COPENHAGEN BUSINESS SCHOOL 2015

Avoiding failures in biotechnology start-up

Managing and balancing innovation, money and human factors

By

ASHISH RANJAN

and

NANZI JIANG

BUSINESS ADMINISTRATION AND BIOENTREPRENEURSHIP MASTER THESIS

PART I

February 6th 2015

Supervised by

SOF THRANE

34 pages (67500 characters with spaces) excluding cover and reference

Contents

Abstract

Biotech start-ups fail for many different reasons which can result both from the competitive landscape they are in and because of the lack of capabilities within the firm. The latter, or the resource-based view of firm has been studied by many scholars, and three main resources have been identified as key for biotech start-ups: innovative technology, money, and human resources. These factors have often been analyzed separately, but it is important to look at them as one single entity as they interact closely.

This work mainly concerns with the literature review of the three different factors and tries to throw light on the intertwining nature of all three. While doing that, a model for the evaluation of biotech start-ups risk of failure is compiled. The model shows the compensating relationship of the three factors and can be used for a quick risk evaluation of biotech start-up.

The prospect and the application of the model are practiced within the context of our own start-up, Fidubrin. The model indicates that Fidubrin is currently facing low-medium risk and suggests areas of improvement. We have tried to rest our case stating the importance of synchronous functioning of the three factors, which can lead to success of Fidubrin.

Acknowledgement

We would first like to thank our supervisor, Professor Sof Thrane, who has guided us through the thesis with critical feedbacks and suggestions. We would also like to express our appreciation to the BBIP program management, Finn Valentin, Katla Rán Sturludottir and Pascale Florentsen for running a challenging study program and making the thesis work possible.

Introduction

Most biotech start-ups end up in failure. This statement is not surprising to people familiar with the industry as it has been shown that around 90% of all biotech start-up fails. Since many biotech start-ups, especially those dedicated at developing pharmaceutical or medical devices for humans, experience a lengthy development cycle faced with various uncertainties, risk of failure is often extremely high[1].

Biotech start-ups fail for many different reasons which can result both from the competitive landscape they are in[2] and the capabilities they own[3]. External factors resulted from the competitive landscapes include entry barriers, substitutes, intra-industry rivalry can influence performances of biotech, but what differentiate the success of one start-up from the other is mainly the internal factors.

Internal factors can be seen as resources or capabilities a firm own; therefore the resource-based view of firm will be used in this thesis to evaluate biotech start-ups risk of failure. This topic has been studied by many scholars, and three main resources have been identified as key for biotech start-ups: innovative technology, money, and human resources[4].

There is a long debate over what factors are the most damaging to biotech start-up. Innovation is the core of any biotech, and biotech start-ups would not succeed if they do not have an innovative idea or the idea cannot be put into practice. But the end of the road for start-ups is usually running out of cash. Since biotech is highly capital intensive, money is both a scarce and a vital resources for biotech success. People are the ones who drive innovation and bring in the money; therefore, they are often seen as the most crucial element of business. But they are also most unpredictable; therefore many argue that human factor is the most damaging to biotech start-up[5].

A comprehensive understanding of the role of different factors is lacking. Questions such as which is the key factor that leads to the failure of biotech start-up? How do the different factors interact? still remain unanswered.

Research question

It is obvious that biotech start-ups face high risk of failure, and in order to survive, an understanding of the different factors that can influence the risk of their failures is essential. In this thesis, an overview of the resource-based view is provided and the different factors are analyzed and discussed in the biotech start-up context. This thesis focuses on developing a comprehensive understanding of the reasons leading to biotech start-up failure and proposes a framework that can guide entrepreneurs to better manage their failure risk.

The academic aspects are gathered into the research question:

"How do innovation, money, and human factors interact and compensate in influencing the risk of failure of biotech start-ups?"

To answer the question, the thesis will compare findings from literature and combine to form a theoretical framework that can be used to analyze biotech start-ups risk of failure and provide general recommendations for those start-ups.

The thesis also uses an example from a newly established biotech start-up to discuss and conclude on various aspects. This start-up is in its very early stage and faces a development plan of 5 to 10 years thus experience high uncertainty and high risk of failure.

In this thesis, we found that despite the vital role of innovation, money and human factors, facing high risk in one of the factors can be compensated by performing well in another. We therefore conclude that since for biotech start-ups it is difficult to change the innovative aspect of their business, they can lower their failure risk by managing the team members and by working on changing their money factor status.

The following part of the thesis will start with a literature review section to map out the different theories and views regarding start-up failure factors to provide an overview of a complex subject. This is followed by the methodology section which introduces the empirical case and outlines the steps taken in this thesis to perform the analysis for the case. The analysis result is then stated in the following section and a discussion is written to further describe the result outcome and its implication.

Literature review

This section provides an overview of the existing literatures that study the subject on the causes of start-up failure. The section begins with an introduction of the resource-based view, building the platform for this work. This is followed by an overview of the literature on factors leading to start-up failure. As presented in the introduction section, three main factors are the driver for the fate of biotech start-ups: therefore they will be the focus in this section. The definition and existing literature of the three factors: innovation, money and human, are stated, followed by, a comparative overview of different factors and their interaction with each other. The section rounds off with an overview of the relationships between the different factors and presents a literature framework that is used to drive the result and discussion.

The concept of resource-based view

The resource-based view of firm has developed largely as a reaction against the competitive forces analysis of firm strategy developed by Porter (1980)[2]. The competitive forces framework states that firms' performances are influenced mainly by external factors that are determined by the structure of the industry which the firms are operating in. Five factors or forces are identified as the key drivers: entry barriers, substitutes, buyers' and suppliers' bargaining power, and intra-industry rivalry. Since biotech start-ups are operating in the same industry and experiencing similar five forces, internal factors have to be analyzed in order to evaluate the performance of individual biotech start-ups; therefore the resource-based view is utilized for this thesis.

In contrast to Porter's five forces, the resource-based view argues that firm is best viewed as a collection of difficult-to-imitate resources and capabilities. These resources can be tangible such as product design and money, or intangible, such as technical knowledge and management skills.

Three resources: innovation, money and human have been identified as the most important for biotech start-ups. Innovation, the core of science, justifies the existence of biotech. Owning an innovative idea that is superior to existing technology is usually the start of a biotech. Since scientific research is expensive and lengthy, large amount of money is often a necessity for the survival of biotech. Human resources are important for all firms, but for biotech, a knowledge intensive business,

having experts in their fields is hugely beneficial to the business. In addition, the long and complex development cycle also calls for entrepreneurs that have managerial skills besides scientific expertise. The roles of each of those factors are undoubtablely important, but to what extent and level are they needed for the survival of biotech start-ups?

Innovation factor

The biotechnology industry has long been one of the most innovative industries among all. Because of the risky nature of biotechnology and pharmaceutical sector, innovation has always been the strength of these industries. Here in this section the objective is to make sense of the extant literature on innovation, and how two, incremental and radical stands against each other.

Innovation usually begins with a need. Start-ups are generally directly involved with the customers and try to solve the gap that exists in the market. Hence, a successful start-up knows exactly what the market demand is and strives to come up with solutions to fulfil those needs. They seize the opportunity to innovate to ease problems and make lives more comfortable. Keeping abreast with current trends and demands is an important factor for entrepreneurs to fuel their creativity and innovation. Manufacturers are constantly innovating to produce more without sacrificing quality. Competition is one major factor that elevates the importance of innovation in entrepreneurship. It motivates entrepreneurs to come up with better, improved products and services than their competitors for a higher share of the market. The economic benefits of innovation, which include greater productivity and leadership in new markets, are what will ensure that start-ups maintain their competitive edge.

