

Management competencies in the biotech industry in Switzerland

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Thierry Volery, Karel Doclo, Richard Munton and John Sheaand

University of St. Gallen

Dufourstrasse 40a

9000 St. Gallen

Switzerland

email: thierry.volery@unsig.ch

Abstract

The aim of this analysis is to determine the major challenges in the Swiss biotech industry. After face-to-face interviews with executive management of 17 early stage biotech companies and several associated stakeholders in the therapeutic and product/service biotech sectors, we extracted quantitative and qualitative empirical data on a variety of management issues including strategy, marketing, human resources and intellectual property. The quantitative analysis showed some interesting correlation, such as the maturation of product/service biotech companies over time. However, this learning curve is not so obvious in therapeutic biotech, due to the capital intensive and inherently risky nature of these ventures. There was a clear indication that those companies that did very well in business planning, were likely to be the most promising overall. The results of the qualitative analysis revealed several key challenges for the management of young biotech companies. These include managing funding and planning strategies, marketing and sales, intellectual property, and human resources.

Introduction

The biotechnology industry is a booming industry. Over the last three decades, advances in technology have provided a multitude of possibilities for new products based on the application of biological organisms, materials or processes. However, the commercialisation of biotechnology is a difficult task for several reasons. Firstly, the ideas and technology behind biotech products and services are often complex and it is therefore hard to convince consumers or investors about the benefits. Secondly, biotechnology is capital intensive and in many cases requires large funding rounds with many years of no financial return. Initiating a biotechnology venture also requires a multi-disciplinary background, covering the science and technology in addition to an astute knowledge of the business environment.

The gap between science and business is well documented, and bridging this gap is the aim of many governments in the Western world (OECD, 2006). However, although entrepreneurs are increasingly tempted to commercialise their inventions, the success rate is low. For example, a study conducted in the US demonstrated that only 30 % - 40 % of all start-ups will survive past five years. However, a planning process of six months or longer can increase this to over 70 % (Williams, 2001). Also shown to be important is to have a strong network of expertise behind the management team (Camp, 2002).

Good planning and a strong network of contacts appear to be critical success factors in biotech start-ups, at least in the US. Yet, there is a need to validate these findings in other parts of the world. Switzerland has the worlds most active and innovative biotech industries, per head of population and percent of invested GDP (Geneva Economic Development Office, 2005), driven in part by the presence of several multinational pharmaceutical corporations and high quality applied research in universities. Therefore it is an ideal country to identify the success or failure of start-up companies and to validate the findings gathered elsewhere.

The purpose of this study is to gain further insight about the challenges involved in starting a biotech company in Switzerland. In the first part of the part of the paper, we give an overview of the biotechnology industry and outline what are the key industry drivers. In a second part,

we identify the business models currently employed by the industry actors. The third part details the methodology employed for the data gathering and analysis. In the fourth and fifth parts, we provide the results of a quantitative and qualitative analysis.

1. Overview of the biotechnology industry

The technological application of biology is by no means a new phenomenon. There is evidence to suggest that as early as 8000 BC, the Mesopotamian people used selective breeding to artificially improve livestock. In the last century biotechnology became integral to the development of new therapies and medicines. In 1928, Alexander Fleming, Ernst Chain and Howard Florey's Nobel Prize winning discovery of the curative properties of penicillin led to its large scale industrial production from broth tanks (Bentley, 2005). In the early 1980's, advances in genetic engineering led to the modern era of biotechnology. Cloning and recombinant DNA technologies now give scientists the potential to fundamentally modify a variety of organisms, including bacteria, plants or even mammals.

Therapeutic, or red biotech has progressed rapidly, from production of insulin to treat diabetes (Brange, 1997) to the development of vaccines to treat Polio (Beale, 1990). Similarly, agricultural (green) biotech promises to efficiently grow tastier, larger and herbicide-resistant crops whereas industrial (white) biotech has the potential to capitalise on biological processes to facilitate for example large-scale production or recycling. Bioinformatics has benefited both the biotechnology and pharmaceutical industry because of its success in sequencing the genome of a host of organisms. This includes what many regard to be one of the most significant and influential triumphs of biology to date: the sequencing of the human genome (Austin, 2004).

