes time to change the entrepreneurial culture and discourse in society. As we have seen from Greta Thunberg's movement for climate change, and the call from Occupy Wall Street movements, the triggers for capitalism to correct its course have been emerging and gaining critical mass. I am hopeful I may see the vision of equality for all through democracy and capitalism — meaning through ballot, but not bullet. Yes, China's movement to eradicate poverty has been working, but it raises an eyebrow as to whether it will be sustainable. The equality syndrome was happening in the Soviet era also, but it crumbled in no time.

One may argue that the Soviet era was under a command economy, while China's President Xi's era is based on a free-market economy and controlled one-party rule. The Constitution of Liberty, written by Nobel Laureate Hayek, argues that suppression and surveillance may work with the less-educated population. When the essential human nature to be free and seek self-interest is suppressed for a long time, it may explode like a human bomb. I am sure China is awakening to this reality through Hong Kong's recent uprising, and building a slow-but-sure path to make liberty a choice in the end, when equality reigns over through the current model.

With the Bhandari Model, the goal is the same: equality for all, dignity for all, peace for all, and prosperity. However, in this model, the path to achieving this reality is based on a balancing act between entrepreneurial exploration and exploitation. The existing models of shareholder value maximization pursued by the firm have failed capitalism to some level — not because the model is inefficient, but the government's tax to provide equal opportunity to its citizens has been ineffective. The scalability needed to solve this crisis is not possible. Thus, enterprises tackling social and environmental problems and making a profit simultaneously would be a sustainable solution, as Grameen Bank demonstrated in Bangladesh, and worldwide.

Love, Peace, Prosperity

1st Feb 2021
Helsinki, Finland

REFERENCE

Posner, E. A., & Weyl, E. G. (2018). *Radical markets: Uprooting capitalism and democracy for a just society*. Princeton University Press.

CHAPTER 1

INTRODUCTION

ABSTRACT

Industry 4.0 (i4.0) can unleash new business models or develop essential insights for a better decision-making process. The emergence of i4.0 not only unleashes technologies like IoT, AI, cloud computing, machine learning, robotics, and 5G, but also Big Data Analytics (BDA). It is enhancing entrepreneurial exploration and exploitation at its best for solving data challenges, process challenges, and management challenges. i4.0 can enhance value creation and value capture at the same time, with efficiency which is unmatched so far. First, balancing exploration and exploitation literature is reviewed to build an understanding of extant knowledge. Based on this review's research agenda, this book answers a key concern of how entrepreneurs can balance entrepreneurial exploration and exploitation in i4.0. The analytics world is moving beyond descriptive to predictive, and in the future, it will be more prescriptive, enabled by AI, machine learning, expert systems, and 5G. Thus, the future of entrepreneurial exploration and exploitation depends on how information is used to develop an insight into making intelligent, smart, and fact-based decision-making to take actions that may have real-time correction mechanisms and a new wave of quality, productivity, and customer intimacy.

Keywords: Customer Development, Lean Startup, Industry 4.0, Quality Culture, Blue Ocean

INTRODUCTION

Since the publication of "Balancing Exploration and Exploitation" (March 1991) to help understand the organizational learning from the lens of balancing exploration and exploitation, to the current review by Almahendra and Ambos (2015), the literature is mature enough in hailing the future changes triggered by i4.0. The concept of balancing exploration and exploitation has been studied in multiple ways with various definitions, new conceptualizations, measurements, and multiple forms of applying the idea to get its living course (Almahendra & Ambos 2015). The organizational issues and activities classified as exploration are search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation (March 1991, 71). Similarly, exploitation includes issues and activities such as refinement, choice, production, efficiency, selection, implementation, and execution (March 1991, 71). When problems and activities are search-oriented, and managers are allowed to take risks, conduct experiments, and invest in flexibility, discovery, and innovation, the organization positions itself as an innovative company. Similarly, when organizational issues and activities are thinking of refining a product or process, building multiple options in products and services, driven by an efficiency mantra with a relentless focus on execution as a capability, the organization positions itself as an efficiency-driven firm.

Literature in exploration and exploitation has volumes to speak about large corporations, and, at some level, SMEs, since the publication of a highly cited article by March (1991). The original idea even encouraged papers to study S&P 500 companies to understand their balancing act of exploration and exploitation orientation ((Uotila et al. 2009). The relationship between the exploration of the search for the business model, and the exploitation of existing organizational learning competencies, is a sound approach to understanding organizational success, as suggested by March (1991). Resource allocation challenges, such as the distribution of costs and benefits, are spread across different times and spaces for those searching and exploitation phases, and ecological interactions. The latter is even true in the new wave of i4.0. The move is from automation and efficiency to smart, intelligent products, connected in the cloud, and accessible for top management on a real-time basis.

March (1991) not only studied the mutual learning between members of an organization and an organizational code, but he also pioneered an idea on how learning leads to competitive advantage and competition for supremacy. This contribution's significance is that focusing on exploitation may be

beneficial in the short-run, but self-destructive in the long-run (March 1991). However, in the new era of i4.0, the competitive supremacy or unfair advantage is inbuilt into the new business model, but this will be supported by competitive supremacy where collaboration across firm boundaries and functional boundaries is happening. Ecosystem thinking with new notions of platformization, servitization, and building smartness into products and services, will be the future.