Innovation have been viewed both as a discrete product or outcome - 'a new idea, method or device'[6] and as a process – 'the process of introducing something new'[7]. However, the commonality that binds both these ideologies is newness. Innovation consists of several stages. There are theories that define these stages in sequential linear fashion[8] or some view them as multiple, complex process with cumulative and conjunctive progression of convergent, parallel and divergent activities[9, 10]. However, the fact that innovation is problem solving and decision making involved in the development of new product and process is undeniable in both of these models. Research in

innovation is usually characterized into sets of contrasting types. Most frequently employed sets are: product vs. process; radical vs. incremental; and technical vs. administrative[11]. An organization can build up on its competitive advantage by gaining any of these three types of innovation strategy. With respect to high-technology sectors, R&D plays a central role in innovation activities, while other sectors rely to a greater degree on the adoption of existing knowledge and technology. As such, innovation activities are often focused on production efficiency, product differentiation and marketing. Innovation activity in services also tends to be a continuous process, comprising a series of incremental changes in products and processes. One of the most successful and recent examples of incremental innovation is the iPhone. While smartphones existed before Apple entered the market, it was mostly the incremental innovations of a larger touchscreen, the app store, various ease of use and an improved overall experience, which enabled the iPhone to be the first in making smartphones mainstream[12].

However, here in this work we will focus on radical and incremental innovation, because many debates have focused on which type of those innovation have better chance of success. Radical innovations produce fundamental changes in the activities of an organization or an industry and represent clear departures from existing practices. Incremental innovations, on the other hand, merely call for marginal departure from existing practices; they mainly reinforce the existing capabilities of organizations[13]. The idea behind incremental innovation is simple: instead of thinking up and executing against audacious new ideas that are risky, firms make small incremental changes to existing products and services. This method of user-centered design thinking applies to both start-ups and large enterprises alike. In Schumpeter's view "radical" innovations create major disruptive changes, whereas "incremental" innovations continuously advance the process of change[14]. Incremental innovation is the most common form of innovation. Radical innovation is generally a complex process, rather than a discrete event, and generally implies a difficult, lengthy and risky process. The diffusion of radical innovations nearly always depends on incremental improvements, refinements and modifications, the development of complementary technologies, and organizational change and social learning. The contributions of incremental innovations to address socioeconomic challenges are substantial and may be even more important in a development context. For instance,

Puga and Trefler, 2010 provide evidence of the rise of incremental innovation in low-wage countries and show how it has been contributing to increasing exports of high-quality and sophisticated manufactured goods.

Norman & Verganti, 2012 stated that most successful products undergo continual incremental innovation, lowering their costs, and enhancing effectiveness. They further go ahead and state that this is by far, dominant form of innovation and even though it is not as exciting as radical innovation, it is just as important[15]. They also reason that radical innovation brings new domains, new paradigms, and creates a potential for major changes, whereas incremental innovation is how the value of that potential is captured. Without radical innovation, incremental innovation reaches a limit. Without incremental innovation, the potential enabled by radical change is not captured. However, with respect to pharmaceutical and biotechnology industry, critics have called for strict policies to inhibit the development and marketing of incrementally improved medicines. Some have suggested that incremental pharmaceutical innovation likewise harm competition too. In general, concern arises when the effect of incremental innovation arises mainly from limiting short-run competition with existing products rather than from delivering greater consumer benefits over the longer term. Those against incremental innovation base their arguments largely on the duplicative nature of follow-on research, waste of resources, and abuse of the patent system[16]. However, supporters of incremental innovation point out that radical innovation in the pharmaceutical industry is often linked with higher prices and unproven or marginal benefits[17].

Golberman and Lybercker, 2014 suggest that incremental innovations undertaken by drug companies have provided great value to the industry and have a significant socio-economic impact. Incremental innovation also promotes increased price competition among drug manufacturers, thereby generating cost savings in the health-care sector[18]. The national research council, in 1996 stated that the cumulative effects of numerous minor incremental innovations could sometimes be more transforming and have more economic impact than a few radical innovation of technological breakthrough.

From individual firms' perspectives, incremental innovation is beneficial because they have shorter time to market. They are also expected to hit an expected market window for the enhancement; therefore time to market is critical in incremental innovation. Companies with shorter product development cycles can bring new technologies to market quickly and benefit from more frequent feedback from consumers. However, successful incremental innovation requires that a firm become efficient at all level and functions of innovation, like in research, design, development, manufacturing, and marketing. Having access to complementary assets, such as distribution or service networks also is crucial for incremental innovation[19]. Often this includes being able to maintain a steady flow to the market that will match forecasted demand. Hence, incremental innovation can be multilayered and can influence the success of start-up at different stages of development.

Incremental changes have a manageable impact on resources. Frequently, innovation project management seeks to reduce risk for supply chain resources and partner. Incremental innovations have easy access, are also easily understandable, and adopted by target customers. This is because of the fact that the underlying technology or the problem still stays relevant to the customers and this in turn builds up the confidence for trying new product. Small improvements in experience can provide significant customer value and provide opportunity for innovation across the organization. With respect to biotech industry, which is regulated tightly by regulatory authorities, incremental innovation may only face lesser regulatory challenges.

Firms can get involved and absorbed by the idea of radical or disruptive innovation but, most growth is achieved through a steady stream of incremental innovation that is more frequent and economically predictable. The success rate of radical innovations is amazingly small, likely less than 10%. Small improvements can add up to significant change over time, and represents continuous learning by researchers, managers, developers, suppliers and customers[20]. Gradual change is the key source for low risk growth and successful incremental innovation must establish the balance between evolutionary and revolutionary initiatives that will grow and sustain the business for the short and long term. Although differences might be there when it comes to selecting the innovation ideologies by firms to gain their competitive advantage, it cannot be denied that innovation is vital for the durability of any business.

Money factor

Financing is one of the more important processes in young firms. In fact, one of the common problems for new ventures is raising sufficient funding enabling them to launch and operate businesses successfully. Accordingly, finance availability and cost have been cited as one of the major constraints for entrepreneurship[21]. It is a known fact that experienced entrepreneurs in general, have a strategic and long-term approach to funding and to a limited extent deviate from their pre-set plans. Berger and Udell, 1998, rightly pointed out that the lack of funding facing young and innovative ventures is an ever-occurring theme[22]. Absence of finance happens because of the newness of a firm, due to absence of records of accomplishment and a high default risk; and hence potential financiers are skeptical to provide funding[23]. Because of these reasons, innovative start-up firms are considered more financially constrained than other companies, which in turn restrain their development and growth paths. Studies on start-up financing have mostly been motivated by the arguments pertaining to the informational asymmetries theories, the central theme of which is that market imperfections lead to credit rationing[24]. Early investment can be particularly risky since the information asymmetries are extreme. There are also risks associated with the success of technology, and how market is going to develop in future.

With respect to biotechnology industry, equity finance is important because they are typically rich in intangible assets such as technology and specialist knowledge but lack the sort of assets that help them to access external finance. The long lead times and high costs associated with research and development work mean that these firms require access to capital long before revenues are possible. Their undercapitalization due to their inability to access external finance can limit their ability to achieve their full potential.

Interestingly, historically finance scholars tend to view entrepreneurship as entirely separate from the field of corporate finance. However, more recently financial economists have recognized that entrepreneurial situations are characterized by the same two fundamental problems of information asymmetry and agency problem. Entrepreneurial finance differ from corporate finance only in the sense that magnitude of these two problems is larger, thereby requiring contractual solutions that differ from those typically encountered in large, more established corporations[25].

The topic of financial factor has a variety of dimensions and can be analyzed by numerous criteria. Few of the major protagonists in the entrepreneurial finance are, alternative source of capital, issues related to financial contracting, public policy issues and risk and return in private equity return[26]. However, this work here is not meant to be an exhaustive survey of the literature on the issues listed above; instead, it tries to look into the entrepreneurial finance with broader glasses of short and long term funding scarcities. Although, while talking about the short and long term financial constrain one ends up discussing a labyrinth of issues listed above.

Short-term funds are those that satisfy the immediate need of a firm. For biotech start-up, this is usually funding to support day to day tasks such as buying laboratory consumables. These are categorized as short-term funding because it's immediate need in comparison to long-term funding which is more important in the long run for the overall business. Specifically, longer term funding is used to support large expenditures such as conducting human trials, obtaining regulatory approval and commercializing products. Both are vital for biotech start-ups but they are also difficult to obtain from a start-up perspective.