These developments indicate the biotechnology industry has grown rapidly and diversified. This diversification has lead to the word "biotechnology" having different definitions. In this paper we adopt the UN Convention on Biological Diversity (1992) definition: "Biotechnology is any technological application that uses biological systems, living organisms, or derivatives

thereof, to make or modify products or processes for specific use."

During the thirty years of its modern history, the biotechnology industry has been growing continuously and summed to more than 4,000 companies in 2005, employing almost 300,000 individuals worldwide. As shown in Table 1, the public companies are the biggest biotech employers in the US, whereas public and private companies employ roughly the same number of people in Europe. Currently, the biotechnology industry is primarily located in the Western world. However, in the last three years, the growth in the Asia-Pacific region clearly outnumbers the growth in the US and in Europe, both with regard to number of companies and number of employees. In Europe, the major markets are UK, Sweden, Switzerland, Germany, France, Denmark and the Netherlands: they account for 72% of all biotechnology companies in Europe and for 84% of all public companies.

	Global	US	Europe	Canada	Asia-Pacific
Total number of companies	4203	1415	1613	459	716
Public companies	671	329	122	81	139
Private companies	3532	1086	1491	378	577
Number of employees (public)	190600	137400*	33340	7370	12490
Number of employees (private)	> 85000	50100*	34190		
	2002				
Total number of companies	4361	1466	1878	417	601
Public companies	613	318	102	85	108
Private companies	3749	1148	1776	332	493
Number of employees (public)	193753	142900	33304	7785	9764
	% change				
Total number of companies	-3.62	-3.48	-14.11	10.07	19.13
Public companies	9.46	3.46	19.61	-4.71	28.70
Private companies	-5.79	-5.40	-16.05	13.86	17.04
Number of employees (public)	-1.63	-3.85	0.11	-5.33	27.92

Table 1: Overview of the number of companies and employees in the biotech industry in 2005

Source: Ernst & Young Global Biotechnology Report (2006)

As shown in Table 2, the US accounts for more than 70% of revenues and more than 70% of R&D spent. European biotech companies, which outnumber those in the US, contribute approximately 20% of revenues and 25% of R&D spending. As for market capitalisation the US has the clear lead: the total market capitalisation of the 122 public European companies was \$53.5 billion, less than the market value of single American companies like Amgen (\$97.3 billion) or Genentech (\$97.5 billion).

	Public companies (2005)		
	Global	US	Europe
Revenues (\$b)	63.2	47.8	9.8
R&D Expenses (\$b)	20.4	16.0	3.3
Net Loss (\$b)	4.4	2.1	2.1
Market capitalization (\$b)		410.0	53.5
	Public companies (2002)		
	Global	US	Europe
Revenues (\$b)	41.4	30.2	8.3
R&D Expenses (\$b)	22	16.3	5.0
Net Loss (\$b)	12.4	9.4	2.8
Market capitalization (\$b)		220.0	51.0
	% change		
Revenues	52.7	58.3	17.8
R&D Expenses	-7.3	-1.8	-34.6
Net Loss	-64.5	-77.7	-26.2
Market capitalization		86.4	5.0

Table 2: Financial performance of listed biotech companies

Source: Ernst &Young Global Biotechnology Report (2006)

Revenues in the biotech industry have been growing continuously over the last decades: the collective revenues of the publicly traded companies reaching more than \$63 billion in 2005, an increase of more than 50% compared to 2002. This is mainly reflecting the fact that several products were improved, leading to stronger product sales. The growth in revenues was much more pronounced in the US than in Europe, where the restructuring process of the industry was

more laborious and lengthy.