The assertion that short-term myopia of the success trap must not be the reason for start-up failure by premature scaling, is one of the significant problems in start-ups. Having such good coverage of studies about the balancing act of exploration and exploitation in large corporations and SMEs does not help start-ups, as start-ups are not small-scale versions of large companies. There are institutions set up to explore new possibilities, such as new products, or to search for a business model under extreme uncertainty conditions (Ries 2011). While the existing literature is alien to the concept under discussion, the emerging i4.0 wave makes the topic even more interesting in understanding the implications of this new wave of technological change in entrepreneurial exploration and exploitation.

As the literature review for this work was done during the author's dissertation process, a long chapter on this area is avoided. Still, Bhandari (2017) is used as a reference to move forward. Similarly, this book is an extension of my earlier book chapter on the topic, which had high demand, and so the publisher wanted to build a comprehensive book on the same subject. Then, rather than being a vision-driven book, it was developed in a small, minimum viable, book chapter, to test the readers' feedback. Now we have a full text at the readers' service. This is precisely what a customer development model and lean start-up suggests. I revisited those concepts in the context of industry 4.0 and modification on a scale that demands a book in itself, as the balancing of entrepreneurial exploration and exploitation in i4.0. Where I have written the full book in the first phase, and the readers have not liked it, this follows the old paradigm of developing a product and figuring out the product-market fit afterwards. However, I have practiced the development process which I preached in the book itself. By demonstrating the product-market fit as an example, the book itself is an example of how to avoid start-up - or for that matter, any project - failure.

Failure in start-ups is the norm rather than an exception. However, the author's lean start-up approach gives a guideline, with optimization as a differentiation factor of the book in the BMOL loop, while testing the very

early MVPs or MVDPs where the minimum viable product is desirable also. The old business model canvas becomes i4.0BMC, where unfair advantage, platformization, and innovation with sustainable development, are integrated. These notions will propel our mindset of curiosity and shaping future development to the next level.

BACKGROUND

The new wave of Industry 4.0 (i4.0) makes many business models obsolete and may demand regeneration of the existing business models. While many authors have analyzed this change, the purpose of this book is to focus its impact on entrepreneurial exploration and exploitation. Though practitioners have been using multiple models such as the customer development model, lean start-up, or business model canvas (BMC), these models need to be aligned with the existing scientific literature on exploration and exploitation started by March (1991). While March (1991) proposed the model for general exploration and exploitation, this book focuses on the entrepreneurial exploration and exploitation triggered by the new wave of i4.0.

By linking the rigorous academic domain with the emerging practitioner's methods and tools, I have started to rectify the significant criticism faced by lean start-up methods of being experience-based rather than evidence-based. However, standalone evidence-based research to validate lean concepts is further due. The earlier wave of information technology triggered automation and efficiency. But the new surge of i4.0 puts pressure on the entrepreneur to adapt to this new reality, which changes the firms' value chains, and creates smart and intelligent products and services, real-time optimization of performance, and transparency and flatness in the hierarchy. Thus, it is timely to revisit existing business and management concepts where innovation has been costly so far. Perhaps a new dawn of successful creation is possible, due to real-time optimization algorithms.

A deep dive into the existing literature on exploration and exploitation is covered with an open mind as to what happens to the current models when i4.0 becomes a reality and passes the hype phase. Neither March's (1991) concept on exploration and exploitation, nor Blank's (2017) ideas on lean start-ups, customer development, and business model search, would be sufficient. Existing literature in the management domain hardly introduces a nuance variable of technological uncertainty into a firm's performance equation. Whenever Porter and Heppelman (2014, 2015) attempted to do

so, a new wave of research in this domain emerged. In an attempt to grasp this reality, this book focuses on the impact of IoT, AI, machine learning, cloud computing, 5G, etc., on business performance.

EXPLORATION AND EXPLOITATION AS AN ARTIFACT, AND ENTREPRENEURSHIP AS A CALLING

Issues, Controversies, Problems

Entrepreneurial Exploration and Exploitation: The Persevere or Pivot Decision. The exploration-exploitation research has evolved into multiple directions since March's (1991) article on the topic. However, when i4.0 is in the emergent stage, understanding this change's fundamental nature from the lens of entrepreneurial exploration and exploitation needs attention from researchers. This is an attempt to explore how the forthcoming changes in technology will impact entrepreneurial exploration and exploitation. During my entrepreneurial investigation in multinational and start-up worlds alike, I encountered that most promising business ideas or start-up ideas fail at the point of either persevering or pivoting — meaning that when they need to pivot, companies scale it up. This resonates with the Startup Genome report (Marmer, Herrmann, Dogrultan, Berman, Eesley & Blank 2011). However, this book aims to decode this problem from the rigorous academic lens and bridge the theoretical lens and practitioners' experience. Thus, in this notion, exploration and exploitation are just an artifact, while entrepreneurship is a calling.

The underlying question now is to ask whether new waves of technologies will enable more mature scaling or not. Products and services are becoming smart and connected with the cloud, reshaping the value chain internally and changing the competitive game in parallel. The highest number of observations in the pivot or persevere stage in Figure 1 indicates that, most of the time, firms pass the gate without thinking whether the product-market fit is there or not. If we recall Moore (2002), it may be a false feeling that the customer we have at the customer validation stage will continue to market us throughout the product lifecycle. *Crossing the Chasm* (Moore 2002) is a grand challenge for any business if planning to scale the product or venture.