Inability to have short term funding is related with the fact that these firms are generally not profitable and lack tangible assets. The entrepreneurs are then either forced to invest their own private equity, which is often not enough to start an enterprise, and hence consequently entrepreneurs tend to rely on three primary sources of outside equity financing, venture capital funds, angle investors and corporate investors. This ends up being the ideal agency problem situation. However, several studies have shown that external funding like angle investors play an active role in providing mentoring, strategic advice, help bringing innovative products to the market place and assistance in the recruitment of top team[27].

With respect to long-term financing, two types of long-term financing are available to start-ups: debt and equity. Debt financing usually relates to bank or lender loans for various business needs. Entrepreneurs often secure debt financing for start-up costs and other business needs doing the line of the small business. Equity financing involves direct capital investments from venture capitalists or private investment firms. Business owners and investors often use written contractual agreements to

outline the amount and length of the investment. Because of the importance and incomparable influence on the growth and future of start-ups, roles of VCs have been under scrutiny. Lerner, 1995 further went ahead and states that if VCs serve such an important factor in determining the success of a firm, their need to be a stringent venture capital monitoring. Kaplan and Stromberg, 2001, perhaps provide the most direct evidence of VCs monitoring. Their finding indicate that VCs play a primary role in not only deciding the strategy of the newly form firm, but also play a key role in shaping the top management team of the companies in which they invest[28]. However, this form of short term funding is not costless to entrepreneurs. The close involvement of the VCs can be time consuming for the entrepreneur. VCs financing is associated with a significant reduction in entrepreneur's decision and control rights[29].

Be it short or long term financing, it is inseparable with the success of a newly formed firm. Finance is a crucial part of a start-up business; it is the cornerstone to determine whether a start-up will jump over the first hurdle. Without sufficient finance, a business has a very low risk of surviving the first stage of development. Not having the sufficient finance will reduce the chances of the business accepting negotiations, therefore restricting the business in terms of growth.

Human factor

This part of the work aims on human factor, which is regarded as the most valuable intangible asset, and tries to throw some light on how it affects a start-ups success. Relationships between human factor and success of a firm have been a burning topic of research. Often human capital in an organization is confused with only people who are working in the firm, however it is a broad combination of their experiences, abilities, attributes, culture and other non-measureable values that they bring to the firm. Furthermore, a number of researchers have suggested a positive relationship between human factor and organizational success.

Weatherly, 2003 described human capital as collective sum of the attributes, life experience, inventiveness, energy, knowledge and enthusiasm that its people choose to invest in their work[30]. On the same note, other researches like Florin, 2003; Sexton and Upton, 1985, have defined the human capital as attributes, relevant to education, knowledge, experience, and skills[31, 32]. Researchers who

are interested in human capital have done numerous studies that have applied the concept and reflect importance of human capital with respect to entrepreneurship[33, 34]. According to most researches, human capital increases employees' capabilities of discovering and exploiting business opportunities also helping employees' to identify and acquire other useful beneficial resources such as physical and financial capital, and it assists in the stockpile of new knowledge and skills[35]. Although a positive relationship between the variables of human capital and success is well established, the magnitude of this relationship and the reasons under which human capital variable is connected with success is still uncertain. Interestingly, the literature of human capital remains fragmented with studies depending on, the choice of success indicators, and the study contexts such as industry, age of the business and country. However, Unger, Rauch & Frese 2011, does indicate that there is a high force from human capital, towards the success of an entrepreneurial organization[36]. Shane and Venkatraman 2000, further reinforce the view that human capital helps to increase the ability of employees to perform their day-to-day entrepreneurial tasks of discovering and exploiting business opportunities[37]. Further work on the same by Pfeffer 1994, points out that human capital is positively related to planning strategy, which in turn, is positively impacts success of a firm[38]. Another important work from Chandler and Hanks 1998, points out that human capital may be helpful to compensate a lack of financial capital, which is a constraint for many entrepreneurial firms and hence can make a difference in the success or failure of the start-up[39]. Finally, a magnitude of work have been done by researchers suggesting that human capital is helpful for gaining further learning, and it assists to collect new knowledge, training and skills which eventually make or break a start-up organization. Increasing the stockpile of knowledge and skills of an organization is correlated strongly with its existence and finally in turn, positively influences success. Owners with higher human capital should be more effective and efficient in running their business than owners with lower human capital.

The effect of human factor on success of an organization is even more striking when the firm is involved in high-technology industry, like biotechnology. Khandwalla, 1976 state that industries having high-technologies, which use sophisticated technologies for their day to day activities, and typically require specialized knowledge and where research is dynamic and surrounded by uncertain environment, is highly influenced by human factor[40]. Since high technology industries are relatively

more dynamic and rapidly changes overtime as their low technology counterparts, they need to evolve rapidly and innovate in order to survive. Since human capital is the only way to adopt new knowledge and skills, business owners can make better and faster decisions. Thus when talking about the organizational success, human capital is more important aspect in high-technology industries than in low-technology industries[41].

Relevance of human factor for a young organization is inseparable. Davidson and Honing, 2003, point out the need of good human factor in a start-up[42]. Young organizations and start-ups suffer from the effect of newness and challenge, which refers; most of the young organizations have a higher propensity of failure comparing to older and more established enterprises, especially when implementing new projects, and development plans. Aldrich and Auster, 1986 blames less experience and skill shortage to be the liability that can reduce newness[43]. All these arguments do rest a case in favor of human factor and its importance in the initial years of business rather than during later stages.

A start-up becomes successful because of majority of factors like, having a great idea, presence of a receptive market, and a passionate promoter. And often also, comes from a tolerance for failure and ability to learn from it. Entrepreneurs who have experienced the ins and outs of building a start-up venture has a better understanding of the problems that come up, such as how to present to potential investors, how to find the right partners and employees, and how to identify potential customers. Having a previous experience in the business of start-ups do add on to the value of the team and hence increases the chances of success considerably[44]. However, this does not guarantee success.

Human factor is the one of the most valuable asset to any start-ups. It often forms the core of other two factors. Unlike any other factor involved in the functioning of an organization, people tend to be the greatest potential assets and often the only greatest potential liability that a start-up will acquire as it moves about its business.

Interactions among three factors

Star-ups are difficult to manage. The chances of one failing is considerably high and the risk involved in it is of great magnitue. Because of the mere nature of star-ups, it need dedicated and balanced appraoch. Having a great idea , just isn't the appropriate and does not guarantee sucsess. The mobilization of resources is one of the key activities performed by entrepreneurs and plays a critical role in theories of firm performance and growth. What is needed indeed is a synergy between the three pillars of a start-up, innovation, money and human factors.

The pursuing a "hot idea" is likely to turn out to be a wild goose chase, because one often don't know what others in the competition know and firms end up competing at a disadvantage with those who are true experts in the field or with well-financed already existing players, that can outspend a newly formed firm to gain a competitive advantage. A significant number of pitfalls can be mitigated if start-ups concentrate on their competitive advantage using their innovation, taking care of the money situation and with a good team. New venture failure has been a topic of study for at least two decades. It has been investigated in one form or another at multiple levels of analysis: in the economy[45], in organizational populations[46], in firms[47], and in individuals[48].

Kirzner 1979, widely recognized sources of inspiration for entrepreneurship as market inefficiencies[49] while Schumpeter, 1950 looked at it from technological progress point of view[50]. An entrepreneurial initiative, thus, is a specific effort by an existing firm or new entrant to introduce a new combination of resources, often termed as innovation. Innovative activity is capital intensive and tends to require outside financing, hence innovation goes parallel with good financial support. There are repetitive evidences that financial sector development increases the effectiveness of innovation activity[51]. In the macroeconomics literature, there is a well-established empirical link between finance and development. This is also mirrored with respect to start-ups.

Despite the importance of innovation, money and human factors, lacking resources in one of them does not equal to start-up failure. To survive in a highly competitive and risky industry, a biotech start-up needs of course an innovative idea that addresses existing pains and is demanded by the market, and it also needs some money and team members that know the innovation. But being in a more risky state in one of the factors can potentially be compensated by another factor. In this part,

the interactions between the different factors are presented and a risk evaluation model is developed utilizing those interactions.

In terms of innovation, incremental innovation is often considered less risky and more likely to produce successful products compared to radical innovation, because it has shorter time to market. Having a shorter time to market is beneficial for start-up as it lowers development cost and speed up income generation. While in radical innovation, availability of long-term funding is extremely important, it is a smaller concern for start-ups developing incremental innovation.