As can be seen in Table 3, the Swiss biotech industry employed more than 14'000 people in 2005. This represents a 28% increase since 2002. Geographically, most of the companies are located in the Zurich area, in Basel and around the lake of Geneva. The long tradition of the pharmaceutical industry in Switzerland influences the composition of its biotech industry: 86% of all companies are active in the red biotech, with a strong focus on therapeutics, diagnostics and genomics / proteomics technologies. The relative maturity of the industry is underlined by its strong pipeline.

	2005	2002	% change
Total number of companies	138	133	3.8
Public companies	9	7	28.6
Private companies	129	126	2.4
Number of employees (public)	7713	6765	14.0
Number of employees (private)	6683	4483	49.1

Table 3: Overview of the biotech companies in Switzerland

Source: Ernst &Young Global Biotechnology Report (2006)

2. Business models in the biotechnology industry

In order to capture the specificities of the biotech industry, Porter's value chain has been slightly modified (see Figure 1). The secondary functions have been extended and now also include intellectual property (IP) protection and financing. The primary functions have been adapted to reflect the typical drug development phases.

A good IP portfolio management is crucial for the success of a biotech company. "For start-ups, IP protection reduces the risk for investors that they might be investing in something that others can co-opt. The reality is, that in most cases, if you have not protected your IP, they will not invest in you." (Rochlin 2005, p128). Companies compete to create the most valuable IP, they

compete to patent IP first, suppliers supply IP through licensing, or technology and so on. Thus most aspects of the competitive environment are affected by IP, and it also plays a part in the core competencies of a company. Therefore, this function tends to be much more developed in the biotech and pharmaceutical industry than in most other industries. The same goes for the financing function, because of the capital-intensive nature of the biotech industry.