Around 32% of ventures scale prematurely. Another 18% fail in the customer validation process, and 17% of firms fail to build the company even if they have done well in the persevere phase. Similarly, 16% of firms fail due to the founder's attention span on vital strategic issues

related to products, markets, and product-market fit, as shown in Figure 1. Only 10% of companies fail to create the customer, while only 7% of firms fail due to not figuring out the real customer in the early phase of idea generation. These percentages reveal a pattern that entrepreneurs are profitable in entrepreneurial exploration, but bad at entrepreneurial exploitation. Thus, a founder's team must balance these skills. Usually, finding an ambidextrous entrepreneur is very hard, but building an ambidextrous founding team is possible. From day one, the firm's focus must be on creating innovative products, but at the same time, they need to build a solid revenue pipeline so that the firm succeeds in taking off before it is too late; however, premature scaling is not an option.

The book by Moore (2002) called *Crossing the Chasm* was a classic in understanding how start-ups can progress from the stage of early adoption to mass-market customers. However, with the emergence of a new wave of new technology, products, business models, and machine intelligence, those existing models fall short, as suggested by Porter and Heppelman (2014, 2015). In earlier waves, automation and efficiency were the key drivers; collaboration with all partners, including customers, is needed in the new wave. Thus, the emergence of new cloud infrastructure will provide a massive new market for technology giants and start-ups alike.

Culture of Fear vs. Trust and Empowerment. The author of this book witnessed the colossal rise of Nokia, as an insider, and its turnaround as an outsider. Though multinational, Nokia has an entrepreneurial culture. Though it is not an excellent example for start-ups, we can learn lessons from the literature which elaborately discussed why Nokia failed in one wave of technology while succeeding in the next. Vuori and Huy (2016) argue that distributed attention and shared emotions are critical issues in the innovation process's success or failure. Lessons learned from such a narrative can be used in start-ups as well, but with caution, as start-ups are not small-scale versions of large corporations — whether we want to build a culture of trust and empowerment or fear. If you wish to place short-term focus on exploiting existing competencies, a culture of fear might work for a time, while pursuing a culture of exploration demands cultural DNA with trust and empowerment. Thus, start-ups need to figure out 'who' in the team first, rather than 'what.' Though 'culture eats strategy for breakfast', distributed attention is a real problem when resources are thin, and time to compete is short. Innovation cycles are faster than we thought, which drives temporal myopia. As listed below, balancing entrepreneurial exploration and exploitation requires balancing each subtopic under the exploration and exploitation umbrella. Success through innovation, search,

differentiation, and experiment, must be balanced with success through efficiency and optimization.

Balancing Entrepreneurial Exploration and Exploitation

1. **Entrepreneurial Exploration:**
    a. Success through innovation,
    b. Search, differentiation,
    c. Experiment.
2. **Entrepreneurial Exploitation:**
    a. Success through efficiency,
    b. Optimization.

As shown in Figure 1, 32% of ventures fail at the pivot or persevere decision gate, as, most of the time, premature scaling becomes a bottleneck. Another 18% of failures are during the customer validation phase. This phase is critical, as minimum viable and desirable product (MVDP)-related assumptions, and hypotheses testing get it wrong. Another 17% of ventures fail in company development, 16% having the wrong attention from founders, 10% during the customer creation phase, and 7% during the customer discovery process. As shown in the Pareto map, it is critical to make proper scaling-up decisions, which is the most fundamental stage for start-up failures.

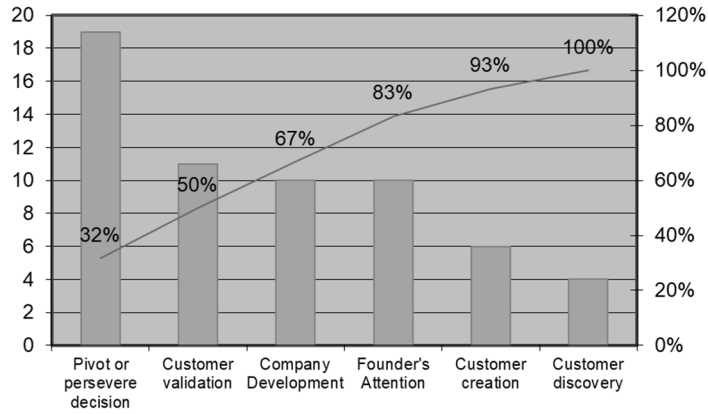

Figure 1-1. Pareto Map for Startup Failure (Based on Author's Observations)

The central idea of i4.0-related change is that, as the firm and industry boundaries are fading, and real-time optimization of performance is

possible through live experiments and decision making, platformization will be the driving force in each industry, as is evident through the business model of Facebook, Apple, Alibaba, Netflix, and Google's (FAAANG's) approach. The exciting part is that manufacturing companies will embrace a new wave of servitization to build and bundle services with their product. This is possible due to digitalization, and the performance impact of such services would be high. Therefore, the future industrial landscape of i4.0 is more or less comprised of digital companies with a platform concept embedded into them, whether they are start-ups or large firms.

Large firms' research in balancing these exploration and exploitation-related activities and issues has been significant. However, the research in balancing the two delicate dilemmas in entrepreneurial ventures is scarce to my knowledge. This is fundamentally the reason for substantial start-up failures. They are in the 'failure-trap', as they are busy with exploration, and they are not good at exploitation at the right time. Even the strategic choices for entrepreneurial exploration and exploitation are challenging to solve, as the runway for start-up survival is usually too small compared to the large firm context, as the competition for scarce resource is very high. There is no room for too much or too little exploitation — rowing this boat with both hands is necessary to sail it to safe harbor amidst ever-changing reality. As stated in the definition, start-ups are ventures searching for a new business model in an environment which is too uncertain. Therefore, we cannot rely on the school of planning knowledge when we need the school of tools and expertise for experimentation and learning. I know, the Porterian school of thought is not happy with my claim in the previous sentence, but Mintzberg may be smiling on the other side, and he believes in the emergent nature of strategy. Similarly, now for the first time, Sarasvathy's (2001) effectuation logic gets recognition by the author's attempt to tell the world that lean start-up is not a brand-new concept, as it is rooted in effectuation logic in greater detail.