Shorter time to market is not only a benefit of incremental innovation, but also critical as it is expected many competitors are working on similar solutions. To win a market with an improved product, it is important to be an early mover. To become an early mover, both fast development and strong commercialization are needed; therefore having a strong team with commercialization skills is vital. If the team does not have marketing and sales personnel, then alliances would need to be formed with companies that do have those skills; therefore having the right connection to those companies will be beneficial for the start-up.

In addition to having shorter time to market, incremental innovation is also more manageable for the firm and easier to communicate to customer compared to radical innovation. Developing a radical innovation requires extensive expertise about the technology and strong passion that can keep individuals motivated for a long period of time. Human factors such as technology experiences and managerial experiences play important roles to balance out the risk involved in developing radical innovation. Since radical innovation is more difficult to convey to customers compared to incremental innovation, having team members that are well connected to key opinion leaders in the field would be greatly beneficial to start-ups developing radical innovative products.

Though facing much higher risk than incremental innovation, there are many examples of successful radical innovation. Groenewegen and de Langen 2012, have pointed out some critical success factors for the survival of start-ups with a radical innovation. Three major variables, the uniqueness of the innovation, organizational characteristics and entrepreneur characteristics can drive for biotech success. They found that money factors such as owning large seed capital and using

investor's capital have increased employment of start-ups. In regards to human factor, usage of external advice has increased employment of biotech. Entrepreneurs years of industry experience, relevant social network, number of previous jobs and years of working experience have all shown positive impact on start-ups turnover. From these result, we can see that money and human factors have large influence of the success of start-ups with radical innovation.

As stated previously, good human resources can compensate the lack of financial resources. One thing is the connection of team member to the investor communities. Also if team members have access to laboratory for experiments or experience in patents, the cost of conducting those activities can also be significantly reduced.

Based on the interaction of the different factors, a model is compiled for the evaluation of biotech start-up risks. The model is presented in the following theoretical framework section.

Theoretical Framework

As presented in previous literatures, both the competitive landscape a firm is in and the firm's own capabilities have huge impact in determining the fate of the firm. As illustrated in figure 1, externally a firm is influenced by the five forces Porter has identified and internally the three most important resources for biotech start-up are innovation, money and human. The model that combined both external and internal factors is more comprehensive for the performance evaluation of biotech start-up.

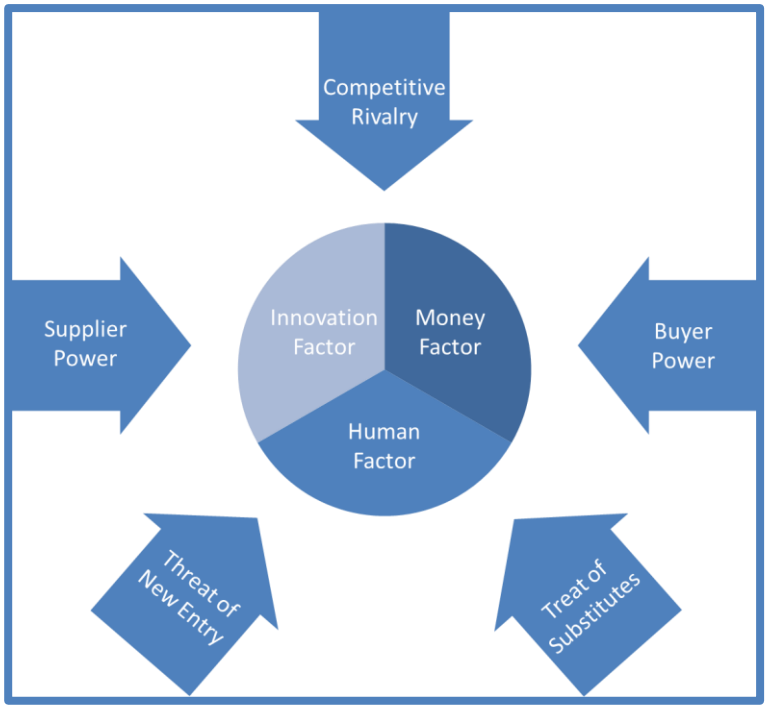

Figure 1. External and internal factors that influence biotech start-up success

The specific determinants of Porter's five forces have been illustrated many times in literature before, therefore we do not present here. The three internal factors are broke down further in figure 2 based on arguments presented in the literature review. Specifically, innovation factors can be determined by the existing pain and need in the market, the type of innovation, and the level of innovativeness. In this thesis, we focus on the level of innovativeness specifically incremental and radical innovation as there are many debates over which form is better for start-up to succeed. Money factor can be affected by the availability of money, the forms of finance and the length of

finance. It is obvious that if money is not available start-up would fail, but the effect of form and length of finance on failure risk can vary across start-up. We focus on the length of finance in the discussion as this is most relevant when evaluating start-up risk in respect to type of innovation. Human factors can be described as the scientific and managerial experiences of team members, entrepreneurs' previous start-up experiences, relationships and networks the team has including availability of external advisors, and personal connection to the industry and investors.

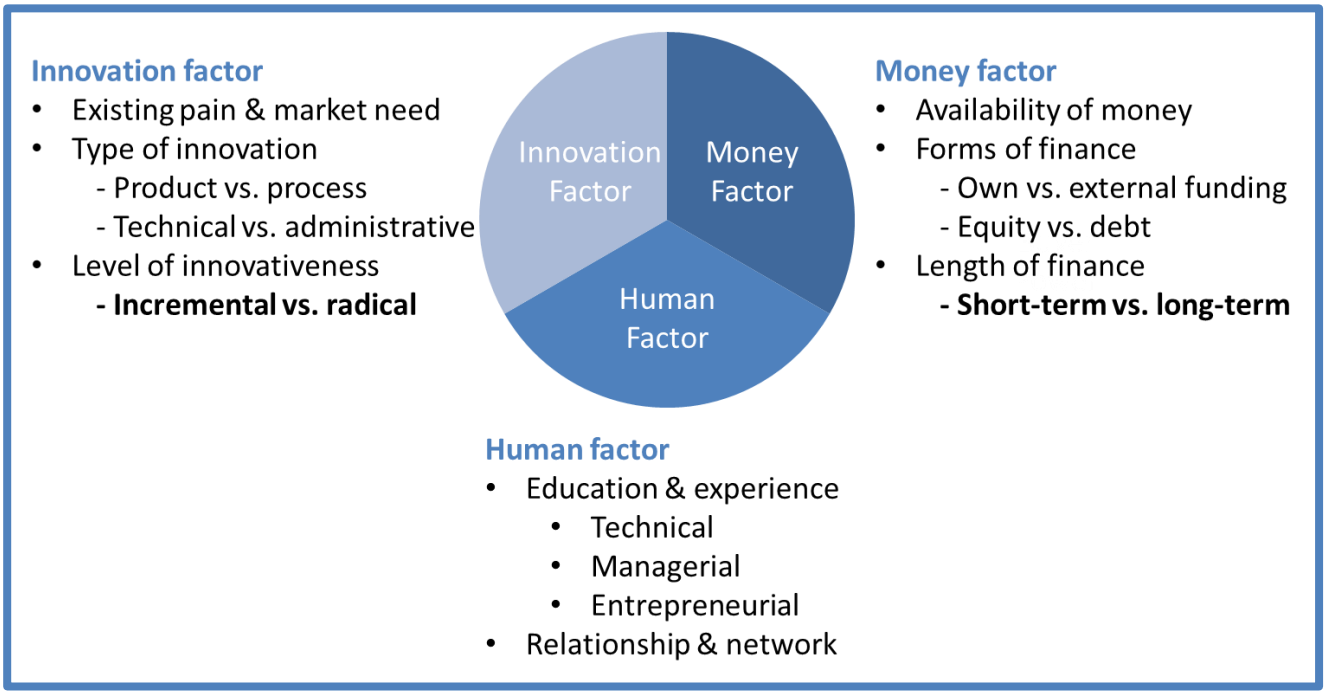

Figure 2. Details of the three internal factors: innovation, money and human

As discussed earlier, the different factors interact and can compensate each other. Such that a start-up developing radical innovation will be influenced stronger if lacking long-term funding compared to start-up focusing on incremental innovation. Having a strong team can also relieve the risk faced by lacking funding and developing radical innovation. These compensating effects are illustrated visually in figure 3. As shown though radical innovation bears a higher risk of failure than incremental innovation, this risk can be moderated by the presence of long-term funding and a strong start-up team. The same goes for money factor, a strong team can better manage away the risk involved when lacking long-term funding. This model is elaborated in detail in the discussion section.