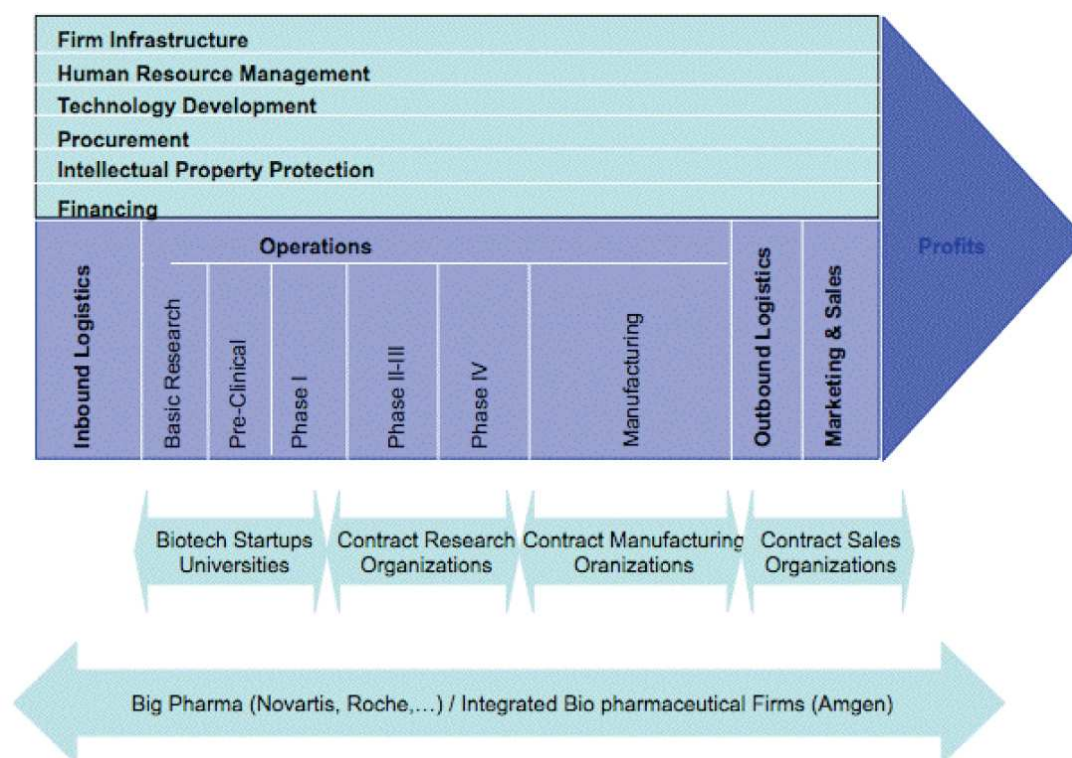


Figure 1 The value chain in the biotech/pharma industry

Several business models co-exist within the biotech industry. One common business model is the fully-integrated company operating in the therapeutical area. Such a company has basic research, but at the same time also several projects in the different clinical phases. These product development cycles differ from most other industries, in the duration (pre-clinical to clinical phase IV can easily have a timeline of five years or more), the financial resources

involved, and the uncertainty of the outcome. High returns are necessary to be successful and hence, these companies have a need to bring block busters to the market. Therefore, we can also call the totally integrated model the blockbuster model. Only a few established biotech companies operate according to this integrated model. Examples include Amgen, Biogen Idec and Serono. Most of the young biotech companies simply do not have the required capital to operate in this way.

Because of the reasons outlined in the previous section, most of the biotech companies are active in a specific part of the biotech value chain. Small start-ups, often spin-offs from universities, are usually involved in the identification of new drug candidates, which are then brought to the preclinical trial phase and subsequently to phase I or II, with or without the help of a contract research organisation. At this stage, the product is then often out-licensed to a big pharmaceutical or biotech company because young companies do typically not have the financial resources to carry out the next phases. Out-licensing provides the small biotech companies with an additional revenue stream through an up-front payment and/or royalties once the product is on the market. An alternative to out-licensing is to engage in a strategic alliance. In doing so, the larger company can fill its pipeline whereas the smaller company gets access to global markets and additional research knowledge. These collaborative arrangements increased from 200 in 2003 to 328 in 2005 (Ernst & Young, 2006). The subsequent clinical trials, manufacturing and even marketing of the compound will then be done in-house or certain part might be outsourced to contract research organisations, contract manufacturer organisations and contract sales organisations.

3. Methodology

Data were collected via a series of face-to-face interviews with senior executives of 17 biotech companies. To ensure that the data were comparable a semi-structured questionnaire comprising 5 major parts (strategy, market, human resources, intellectual property, regulations)

was developed. Each part included a list of items where the respondent had to express his opinion on a 6-point Likert-scale and a series of open questions. Thus, the survey instrument allows for both a quantitative and qualitative analysis of the data.

Companies were selected based upon following criteria: founded in 1998 or afterwards, less than 100 employees, active in therapeutic biotech or in the product/service biotech area. Addresses and contact names were taken from the websites <http://www.swisslifescience.com> and <http://www.venture.ch> or from personal contacts. Senior executives from 17 biotech companies were interviewed: three in Geneva, one in Lausanne, two in Bern, two in the Basel Area and the remaining in the Zurich area. Two companies were removed from the data set due to incomplete or suspected inaccurate communication during the interviews.

The data set was either analysed as a whole, or grouped into categories, including private initiatives, university initiatives, therapeutic biotech and product or service biotech. Further comparative statistical analysis was performed using Student's T-test (two-tailed, two sample with equal variance)

4. Results of the quantitative analysis

Companies were scored for performance in four major categories: strategy (S), market (M), human resources (HR) and intellectual property (IP) and an average of these four values was used to determine an overall score (O) in Table 4.

Three groups of companies emerge from this overall score analysis. Companies with high scores (group 1 in Table 4) were largely private initiatives with simple but brilliant business models and strategies. The second group consisted largely of university start-ups, either early in development with a promising future, or successfully operating with one critical issue needed to resolve. The third group included early stage companies facing critical challenges, including major deficiencies in the business model, or a highly-risk and unpredictable product market.