SOLUTIONS AND RECOMMENDATIONS

Balancing entrepreneurial exploration and exploitation demands the understanding of exploration-related risks and exploitation-related risks. I use risk and uncertainty as mostly synonymous for simplification purposes, but the concept is more in assessing the uncertainty. First, an example of exploration-related risks may be not identifying the real needs for the product or service we are developing. The entrepreneurial quest is not an easy task. We are searching for new business models — to build a

new business line, turn around the existing business for large corporations, and test the new business model for start-ups. In both cases, proper assessment of entrepreneurial risk is a significant factor, as shown in Table 1. In the quest for early profitability, less focus on R&D and premature scaling may happen to drag the start-up into exploitation or a profit trap. These traps are natural when time and resources are enemies, and there is no knowledge in the team or so-called board on the timing of scaling up. Even seasoned venture capitalists (VCs) will face this dilemma in start-ups working in the i4.0 domain, as knowing or simulating the venture's hockey stick growth is still a challenge. However, we will have more real-data possibilities based on experiments and simulations given by the BMOL loop in the i4.0BMC validation phase.

Having everything change in an entrepreneur's favor makes the future of entrepreneurship a good calling, while entrepreneurial exploration and exploitation become an artifact. However, usually, entrepreneurs are exploration oriented — they are good at innovating but bad in monetization. They are mesmerized by their innovation, but the growth potential does not lure them. Nevertheless, understanding exploration myopia and sailing the firm further along the exploitation curve early enough, but at the right time, are critical decision challenges for any entrepreneur. A sense of urgency is needed, as speed may be the only competitive advantage, but deciding in a hurry and repenting in free time should not happen. The entrepreneurial quest and mindset, geared towards unleashing the potential of new growth and seeing humanity free from poverty and climatic disasters, must give an entrepreneur a mission that keeps me awake during the night to seek solutions to these perplexing problems. However, never in human civilization, has such a mass flourishing of innovation existed with such a vibrant innovation ecosystem. Now is the time for many to pursue this vocation. Entrepreneurship-related degree programs and entrepreneur-in-residence concepts must exist in all types of companies. The future is bright, not only for exploring but also for exploitation, not only for small companies with global ambitions but also for large companies.

In the horizontal axis in Figure 2, the likelihood of risk is plotted, while the vertical axis represents the level of risk associated with entrepreneurial exploration. The size of the ball in the diagram indicates the level of risk. The larger the size, the more planning to mitigate the same risk is crucial. In our example, risk one is called need assessment, and bet two is called a new business model search; two major risk factors with a high chance of happening. Therefore, our resources to mitigate the same must be allocated

from early on. As discussed in the introduction, issues, and problems sections, literature gives prescriptions for entrepreneurial exploration and exploitation. Still, there is a gap in the literature on how to achieve this elusive balance. Therefore, our example tools and tables with illustrative graphs drive the discussion on 'how' a balance of entrepreneurial exploration and exploitation could be achieved. However, in doing so, we are focusing only on the industry 4.0 (i4.0)-related activities and processes, starting with the existing models suggested by Ries (2010) and Blank (2013) to build a modified model to embrace the change initiated by i4.0.

Table 1-1 Entrepreneurial exploration-related example activities and their risk assessment

Process Name:	Entrepreneurial exploration	**Process Owner:**	Dr. Krishna Raj Bhandari	
		Date:	12/09/2019	
Risk Identification		**Risk Analysis**		
Risk#	**Description**	**Likelihood**	**Consequences**	**Risk Level**
1	Need assessment	4.50	4.00	8.5
2	New business model search	3.50	4.25	7.75
3	New business model validation	4.00	3.00	7
4	Less focus on R&D	3.00	3.00	6
5	Exploitation or profit trap	2.50	2.50	5

In this pursuit of modifications, or rather of an alignment, my attempt has been to link these practitioners' contributions with March (1991) and Sarasvathy (2001). They gave us the exploration and exploitation lens and the effectuation lens, respectively. By linking these theories with that of lean start-ups, a comprehensive understanding may be developed. Dwelling on the linkages and building decision models, however, will be done in later chapters. Figure 1 raises the alarm to entrepreneurs to avoid the failure trap, or the relentless search trap, by using a minimum viable product or service concept in validating customer needs and testing i4.0BMCs.

Taking this adventure as a potential contribution to reducing the start-up failure rate, I found my calling. Sleepless nights of digesting various concepts and models to synthesize into more comprehensive thinking have given me a rewarding feeling. However, if an entrepreneur takes it as a simplified view of the complex world, I may take it as fair criticism. Nevertheless, the attempt here is to clarify many issues about the impact of i4.0 itself that might perplex entrepreneurs and academicians alike. There is a lack of understanding of this phenomenon, as universities have not yet started to train the future workforce, nor have best practices on this front emerged. Therefore, sandwiched between these dilemmas, this book seeks to find its space.