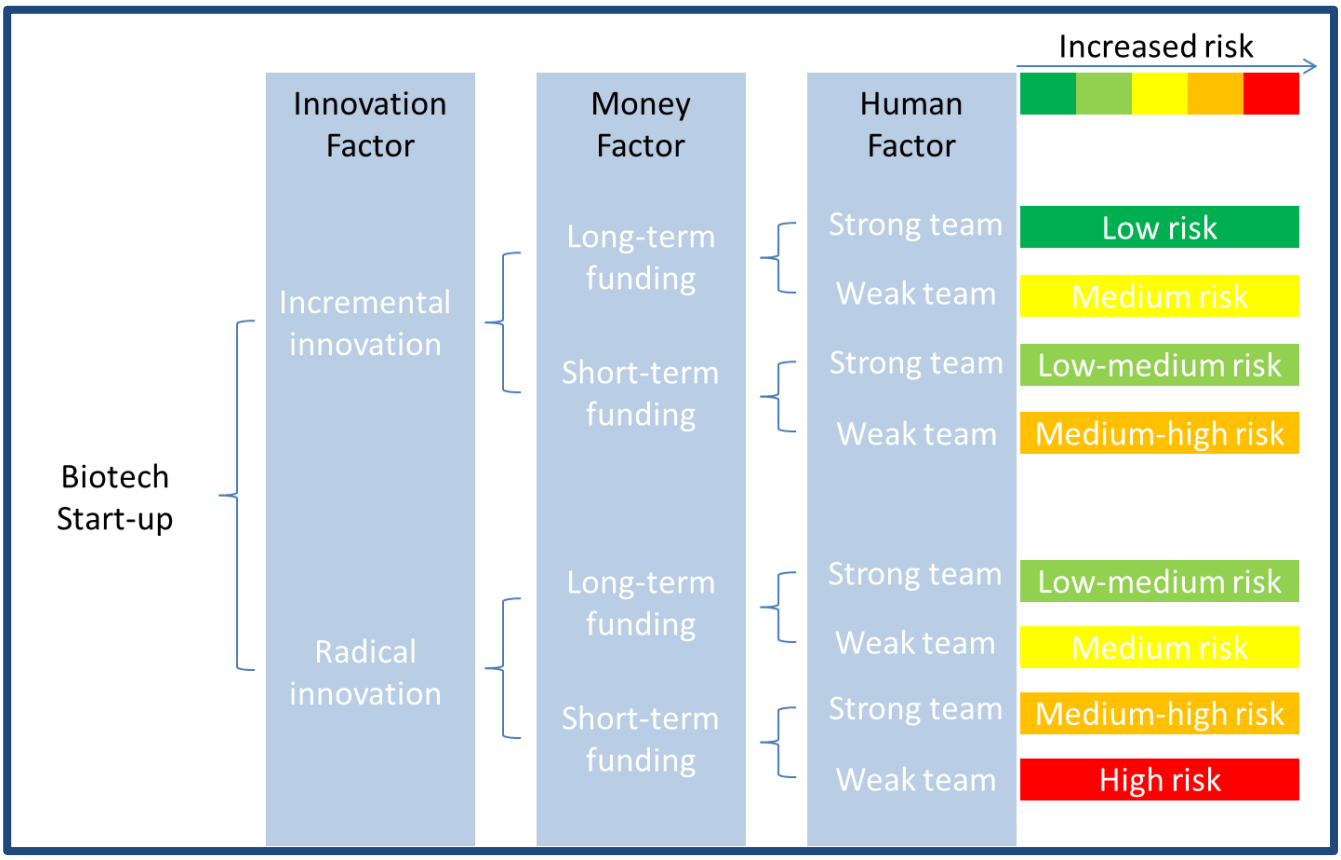

Figure 3. Risk evaluation framework of biotech start-up

In this section, we presented a literature overview on the important factors influencing start-up success. Next, the methodology used for this paper is stated to provide a better understanding our approach to answer the research question.

Methodology

In investigating the research question, desk research is first conducted to compile a review of existing literature in the previous section. This involved reading and reviewing literature on resource-based view of the firm and biotech start-up failure factors to gain an overview of the key concepts in thesis fields. This method allowed us to gain large amounts of information with limited time.

A comparative analysis of different theories is then discussed to investigate the relationship between the different factors. The relationships are compiled and illustrated into a theoretical framework that can be applied by different biotech start-ups.

The framework is then implemented for a case study of Fidubrin to provide more qualitative results. It also serves as an example for the usage of the theoretical framework developed in this thesis. The description of the case is illustrated below with specific focus on the innovation, money and human factors.

Case description

Fidubrin is a start-up that is developing a new prostate cancer radiotherapy imaging marker. The marker is considered a medical device not a drug, therefore the development cycle is relatively shorter compared to other biotech, but since it is to be injected into human, a 5-8 years development time is expected. With the lengthy development, Fidubrin faces high uncertainty, therefore high risk of failure.

Case innovation factor

The technology Fidubrin is aiming to develop can only be considered an incremental innovation, as imaging markers exists and have been used for many years. The new marker will be an improvement of the markers used today by replacing the solid gold seeds with a liquid hydrogel. Though the change is incremental, the new marker is expected to be more accurate for location and less painful for patients.

Case money factor

In order to develop the product, Fidubrin requires significant monetary resources. Since the marker is to be injected into human, clinical trials are needed prior to product approval. At the

current stage, money is mainly needed for basic testing and establishing intellectual property rights which is also costly. Fidubrin has not received any funding as of the thesis submission date.

Case human factor

The team consists of six members with a diverse background including cancer research, medical devices, start-up entrepreneur, consultant and engineer. In addition, three external mentors serve as the business and science advisors of the team. The three advisors are associated with Montreal Heart Institute in Canada and Georgia Tech University in USA.

Next, the framework developed in the end of the literature review section is applied to the empirical case, Fidubrin. The qualitative result is explained in following result section.

Result

In this section, the start-up risk evaluation model is applied to Fidubrin and the result is presented. As shown in figure 4 below, Fidubrin is under low to medium risk at this stage. As presented earlier in the case description, Fidubrin is developing a technology that is incrementally more innovative than current solution, therefore experiencing relatively lower risk. But it has yet to obtain any funding, so in the short-term team members will have to rely on own equity to support development. As all of the team members are students, the availability of short-term self-funding is limited and increases the risk Fidubrin faces.

The money factor risk is however relieved slightly due to the presence of a strong team. The team is considered strong for three reasons: presence of external advisors with connection to industry and university, availability of previous start-up experience, and connection to start-up community in both the United States and Denmark. These reasons will be discussed in details in the following section.

Overall, at this stage Fidubrin experience relatively low risk of failure taking into account the internal factors, or the three most important resources we discussed in this thesis.