Company	M	S	HR	IP	O	Type
A	5.80	6.00	6.00	6.00	5.95	Group 1
B	5.80	6.00	5.60	6.00	5.85	
C	4.60	6.00	6.00	6.00	5.65	
D	5.20	5.50	5.40	5.80	5.48	
E	4.80	5.50	5.00	6.00	5.33	
F	5.00	5.75	4.40	3.80	4.74	
G	5.00	4.25	4.80	4.60	4.66	Group 2
H	5.80	5.00	5.00	2.60	4.60	
I	4.60	5.00	4.40	4.40	4.60	
J	5.20	4.25	4.60	4.20	4.56	
K	3.33	4.00	3.25	4.80	3.85	Group 3
L	3.40	4.00	4.00	3.20	3.65	
M	2.80	3.25	3.00	2.00	2.76	
N	2.60	3.25	2.40	2.40	2.66	
O	3.10	2.75	2.60	2.00	2.61	

strategy (S), market (M), human resources (HR), intellectual property (IP), overall score (O)

Table 4: Overview of company evaluations

These data support previous analyses of Swiss start-up companies. A recent article in the Swiss business magazine Cash ranked the top 50 ventures in the Swiss biotech and medtech industry (Cash, 2006). Companies C, E and F, amongst the highest rated in this study, were also ranked highly in the Cash study. Overall, the comparison between our results and the ranking in Cash suggests our evaluation methods are comparable with techniques utilised by expert analysts in the field.

To evaluate the characteristics of the data, a bivariate correlation analysis was conducted to detect the relationship between the key variables and the overall score. As shown in Table 5, all variables correlate positively with the overall score and major categories of evaluations ($R^2 =$

0.90 and above). This is to be expected, as few companies have major deficiencies only in one specific category. Furthermore the funding stage, number of employees, number of PhDs and age of company show intermediate correlation with major categories evaluated ($R^2 = 0.56$ and above). On the other hand, the proportion of PhDs is negatively correlated with overall scores and the scores from the four major evaluation categories ($R^2 = -0.56$). This can be explained by a number of recent university spin-off companies that have a high proportion of post-doctoral researchers in the early stages of their business careers.

Key variable	R^2	p
Strategy	.907	.95
Market	.785	.89
HR	.935	.98
IP	.800	.90
Age of the company (years)	.354	.56
Funding stage	.293	.61
N of employees	.344	.59
N of PhDs in staff	.252	.60
% of PhDs in staff	.291	-.56

Table 5: Bivariate correlation of key variable with overall score

The 15 companies were further divided into two categories: therapeutic biotechnology companies and product/service biotechnology companies. This categorisation is relevant because of the large differences in business models, operations and funding. A bivariate correlation analysis was performed individually for the two categories. For product/service

biotech companies (n=6), age and funding stage is positively correlated with the overall score ($r^2 = 0.8$). However, for therapeutic biotech, age and funding stage is not at all correlated with scores ($r^2 =$ close to 0). This can be explained by the need for product companies to generate profits for survival without the large funding secured by therapeutic companies with the future profit of blockbuster profits to investors. Without this funding, product or service related companies may find it hard to survive unless they develop the means to generate income internally.

A comparative statistical analysis was also performed on therapeutic and product/service biotech. Therapeutic biotech companies scored significantly higher in a number of categories, particularly strategy and IP processes. This could be due to less emphasis on IP required for some types of product/service biotech and for the complex business models that therapeutic biotech companies typically operate. However, it must be noted that this could also be explained by the difference in age (product/service biotech, 2.5 ± 1.8 ; therapeutic biotech, 4.8 ± 2.0 ; $p < 0.05$) and also funding stage (product/service biotech, 1.0 ± 1.4 ; therapeutic biotech, 2.4 ± 0.9 ; $p < 0.05$).

5. Results of qualitative analysis

In addition to quantitative analysis, we also evaluated the competencies of companies in a qualitative manner in respect of strategy, marketing, human resources, and intellectual property. Furthermore, we evaluated the ability of companies to manage required regulatory processes.