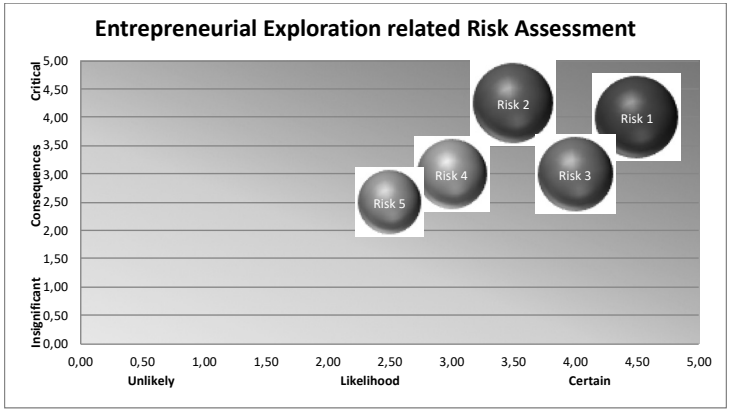

Figure 1-2. Risk assessment in entrepreneurial exploration

As we have seen in the exploration-related dilemma in the previous section, this section discusses the significant dimensions of entrepreneurial exploitation-related risks, which can be listed as corporate arrogance (or founders' arrogance), the CEOs' (founders') attention to the right issues, the challenges of a saturated market, the profit (or exploitation) trap, and agency problems associated with the CEOs' benefit maximization at the expense of shareholders, as shown in Table 2. These factors are symbolic but demand proper understanding.

Table 1-2. Entrepreneurial exploitation and risk assessment

Process Name:	Entrepreneurial exploitation	**Process Owner:**	Dr. Krishna Raj Bhandari
		Date:	12-09-19

Risk Identification		**Risk Analysis**		
Risk#	**Description**	**Likelihood**	**Consequences**	**Risk Level**
1	Corporate arrogance	4.50	4.00	8.5
2	CEO's attention problem	3.50	4.25	7.75
3	Market saturation	4.00	3.00	7
4	Profit (exploitation) trap	3.00	3.00	6
5	Agency problem	2.50	2.50	5

Entrepreneurial exploitation is not an easy task either. This demands a sharp focus on avoiding premature scaling, which is the primary factor in start-up failures, as per the start-up genomes report. We discuss efficiency, cost leadership, and optimization, of the existing business model for large corporations, and explore and implement the new business model for start-ups. In both cases, proper assessment of entrepreneurial risk is a significant factor, as shown in Figure 3. On the horizontal axis, one can plot the likelihood of trouble, while on the vertical axis, one can plot the dimensions of entrepreneurial exploration. The size of the balls in the diagram indicates the level of risk. The larger the size, the better planning to mitigate the same risk is crucial. Mitigating such risks becomes the focus of this book and the emerging literature on i4.0.

Key dimensions that entrepreneurs or entrepreneurial managers need to focus on to balance the entrepreneurial exploration and exploitation are listed, for example as in Table 3: balancing search and profitability, balancing effectiveness and efficiency, balancing CEO’s attention for short-term and long-term thinking, balancing agency problems with shareholder’s interest, and focusing on sustainable development. Once the proper risk assessment is accomplished for both entrepreneurial exploration and exploitation processes, founders or entrepreneurial managers need to consider balancing them both, as shown in Figure 4. Risks 1 and 2 are substantial in size compared to others, revealing the level of risk and attention needed to solve the same. Such a map gives an idea of optimizing the resources required for each phase of the customer development model embedded in lean start-up (Blank 2013).

Balancing the twin trade-offs of exploration and exploitation was implicit, or not dealt with, in extant literature. The illustrations are just an example,

and the content in tables in assessing the risk and implied uncertainty will be entirely different for different start-ups.

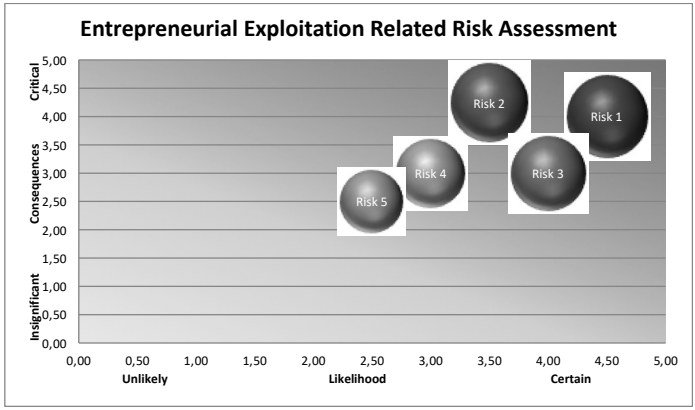

Figure 1-3. Assessment of risk in entrepreneurial exploitation

As illustrated above, the extant literature suggests that existing entrepreneurship models fall short in understanding the emerging nature of i4.0 related changes. We need models that adapt to the changing process itself, and preplanned approaches do not hold in a dynamic industry. Sarasvathy (2001) outlined how opportunity creation is possible by focusing on who you are, what you know, and who you know. The emergent nature of means orientation, though with a vision, brings feedback loops in learning and adaptation, as and when the change unfolds. Management discipline is more focused on goal-orientation but having a means-orientation mindset is beneficial in uncertain environments such as triggered by i4.0. Practitioners have used the customer development model, lean start-up, and business model canvas, to understand the existing entrepreneurship development processes.