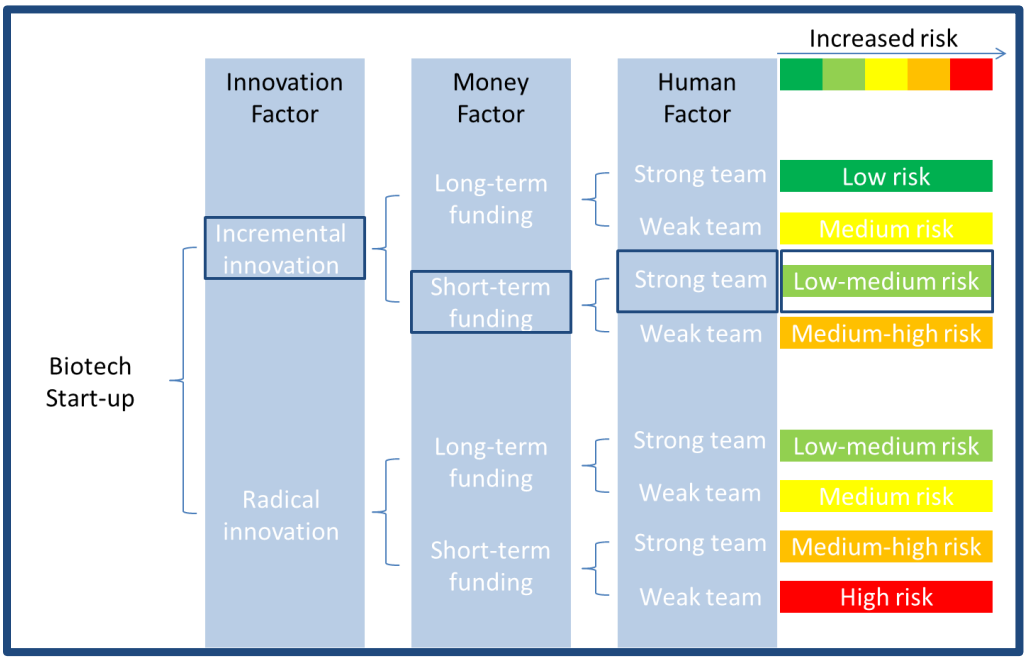

Figure 4. Risk evaluation of Fidubrin

Discussion

Theoretical framework analysis

At the end of the literature review section, we presented a theoretical framework that can be used for a simple evaluation of the intrinsic risk biotech start-up face (figure 3). The framework consist of the three main factors that influence the fate of biotech start-up and provides a risk evaluation based on the biotech start-up's current performance on those different factors.

In innovation factor, the model focused on the level of innovation, as that is often debated to have a strong influence on start-ups likelihood for success. Innovation factor is put as the first branch, because this is usually determined when start-up is formed and cannot be easily changed compared to the other factors. The model also shows that radical innovation usually faces higher risks than incremental innovation given the same other factors.

Innovation factor branched out to money factor which includes long-term and short-term funding. As shown, lacking long term funding has a stronger influence on the risk of failure for start-ups with radical innovation than those with incremental innovation. Radical innovation start-up's risk level is expected to moved up two grades when lacking long-term funding compared to moving one grade up for incremental innovation start-up. This is because radical innovation is often much more costly than incremental innovation and requires a longer development time. Not having secured long-term funding, start-up risks stopping development projects mid-way when running out of cash. Though the money factor is not as difficult to change as innovation factor, to move from one branch to another still requires extensive effort; therefore we placed the money factor as the second branch in the model.

The third branch is human factor, which is the most mobile factor of the three, as new members can be recruited based on the need of the start-up. But recruiting good members that contribute positively to the team is still a challenging task. As defined previously, human factors include many attributes such as knowledge, experience, energy, relationship, network and so on. A strong team also contains many characteristics. First, they should have expertise in the technology they want to develop. This can come from having experts as part of the team or as external advisors.

Second, besides technical expertise, business knowledge is also vital. A strong team needs to have members who can manage the varying aspects of business including financial controlling, human resources management, and negotiation. Besides the intrinsic skills team members should have, external network is also hugely beneficial for start-up. External networks include connection to potential customer, regulator, investor, pharmaceutical companies as well as the scientific community. These networks broaden start-ups ability to obtain knowledge and funding and provide access to the market. Another general attribute that add significant value to a team is team members' previous start-up experience. These experiences taught lessons on start-ups potential pit falls and help guide the current start-up to avoid failure.

When using this model, a start-up can determine its current state of risk by choosing the right box at each branch. After the evaluation, a firm can decide to take actions to lower its risk by shifting on the branches. As said before, it is difficult to change the type of innovation they have; therefore they can focus on obtaining more funding or attracting talents that complement the team. The specific recommendations to start-ups will be elaborated in a later section.

This model choose the most important attributes in each factors to evaluate the risk of start-up; therefore provide a simplified and fast way for a start-up to evaluate its current state of risk and guide the start-up to take actions in order to prevent failure.

Empirical case analysis

As shown in the result section, Fidubrin is evaluated to have low to medium risk at this initial stage of development, because it is developing an incremental innovation product, currently relies on short-term funding and has a strong team. The team is considered strong because of its external advisors, previous start-up experience of one of the members and connection to start-up community in Denmark and the US.

Fidubrin is considered to have an incremental innovation because the prostate cancer imaging marker it is developing combines known technology and is not unfamiliar to users. Right now the most commonly used prostate cancer imaging marker is gold seeds. Because it's solid nature, it is highly painful when injected. Since, it moves around in the body, multiple gold seeds are injected to

improve accuracy. To solve these two major pain points for both doctors and patients, Fidubrin want to replace the solid markers with a liquid hydrogel, which is injected by a smaller and painless needle and sticks to organs therefore stays in place in the body. Two main technologies are involved in making this new product: hydrogel formulation and imaging marker contrasting. Hydrogel formulation has been done many times for different purposes with tractable patent and literature; therefore it is expected to be relatively easy. One Fidubrin's external advisor also owns a technology that will make hydrogel stick to the tissue. Since prostate cancer imaging cancer marker is also well known and practiced, Fibubrin's product is recombining existing technology. In addition, the techniques required for the usage of the marker will not differ significantly from the current solution; therefore users are expected to be familiar with the new product. Overall, the new marker would be considered an incremental innovation to the existing markers based on its technology and the market perception. In terms of money factor, Fidubrin is placed in the short-term funding box, but in fact, the money factor risk is higher because Fidubrin has yet to obtain any funding. All the cost associated with development is coming from owners' equity at this stage; therefore, development is stalled at validation of value propositions. The next steps of Fidubrin are to conduct hydrogel formulation experiments, animal experiments and applying for patents. These are all costly activities that would require external funding; therefore, the risk for Fidubrin is actually higher than what the model depicts. If no funding is obtained in the near future, Fidubrin would face having to stop the development and end the start-up.

As mentioned above, Fidubrin is considered to have a strong team due to three reasons: presence of three industry and academic experts that serve as external advisors, availability of previous start-up experience by one of the team members, and connection to both US and Denmark biotech start-up community.

Our external advisors can support our team both in the scientific and business development process. Dr. Raoul Bonan is a cardiologist at the Montreal Heart Institute and has worked 10 years as medical advisor to Medtronic. He is also the inventor of the technology that makes hydrogel sticks to the organ. Richard DiMonda is a biomedical engineer with 25 years of experiences in medical device industry from companies including Dornier and Novoste. Professor Julie Champion is a researcher

with special focus in cancer therapeutics. These external advisors on the one hand provide us with expertise in the technology and on the other hand connect us with the industry. Companies like Medtronic could be our potential partner for future research and commercialization or the customer of our technology.

The core team consists of six students from both scientific and business studies. Specifically Fidubrin has scientific knowledge in medical devices engineering, cancer research, conducting animal experiments, and hydrogel formulation. Besides the scientific research expertise, team members also have finance, consulting and start-up work experiences. These work experiences supplement the academic knowledge with skills in management, commercialization and networking which are often lacking in biotech start-ups. The team member who has made her own start-up previously, also are more familiar with the type of challenges Fidubrin can face, therefore adds significant value to the team.

The team is not only diverse because of members' academic backgrounds but also in terms of its geographical location. Team members come from four nationalities and are physically located in Atlanta, USA and Copenhagen Denmark. In addition, members in the US are associated with TI:GER and members in Denmark are associated with BBIP. Both of these are programs are highly involved in their local biotech start-up community. The physical locations provide easier access to the main market Fidubrin is targeting: Europe and US while the connection to start-up communities creates network for Fidubrin to attract funding and find potential partners.

Though the team can be considered strong with the various aspects mentioned above, there are still some weakness that need to be addressed. For example, none of the members in the team has experiences in filing patents which could add significant financial pressure to the team as external patent advisors will be needed. Also none of the team members are associated with labs that can provide access to initial experiments and animal studies, which again increase the need for funding. Recommendations on how Fidubrin could further decrease its risk of failure are further discussed in the following section.