5.1 Strategy

Finding an effective business model is one of the overriding need of a business strategy. It seems that companies which had a simple and clear business model backed by promising pipeline or simple but innovative technology scored highest. Having the company goals

focused on the final customer, with many related products at different stages of development seems like something that every biotech company tries to achieve. In fact, the strategy of several companies was of a different nature: *"We see something good, we buy it, we convince our investors to fund us for another cycle, and in the meantime we hope that someone buys us, when we get something to phase II trials."*

Owner-managers of companies that have a trade sale as primary business goal anticipated that they will no longer be with the company. However, this implies that they will have received adequate payment for their options. One might suspect that sometimes there is a conflict of interest here, that the company's goals are sometime aligned more with what the personal management goals are, and therefore are short term in nature, than what should be right for the long-term survival and success of the business. It was also clear that companies which were far more diligent and rigorous in their planning expected to be operating for a long time to come.

Outsourcing was another major theme in many of the interviewed companies. The decision whether or not to outsource depends on a number of factors. A first factor is based on the most efficient use of resources. Another factor that plays a role is whether the company will need certain skills in house in the future. This is a crucial element in the decision for biotech companies because of the uncertainty inherent to the business. For example, there no need for investment in manufacturing facilities, if the outcome of the phase II trial remains uncertain, and, therefore, it is not certain that the product will eventually be produced on a larger scale. Outsourcing is offering these companies more flexibility and allows them to concentrate on their core competencies.

Once the decision of outsourcing has been taken, the remaining question is how to select the outsourcing partner and more specifically, where he should be located. Some of the companies had outsourced the synthesis of compounds to India, and many others had considered Indian outsourcing partners. Opinions varied widely, from *"We have no problems with outsourcing our synthesis to India"* over *"We have to have someone managing it closely"* to *"We do not have the in-*

house expertise to deal with India"

Investors funding biotech companies (e.g. business angels, venture capitalists, corporate venture funds) have a difficult job to assess a new company. Not only is there the uncertainty of the team and technology and future expansion, but also the uncertainty of when the investor will be able to exit. Young biotech companies often expressed difficulties in finding seed funding, because of two reasons. Firstly, the widely used liquidation preference dictates that the later investors, investing at a less risky time, actually receive a far bigger slice of the pay-out pie. Secondly, the limited time horizon of venture capitalists leads to a preference in later stage investments. Venture capitalists have typically a time horizon from 5 to 8 years. Depending on when in the lifetime of the funds the investment is done, the time horizon is considerably shorter. Because the value of a therapeutic biotech company increases after successful completion of clinical trial phases, the companies are driven towards expansion. Therefore, if companies wish to avail themselves of funding they have to adjust their strategies to allow for this faster expansion.

In order to attract investors, a robust business plan is indispensable. Nonetheless several entrepreneurs stressed that focusing too much on following strictly a business plan restricts strategic options, or in other words, that business plans can stifle flexibility. As one CEO stated: *"I do not see it (the business plan) as an architectural blueprint, but as a document that changes"*.

Most of the interviewed companies are seeking an exit by trade-sale, or more rarely, are aiming for an IPO. However, many (but not all) biotech companies had not considered the end-customer, as it could take many years following the IPO or trade sale of the company, before the product finally hits the shelves. Our anecdotal evidence shows that this de-emphasising of the final customer is a mistake. More mature companies told us that they have actually cancelled projects in early stages because they realised that the final product was not going to address a customer need.

5.2 Marketing

All therapeutic biotech companies interviewed are attempting to achieve a critical expansion speed or critical development stage, from which to get past phase I and eventually past phase II clinical trials. At this point their value substantially increases because of the largely proven technology.