Table 1-3. Risk identification in balancing entrepreneurial exploration and exploitation

Process Name:	Balancing entrepreneurial exploration and exploitation	**Process Owner:**	Dr. Krishna Raj Bhandari
		Date:	12-09-19

Exploration Related Risk Identification		**Risk Analysis**		
Risk#	**Description**	**Likelihood**	**Consequences**	**Risk Level**
1	Balancing search and profitability	4.50	4.00	8.5
2	Balancing effectiveness and efficiency	3.50	4.25	7.75
3	Balancing CEO's attention in short-term and long-term focus	4.00	3.00	7
4	Balancing agency problem with shareholder's interest	3.00	3.00	6
5	Focusing on sustainable development	2.50	2.50	5

The research frontier calling for researchers is still in its infancy. A new innovative business model, efficiency projects, and implications for theory and research of management are on the verge of emergence. We need to understand the relationships between business model alternatives, competitive strategy, and the resulting performance outcomes, in the new industrial internet wave. The changes suggested by Burmeister et al. (2016) have some exciting implications for managements' theory and practice. The new wave offers the possibility for customization of products and services and efficiency optimization at the same time. This will give an edge for those who understand the meaning of adaptation to the individual customer needs. Figure 4 demonstrates how one can assess the balancing acts and plan for mitigation of the same. In doing such an assessment, the alert mechanism in collecting the right information enabled by i4.0 technologies must be thought through to avoid start-up failure, which is a blessing in disguise. I am hopeful my assertion will be valid. Still, one looming danger is the emergence of machines faster than human intelligence and reaching singularity faster than was at first thought. Human civilization falls into machines' hands when our intelligence becomes a witness to machine control of human civilization. We become prisoners of our creation. I trust the opposite would come true, but the fear of the unknown drives us insane sometimes.

Porter's idea of competitive supremacy based on either cost leadership or differentiation is no more valid. The new change wave will delete the concept of 'stuck-in-the-middle' syndrome while pursuing both cost leadership and differentiation. The old idea of 'red ocean'-based cut-throat competition is no more valid, while the new 'blue ocean' thinking, where

competition is irrelevant, is becoming a reality. As business level thinking is changing, so does functional level thinking — balancing the trade-off between novelty-centricity and efficiency-centricity (Zott & Amit 2007) in business model design is becoming a reality illustrated by multiple cases (Burmeister et al. 2016). Thus, both entrepreneurial exploration and exploitation are possible at the same time.

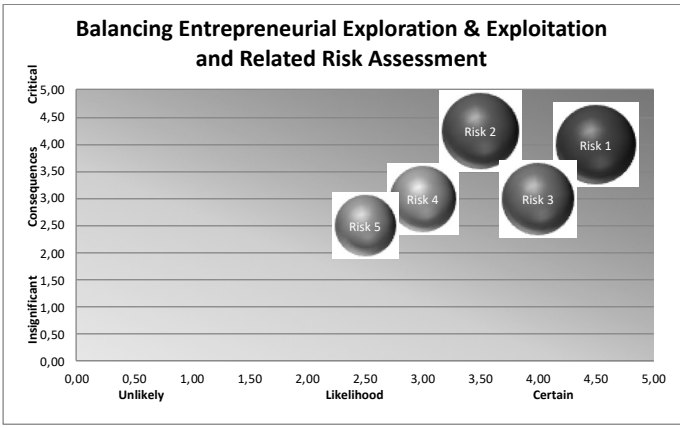

Figure 1-4. Risk map in balancing entrepreneurial exploration and exploitation

In projects, there is a concept of piloting the small scale. Still, it does not have a similar philosophy to the build-measure-optimize-learn (BMOL) loop enabled by hypothesis testing of industry 4.0 Business Model Canvas (i4.BMC). Thus, based on my approach to balancing both exploration and exploitation in the innovation process, existing literature has just scratched the surface in Bhandari (2017). Figure 5 summarizes the proposition made by Bhandari's (2018) framework by synthesizing the customer development model, BM*O*L, and entrepreneurial exploration and exploitation. This will be revisited in Chapter 3 under the theoretical framework later.

From Blank (2005) to Klotz (2020), there is a critical shift in Blank's thinking. In the age of 'epiphany' (Blank 2005), the idea was to work with budding young entrepreneurs where the experience was not that important, or the learning loops of lean start-ups. But Klotz's (2020) interview with Blank suggested that when the 'experiential learning' of scientists and engineers is combined with lean launchpad concepts, the venture becomes strong, and able to thrive in chaos and uncertainty, as shown in Figure 5. The BM*O*L loop curves depict the difference between an inexperienced team and an experienced team. In this notion, all phases of customer

development benefit from faster execution, but are learning-focused. This makes experiential learning a powerful tool for entrepreneurial ventures themselves.

Stanford gave the world Blank's and Ries' lean start-up and customer development models. On the other hand, Harvard presented a theory called 'jobs-to-be-done by the customer with the product or service we are offering them' (Christensen, Hall, Dillon, & Duncan, 2016). The latter becomes an integrating theoretical lens in the comprehensive model, as shown in Figure 5. The model itself will be elaborated in Chapter 3, but the framework's building blocks are shown in this chapter.

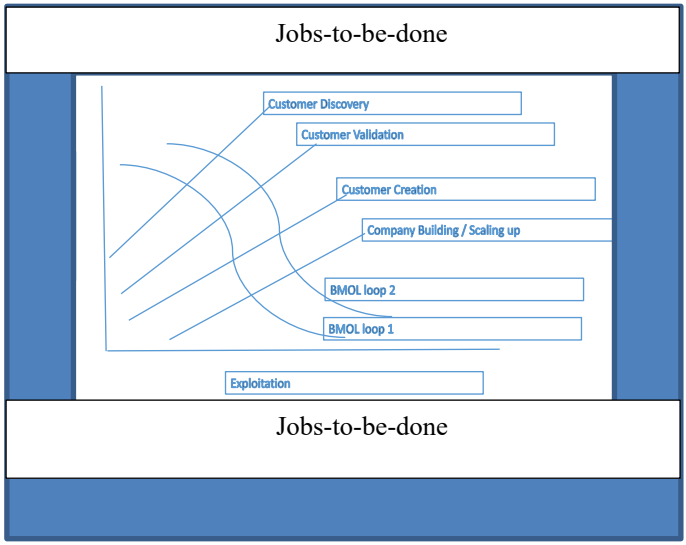

Figure 5. Author's synthesis of jobs-to-be-done theory, customer development model, lean start-up, and balancing exploration and exploitation