Recommendation to Fidubrin

The innovation factor is difficult to change; therefore to improve Fidubrin's risk condition money and human factors are the key areas to improve. In this section, specific recommendations to Fidubrin are provided to improve money and human factors in order to lower the risk of failure.

Since Fidubrin has not received any funding, the first and foremost task would be to obtain some funds in order to initiate proof of concept experiments. Since Fidubrin is formed by students, investing purely with private equity is not a practical option. Attracting external funding such as venture capital, angle investor and corporate investors is a difficult process due to information asymmetry. Fidubrin should signal potential investors that it has a good idea that can generate future revenue. To do that, Fidubrin should involve radiologists who are the potential customers of the new prostate cancer imaging marker to demonstrate the market need for its future product.

Though obtaining external funding is essential for Fidubrin, agency problem arise after receiving funding from external investors. There could be a conflict of interest between the investors and Fidubrin's member; therefore it is very important to formulate a good contract that guides both parties behavior to common interest. At the same time, it has also been shown that external investors can provide mentoring, strategic advice and support on commercialization. Fidubrin therefore should select investors not only based on the amount of funding provided but also the type of non-monetary support they can offer. Joining a biotech incubator such as COBIS could be a good approach to obtain both funding and general guidance.

Short-term funding would be used to mainly for conducting animal experiments and obtaining patents while long-term funding would be used for human trials. A potential long-term funding could come from collaborating with a larger medical device firm. Since human trials are relatively far from the current development, it is probably more important for Fidubrin to focus on attracting enough short-funding to establish IP rights. Once that is established, Fidubrin can switch gears and scout for potential partners in order to obtain long-term funding.

Compared to obtaining funding, recruiting more qualified team members would be relatively easier. Since the next step in development is formulating gels to test in animals, it would be cost

effective to have a member in the team that can freely access research labs. Fidubrin should try to recruit a member that is already working with hydrogel and are willing to explore other options for hydrogel applications. Having such member in the team would not only lower cost of conducting experiments but also bring expertise into the group. After developing a viable hydrogel formulation, Fidubrin needs to file new patents. Though hiring external patent advisors would be necessary, it would add value to the team to have someone with patent experiences. An ideal candidate would be somebody who has experiences in biotech start-up and has been involved in the early stage of development.

Overall, Fidubrin can further improve its money and human factor conditions to lower the risk of failure. In the next section, we will discuss more broadly on the recommendations for biotech start-up in general when using this model.

Recommendations to biotech start-up

Successful entrepreneurship is about building a sustainable, profitable business. Successful biotech entrepreneurship is less about biotech and more about good entrepreneurship. Biotechnology is a high risk, high reward business. A biotech company does not only face the same risks that all start-up businesses face, but also a number of other, unique challenges.

Over the course of this thesis, we have emphasized on the fact and numerous literature have further strengthen the belief that success rate of start-ups is very dim. Out of 10 start-ups, 9 of them do not manage to survive. Among other, one of the most important aspects that start-ups fail to understand is that a start-up requires more than just a good idea to be successful company. Having a successful idea is always a beginning, but what makes a start-up an established firm, is its capability to innovate, its intangible assets like people involved with it, and last but not the least constant supply of financial support.

As a biotech stat up, the firm should focus on the crux of the technology, since investment decision in early stage is mostly governed by the fact that if the scientific thesis are compelling and if the firm is likely to have real impact on patients. One should be able to credibly frame up findings, lay out the data supporting its claims in a thoughtful way and try to eliminate hand-waving by being open

about what one knows and what one does not know. Furthermore, as an entrepreneur, it is easy to focus on building innovative solutions that do not connect directly to market problems. According to David Skok, a serial entrepreneur and venture capitalist, in many cases the cost of acquiring the customer is actually higher than the lifetime value of that customer. This can carry through to poorly thought through go-to-market strategies. They are usually poor at execution, which leads to issues with the product not being built correctly or on time, and the go-to market execution will be poorly implemented. Hence, before moving ahead with the plan, it is highly important to constantly test ones idea and be highly critical about what might be wrong. The process of finding the right market fit and innovating the right technology, which can fulfil that gap, is the building block of any start-up. It is also of utmost important that start-up reach out to the market it is trying to cater. Interacting with its customers and enabling them to understand the product and hence fill the void to achieve right market fit.

Next most critical aspect is to have the finance set right. A start-up needs proper funding, whether it is seed funding in the beginning, or VC's back up later in the development stage, start-ups need monetary support in order to survive. Each individual investor has different funding goals and should be evaluated for its potential match with start-up business's funding goals. In order to generate capital, start-up should know the investors audience. This seems so obvious but it is amazing how little attention is paid to it. There are two key components here: firm and the partner. Before approaching any funding agency, it is important that start-up conduct proper due diligence, and look into the kind of start-ups the funding agency is used to provide their capital into. It is also important to dig into historical performance and see how many of such funded companies have made it. Since, there are different agencies that invest in different kind of start-ups like, single asset plays vs. platforms, early stage vs. late stage, novel vs. reformulation, therapeutics vs. non-therapeutics, it is important to find one which is into the field expertise or technology the biotech start-up is in. Apart from all this, it is also important to look into if the funding agency is dedicated to one or more than one start-ups. Finally, if start-ups find the traditional funding sources of banks and investors do not meet the needs of start-up, one should be prepared to look outside. To find other creative sources of financing it is often useful to look for people who could benefit from what your company offers.

Last but not the least is finding the right combination of people. One of the widely acknowledged reasons that cause start-ups to fail is a weak management team. They are often weak on strategy; building a product, that no one wants to buy as they failed to do enough work to validate the ideas before and during development. Professor Noam Wasserman talks about persistence of the founder's dilemmas and states about the ''paradox of entrepreneurial success''. He argues that the founders who often have a deep knowledge and understanding, and leads the change during the initial development of product, leads to the downfall of its own company since they have often exact wrong set of skills for the next stage of development. In order to keep control they tend to form compromise in making an efficient team. Often, it has been pointed out that lack of good management team to be the core problem of failure. However, there is not cut and dry formula for finding a good team. Nevertheless, few things that are important to consider are to identify ones strong and weak attributes. People with different competencies are important and play a critical role in deciding if the firm going to make or break. Level of experience, education and knowing right people are important when forming ones team. Start-ups should consider their status on innovation and money factors as well to recruit the right members for the team, However, technical skills, expertise of a particular market and industry contacts can be acquired on the go, what is more important to have a common shared value.

To achieve right balance between the three is the key to success. If formed with right strategy, lack of one can compensate the weakness of other factors. The idea of having the synergy between the three pillars of entrepreneurship, innovation, finance and human factor can increase the chances of success of a start-up considerably.

In the following section, we will shed light on some limitations of the thesis and perspectives of future research area going forward, and finally we will conclude the findings of the thesis in the last section.

Limitation

The thesis is subjected to some limitations due to the methods used to approach the research question. First of all, the thesis is based on comparing existing literature and analyzing one empirical case; therefore it may lack an overall representation of biotech start-up in general. In addition, the empirical case used in this thesis is a medical device company which may not be able to reflect the situation faced by other type of biotech companies.

Furthermore, the empirical case analysis was purely qualitative. The evaluation process therefore can be subjective and inconsistent across different start-ups. The performance of different factors can be interpreted differently by different users of the model and the result may not be comparable; therefore a more defined rating system needs to be developed in order to provide a consistent and comparable model.

The empirical case is also at the very early stage of development with little investment. The downfalls of failure may not be as significant as start-ups that have invested heavily in time and resources. The more mature start-ups would probably need to use this model differently from an early-stage start-up.

Taken into account the limitations of the thesis, extrapolation of the model should be done with caution. Additional research should be conducted to prove the effectiveness of the model.

Future research should combine literature studies with a large empirical studies containing start-ups from different stages of development and developing different types of products. A more quantified approach to measure the exact risk and the different factors should also be developed in order to analyze how the different factors influence each other in determining the risks of biotech start-up.

Conclusion

In this thesis, the resource-based view of firm is used, to analyze the factors influencing biotech start-ups risk of failure to provide guidance to entrepreneurs on how to avoid failures in their start-ups. Three factors: innovation, money and human are identified as the main factors that influence the fate of biotech start-ups. In order to have a comprehensive understanding of how those factors lead to biotech failure, a group of literatures are compared and analyzed to provide an answer to the research questions: How do innovation, money, and human factors interact and compensate in influencing the risk of failure of biotech start-ups?