How does this translate to targeting their customers? Just like in other industries, biotech companies can decide on a customer target in two different ways. On one hand, there are companies that have a product and want to sell it (and perhaps themselves) to a customer. On the other hand, there exist companies which first search for a market and a customer, and then decide to build a product to suit that customer. Of course there is a continuum between these two extremes. Biotech companies may have certain expertise and they may search within that field of expertise for a healthy market that they can target. In all cases, it turned out that it was extremely important for potential investors to have a good overview of the market, with regards to size, growth and geography.

Opinions varied widely when the interviewees from the therapeutics biotech companies were asked about pricing strategies. For example some companies do not perform pricing analysis on products in development, because the final product is still several years from completion. However, previous studies have demonstrated that delayed decisions concerning product pricing have led to an unaffordable medication. A small number of companies that scored exceptionally high in the quantitative evaluation performed product pricing at a very early stage. Although they admitted the inaccuracy of the calculation, they also claimed the process was necessary to develop contingencies, and they adjusted the calculations as the product came closer to market.

Service/product biotech companies most often oriented their prices to those of the competitors. Although it seems logical to have different prices for private customers and universities, this is actually difficult to maintain, because the frequent contacts between academia and industry.

Such a pricing strategy might lead to pressure from the private customers to lower the prices.

Companies will market themselves using a mix of different tools, including press releases, a website, conferences, articles, mailings, phone campaigns and flyers. The scientific advisory board, patents, and collaborations with leading institutions also help the company to gain visibility and build a reputation. The youngest and smallest companies interviewed admitted that marketing resources were inadequate. Furthermore, established product and service companies stated that the marketing methods initially chosen were largely inappropriate, and required trial and error to develop efficient marketing strategies.

The challenge for small companies is to both understand the importance of, and develop an appropriate communication strategy for the addressee. For example a company website must be understandable also to non-scientists. As a first contact with investors, it is important to have a good front man who is an excellent communicator, understands financial aspects, and can communicate complex scientific concepts in layman's language. We met several non-scientists who could eloquently describe the technology that their company was developing. Stories that are told by or about entrepreneurs define a new venture in ways that can lead to favorable interpretations of the wealth-creating possibilities of the venture; this enables resource flows to the new venture. Counter examples include a CSO, unable to convey in an understandable way the business model of the company and a CFO focusing solely on the finance.

5.3 Human resources

One of our major question was “how hard is to find good people”. There were wide-ranging answers to this question. Intuitively one would think that a new high-risk venture would have problems in finding quality employees, because of the difficulties to pay competitive wages and the bigger career risk. Indeed many small companies recruited from atypical demographic backgrounds such as young inexperienced school leavers or semi-retired but experienced

personnel. However, many small companies assured us that there was glut of researchers on the market and their intrinsic motivation meant attracting talents was relatively easy. In contrast, two of the more successful companies actually had difficulty in finding “good” people.

Many executives stated the importance of knowing and understanding the company’s core competencies, and to be able to access, develop or reproduce those important competencies. The difficulty of reproducing the competencies is of course a competitive advantage. Often those competencies were the team itself. So being able to find people that did not only become a cog in the machine, but really added a lot of value to the company is important, in the view of some managers.

Another HR issue was how important the communication is with the staff and how the internal hierarchy was shaped. It was fairly universal that upper management believed it was vital to be continually communicating to its other employees, exactly where the company was going, and to be transparent about the risks. As an entrepreneur remarks: *“Management has to protect the scientist from evil which may disrupt their work “*.

None the less there were two major types of management style that we encountered: one where a charismatic or powerful leader dictated what the employees were to do, and another where a number of executives controlled the company as a team. The latter believed that it was very important to have peer review, and that without this peer review, there could have been some disastrous business decisions. This is linked with the question on how much experience helps in this industry to run a business.

5.4 Intellectual Property

The opinion of the entrepreneurs varied greatly when asked about how much resources should be dedicated to IP, with patents in particular. As seen from the quantitative analysis, therapeutic biotech companies were stronger in the IP than product/service oriented companies.