The lean start-up method suggested that the build-measure-learn (BML) loop must be executed relentlessly to search for a new business model. However, in the i4.0 era, the BM*O*L loop (Figure 6) is needed as optimization algorithms are most important in each development and company building cycle. This learning loop could be called an experiential learning loop (Klotz 2020); however, this learning may also be accumulated through scientific knowledge over the years of a career.

The i4.0 business model canvas (i4.0BMC) will also be developed in later chapters as a tool to implement the models suggested in Figures 5 and 6. These models are only good for the starting phase of the open innovation and platformization, which in itself gets modified, as and when feedback emerges from the system as it evolves. Thus, these models are organic, and will become new wisdom from entrepreneurial exploration and exploitation, as the context is different. The ecosystem will be diverse, the country of operation will be different, and its specific advantages will be distinct. However, customization is a real benefit when one can cater unique products and services to every individual customer in the age of i4.0. Pitfalls may be there, but the benefits provided by the new era will be many. We are at the cusp of a dawn of a new age full of surprises, and AI as new electricity may mean a future of fully self-learning machines and tools that makes repetitive tasks things of the past very soon. The future generation may just need to learn how to be creative, rather than memorizing any subject.

As discussed in the context of the larger framework, the BMOL loop also gets its guiding theory finally to solve the jobs-to-be-done by the customers or various use cases and storyboards related to scenario testing. In this core process, in earlier notions, more correlational attributes were collected. Still, now with Christensen et al.'s (2016) approach, a causal link between the product or service and the customer's buying behavior is identified. This tool gives a strong foundation where *Competing Against Luck* (Hall, Christensen, Dillon, & Duncan 2016) becomes finally feasible. According to the authors, it is more about understanding customers' choice and their behavior in making purchase decisions. This removes correlation in the process and builds causality in the real sense.

While executing learning loops based on hypothesis or minimum viable product (MVP), thinking beyond cost or revenue drivers and trying to think simultaneously about how to lower costs and increase revenue would be a plausible approach. However, in such phrases, the unit of progress is just the learning, which is also validated learning. These validated learning loops may change to persevere or pivot loops after customer validation. As we learn fast and fail-safe, this approach downplays the old planning school which was building a plan for an extended period and realizing the rejection from the first customer touchpoint. Such a system was a luxury of the past, and no one is investing in this paradigm and entrepreneurs' vision only. Yes, vision matters, but learning loops anchored on vision are even more critical. In an interview published by Klotz (2020), the father of the customer development model, S. Blank, admitted that "GE management

wanted to train everybody to become innovators, rather than ensure that leaders understood where [innovation] in the company was, and how they could rapidly deploy new products and services. To expect everybody in a company to be an innovator was a mistake".

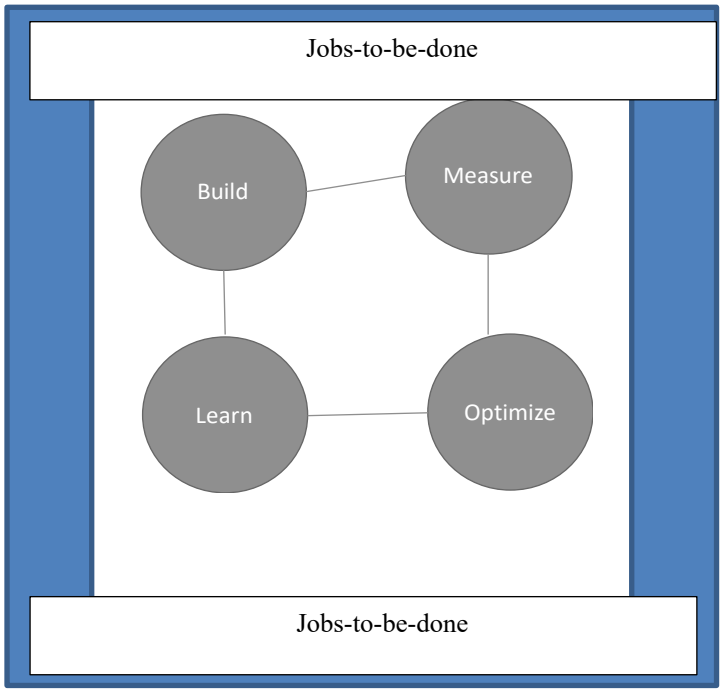

Figure 1-6. BMOL loop proposed by author by emphasizing 'optimize' and 'experiential learning' in i4.0 age

Thus, caution is needed in applying these concepts in large companies, and large companies are not the large scale of small companies. Many variables are known to the CEO and managers in large companies, such as customer needs, business models, customer segments, pricing, and even the customer's business model if the parent company is a B2B company. However, start-ups make assumptions to figure out all of those parameters unknown to the company. We need to understand the customer, build a new business model, figure out customer segments, develop new pricing structures, etc. As we do not know many issues, we search for a start-up rather than operating in large companies' execution mode. Therefore,

without understanding these limitations and differences, applying tools from one domain to another, or vice versa, is a prescription for failure.