The different resources interact closely; therefore, entrepreneurs can learn to manage the different factors to decrease failure risks. For a start-up with radical innovation which faces higher risks than a start-up with incremental innovation, having long-term funding and a strong team become significantly important. It has also been shown, that, start-ups with good idea and harmonized management team, attracts more seed capital and VC's interest. Striking the right balance between the three pillars of entrepreneurship, i.e. innovation, people and money holds the key to success for biotech start-up.

Collecting the result from literature overview, a risk evaluation model for biotech start-ups is compiled and used to analyze our own start-up, Fidubrin. It is shown that Fidubrin is currently under low-medium risk because of its incremental innovation approach, lack of funding, and presence of a relatively strong team. For the entrepreneurs of Fidubrin, in order to manage the risk and avoid failures the next approach would be to attract funding and recruit members that have expertise in the field it is operating in and with biotech start-up experiences.

Reference

1. Parker, Tim. Investing in the biotech sector, 2012

2. Porter, Michael E. Competitive strategies, 1990.

3. Mowery David C, Oxley, Joanne E, Silverman, Brian S. Technological overlap and inter firm cooperation implications for the resource based view of the firm, 1998.

4. Durai, A. Li, B, Metkar, S.et al. Challenges in A biotech Startup, 2008.

5. Hirai, A. (n.d.). *What kills startups?* Retrieved Febuary 1, 2015, from CayenneConsulting: http://www.caycon.com/what-kills-startups.php

6. Kimberly, J. R. and Evanisko, M., Organizational innovation: the influence of individual, organizational and contextual factors on hospital adoption of technological and administrative innovations. Academy of Management Journal, 1981, 24, 689- 713.

7. Rogers, E. M., Diffusion of Innovation. Free Press, New York, 1983.

8. Schroeder, R. G., Van de Ven, A. H., Scudder, G. D. and Polley, D., The development of innovation ideas. In Research in the Management of Innovation, ed. A. H. Van de Ven, H. L. Angle and M. Poole. Harper-Row, New York, 1989.

9. Kline, S. J., Innovation is not a linear process. Research Management, 1985, July-August, 36-45.

10. Arieti, S., Creativity: The Magic Synthesis. Basic Books, New York, 1976.

11. Oliver Som ,Innovation without R&D: Heterogeneous Innovation Patterns of Non-R&D intensive service.

12.http://insights.wired.com/profiles/blogs/the-power-of-incremental-innovation#axzz3Q367rpDB

13. Dewar, R. D. and Dutton, J. E., The adoption of radical and incremental innovations: an empirical analysis. Management Science, 1986, 30, 682-695.

14. Schumpeter J. (1942), “Capitalism, Socialism, and Democracy”, Harper, New York

15. Donald A Norman and Robert Verganti, Incremental and radical innovation: Design research versus technology and meaning change. Desgin issue, March 2012

16. Steven Golberman and Kristina M. Lybecker, The benefits of Incremental innovation: Focus on the pharmaceutical industry, Fraser Institute, June 2014

17. CRA insight : Life Sciences, Febuary 2012.

18. Steven Golberman and Kristina M. Lybecker, The benefits of Incremental innovation: Focus on the pharmaceutical industry, Fraser Institute, June 2014

19. Innovation and commertialization of emerging technologies, Office of technology assessment, Washington DC

20. *Using incremental innovation to grow your business with low risk* Retrived Febuary 1, 2015, from Decision Innovation: http://www.innovation-management.org/incremental-innovation.html

21. Beck, T., A., Demirgüç-Kunt and V. Maksimovic, Financial and Legal Constraints to Growth: Does the Firm Size Matter? The Journal of Finance, Vol. LX (1), 2005.

22. Berger, A. N. and G. F. Udell (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. Journal of Banking & Finance, 22(6-8): 613-673.

23. Hannan, M. T. and J. Freeman (1977). The population ecology of organizations. American Journal of Sociology, 82(5): 929964.

24. Julia Korosteleva and Tomasz Mickiewicz, Startup financing in the age of globalization, Center for comparative economics, UCL, Nov 2010

25. David J Denis (2004). Entrepreneurial finance: an overview of the issues and evidences, Journal of Coroporate fianance ,10 (2004) 301-326.

26. David J Denis (2004). Entrepreneurial finance: an overview of the issues and evidences, Journal of Corporate finance , 10 (2004) 301-326.

27. Jensen, M. 1993. The modern industrial revolution, exit, and failure of internal control system. Journal of Finance 48, 831-880.

28. Kaplan S, Stromberg, P. 2001, Venture capitalist as principals: contracting, screening and monitoring. American economics Review, Papers and proceedings (may)

29. Sahlman, W., 1990. The structure and governanme of venture capital organizations. Journal of Financial economics 27, 473-521.

30. Weatherly, L. A. (2003). Human Capital - The Elusive Asset; Measuring and managing Human Capital. Alexandria: Society for Human Resource Management.

31. Sexton, D.L., Upton, N.B., 1985. The entrepreneur: a capable executive and more. Journal Business Venturing 1, 129–140.

32. Florin, J., 2005. Is venture capital worth it? Effects on firm performance and founder returns. Journal of Business Venturing 20, 113–136.

33. Chandler, G.N., Hanks, S., 1998. An examination of the substitutability of founders' human and financial capital in emerging business ventures. Journal of Business Venturing 13, 353–369.

34. Davidsson, P., Honig, B., 2003. The role of social and human capital among nascent entrepreneurs. Journal of Business Venturing 18, 301–331.

35. Rauch, A., Frese, M., Utsch, A., 2005a. Effects of human capital and long-term human resources development on employment growth of small-scale businesses: a causal analysis. Entrepreneurship Theory and Practice 29, 681–698.

36. Unger, J. M., Rauch, A., & Frese, M. (2011). Human capital and entrepreneurial success: A meta-analytical review. Journal of Business Venturing , 341–358.

37. Shane, S., Venkatraman, S., 2000. The promise of entrepreneurship as a field of research. Academy of Management Journal 25, 217–226.

38. Pfeffer, J., 1994. Competitive Advantage Through People. Harvard Business School Press, Boston.

39. Chandler, G.N., Hanks, S., 1998. An examination of the substitutability of founders' human and financial capital in emerging business ventures. Journal of Business Venturing 13, 353–369.

40. Khandwalla, P.N., 1976. Some top management styles, their context and performance. Organization and Administrative Sciences 7 (4), 21–51.

41. Reuber, A.R., Fisher, E., 1999. Understanding the consequences of founders' experience. Journal of Small Business Management 37, 30–45.

42. Davidsson, P., Honig, B., 2003. The role of social and human capital among nascent entrepreneurs. Journal of Business Venturing 18, 301–331.

43. Aldrich, H., Auster, E.R., 1986. Even dwarfs started small: liabilities of age and size and their strategic implications. Research in Organizational Behavior 8, 165–198.

44. Paul Gompers, Anna Kovner, Josh Lerner and David Scharfstein, skill vs luck in entrepreneurship , July 2006, Harvard business school.

45. McGrath, R. G. (1999). Falling forward: Real options reasoning and entrepreneurial failure. Academy of Management Review, 24(1), 13-30.

46. Hannan, M. T., & Freeman, J. (1989). Organizational Ecology. Cambridge, MA: Harvard University Press.

47. Azoulay, P., & Shane, S. (2001). Entrepreneurs, Contracts, and the Failure of Young Firms. Management Science, 47, 337.

48. Shepherd, D. A. (2003). Learning from business failure: Propositions of grief recovery for the self-employed. Academy of Management Review, 28(2), 318-328.

49. Kirzner, I. 1979. Perception, opportunity and entreprensurship. Chicago: University of Chicago Press.

50. Schumpeter, J. A. 1950. Capitalism, socialism and democracy (3rd ed.). New York: Harper & Row

51. Era Dabla-Norris, Erasmus Kersting and Geneviève Verdier., 2010. Firm productivity, innovation and financial development, IMF