The following quotations illustrate the complexity of the IP question: *"We infringe, they infringe, it's impossible to tell who is infringing!"*

"We use whatever IP strategies we can to move or delay competitors from coming into our space. It's nasty but necessary"

"We don't patent everything, we need to keep moving, keep pushing the limits, and too many patents would make our researchers relax"

"Any large biotech will have no choice but to be involved in litigation."

All companies agreed that a strong IP position is definitely an advantage for attracting investors. However, extensive resources – time, personnel and money – are required to first get a good overview of the competitive IP environment and then to monitor it closely. Due to resource restrictions, several companies were operating in a grey area. Moreover, some university spin-off had experienced a considerable delay to find investors, because the transfer of the IP from the university to the company took several months. One company interviewed had to wait in a "development no man's land" for two years while two technology transfer departments dithered over valuable IP. Another entrepreneur said: *"There are various people around who see the short term advantage. The question we had to clear up was: Is it the technology transfer office, or the head of industrial relations or the vice chancellor who has signing power on these kind of contracts. Each one of them has a political agenda and ultimately wants money that flows back in the part they control. So there's an internal turf battle going on."*

6. Conclusion

This study aimed to gain a deeper insight about the challenges involved in starting a biotech company in Switzerland. In order to achieve this, our assessment was not based on how successful these companies were, but on how well they ran their businesses. Were the necessary

strategies, the market and competitive analysis, the IP and regulatory management, the human resources being professionally planned and implemented?

The quantitative results sections shed some new light on these issues, such as the maturation of product/service biotech companies over time. However, this learning curve is not so obvious in therapeutic biotech, due to the capital intensive and inherently risky nature of these ventures. There was a clear indication that those companies that did very well in business planning, were likely to be the most promising overall; a characteristic observed of industry spin-offs during qualitative evaluation. This result supports previous studies, which demonstrate the lower success rate of university ventures in comparison to industry spin-offs.

The results of the qualitative analysis additionally revealed several key challenges for the management of young biotech companies. These include managing funding and planning strategies, marketing and sales, intellectual property, and administration. The current funding system appears suboptimal for new companies, because of two reasons: (1) the mechanisms in place of the VCs, especially the liquidation preference, and their risk adversity lead to difficulties for young companies to find a lead investor, and (2) this increases the difficulty to convince investors when the intention is to tap into new markets.

Three major aspects related to strategy emerged from the study. Firstly, spinning out a company from the university may not be the most efficient form of technology commercialisation, especially if there are no clear strategic goals associated with this choice. A more detailed study could provide useful results and guidelines for this issue. Secondly, short-sighted company strategies to exit by trade-sale may not be in the best interest of the final consumer, nor the most efficient way to create value in the long-term. Furthermore, final customer delivery may be a long way off, but planning is also useful to prepare for unforeseen obstacles and influences. This includes pricing the end product. The continuing planning process allows the company to remain aware of and in control of its environment. The three companies that scored highest in the study all stressed the importance of these issues. Finally, it

seems to be advantageous to consider the decision of out-sourcing versus building up internal competencies as early as possible.

Most of the companies are aware of their IP requirements, although many small companies have difficulties to allocate enough resources to it. Governmental or institutional tech transfer departments could play a positive role in providing due diligence for the IP situation as part of the start-up aid. More importantly, transfer of IP from the university to start-up companies should be handled swiftly. A best practice standard could be worked out for all technology transfer institutes in Switzerland, or alternatively, a consolidation of the different existing technology transfer institutes could prevent the waste in resources building up similar institutions in many different regions in Switzerland.

Finally, considering the marketing dimension, the analysis revealed that the "right communication" is not simple. In the eyes of some, many of the leading biotech companies in Switzerland are causing problems for themselves because they bungle public communication, creating false expectations and over hype. Product/service biotech companies consistently lack the manpower and finances to market novel products effectively. New and innovative solutions for marketing are often implemented, although this is performed by trial and error, and is prone to mistakes. Product/service biotech companies would benefit greatly from expert help in this specific area.

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