In the past, all the tools used in the start-up world were based on the planning school of management, which was developed in the context of large MNCs. In this way, entrepreneurs thought that start-ups are the small-scale versions of large MNCs. By applying the tools and methods used in large companies where most of the critical issues are known already, start-ups were failing at a larger scale. When this assumption and the same application were challenged recently, a new wave to prove the latest tools and techniques was underway but validating the same empirically has not been possible yet.

A new frontier emerging due to i4.0 needs to embrace a reality that all external factors in a business environment will be fundamentally different, as shown in Figure 7. Suppose we assess the external environment through PESTLEG (Politics, Economics, Society, Technology, Environment, Law, and Global forces). In that case, humans have to make many difficult choices when the new era takes hold. For example, there will be a considerable debate on war or peace, layoffs or growth, hell or heaven, the collapse of society due to technology or control, pollution or renewables, and deadlock in legal systems or innovation to embrace the reality. Above all, global forces are either racing with the machine or against the machine. In designing any future business model, these trends must be assessed in greater detail (Kaplan & Haenlein 2020).

While doing PESTLE analysis, thoughts must be focused on understanding the implications of the same on the start-up, the environment, and society. The earlier notion of maximizing only shareholders' value or, for that matter, profit, is not sufficient, as the environmental degradation and social inequality have put planet earth at the edge of mass extinction. Perhaps the new wave of technologies will support entrepreneurs in executing the i4.0BMC (detailed discussion in Chapter 3) so that the future becomes a safe place to live and leave a legacy to our children and future generations.

As the external environment will be under transformation itself, the impact on businesses' internal environment will be more considerable than we assessed. As economics is associated with politics, sociology, and legal environment, studying a firm under situations where all of these three forces are under uncertainty, a start-up in the i4.0 era will be vulnerable, but at the same time, if an entrepreneur can turn the VUCA world into

reaping the benefits of no regulation in early-stage this might become an opportunity as well. When regulators wake up and tighten the rules, a particular investment level has been returned by the income itself.

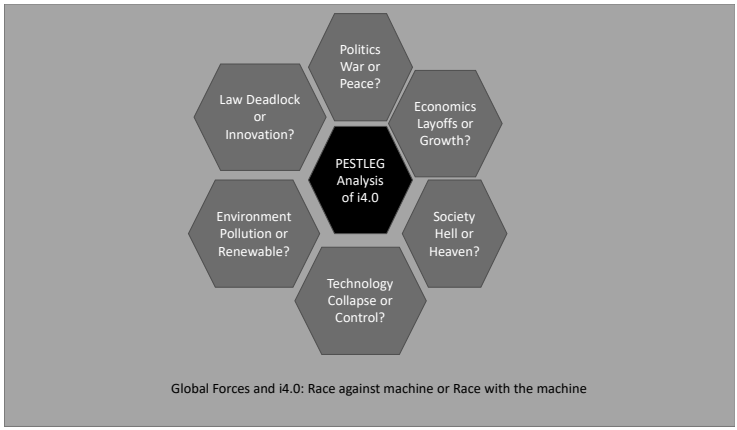

Figure 1-7. PESTLE and i4.0 (extended from AI to i4.0 from Kaplan and Haenlein (2020)).

CONCLUSION

March (1991) argued for balancing exploration and exploitation, but there has been an uneasy vacuum linking this seminal work in the start-up world. I have attempted to fulfill this gap. The emergence of a new wave of technologies and the challenging climate risk makes one vulnerable to the emerging future. Not only assessing the risk, but also planning for the mitigation of the risks identified, would be a logical expansion of these frameworks. Though the book is designed for start-ups, it may be equally applicable to other sizes of firms, and it has been tested in large corporations — but with dismal success in the case of GE. However, there are many limitations to this work, as follows. First, though the models and narratives could be applied to different firms' sizes, one must be cautious in adopting the dimensions appropriate for a start-up or SME, or a multinational. Second, I may be biased in academic rigor compared to practical relevance, but this is where the gap lies. Most of the start-up literature is practitioner biased. Third, quantitative research to test the framework developed in this book is highly recommended, as the book project's scope and size does not allow me to do the same.

The impact of individual technology components of i4.0 on i4.0 BMC is a new research domain that demands my attention, and many others may contribute on the same side. As this book's scope is not to focus on individual technologies, but overall assessment, I may be blamed for too many generalizations. However, to develop the field further, someone needs to take blame and credit at the same time.

Thus, proper assessment of how to balance entrepreneurial exploration and exploitation-related risks is the first starting point to search for a new business model. The comprehensive framework combined with the customer development model, business model canvas, lean start-up, and entrepreneurial exploration and exploitation in Figures 5 and 6, will guide frameworks throughout the book, as discussed in detail in Chapter 3. Though the slight movement was initiated in start-ups, while implementing in large corporations, Blank cautions the entrepreneurial managers to be vigilant that it does not only become a discrete activity among hundreds. The real need is an "end-to-end innovation process" (Klotz 2020) that covers everything from buying, warehousing, curation, prioritization, and solution development to incubation to customer interaction. "That pipeline needs to be part of an overall innovation doctrine". Perhaps we are in the right time of human civilization to build that pipeline, and to implement an innovation doctrine which sweeps power, brings mega returns, builds sustainable societies, and respects the planet's fragile ecology while building entrepreneurial ecosystems where platformization is the new norm rather than the exception. Let us wake up the platform economy where double-sided markets make such platforms interesting for economists and practitioners alike. Juxta-positioning these domains would be an exciting task, and I am up for the challenge, as and when it unfolds.

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