

The Entrepreneurial Imagination and the Impact of Context on the Development of a New Venture

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Abstract:

This paper sets out to empirically explore the impact of a new venture's context on the development of a new venture. The study consists of a single case study based on a new venture attempting to exploit an opportunity in the Life Sciences and charts the impact that the context, in particular actors in the context that the venture are trying to gain resources from, have upon the plans, activities and resources developed by this nascent firm. Spanning the time period of 1999-2006 this case outlines four periods of development of the venture. This accounts for the initial plans of the venture, their struggle to gain venture financing, the development of the venture's technological resources and attempts to create commercial relationships. The study shows the impact that institutions used in a context have on this venture leading to, amongst other things, the discovery of IP, finding a CEO, and developing a product line. The paper contributes to the IMP through its focus on new ventures and by exploring ventures prior to fully entering into commercial relationships.

Key Words: New Venture Development, Context and Institutions, Loasby, Life Sciences.

Introduction:

An exploration and understanding of the development and growth of new ventures in the IMP tradition is still a relatively unexplored area. In perusing recent IMP literature a total of 7 papers over recent years, mixed between conference and journal publications, were found to explicitly investigate the entrepreneurial area (Ayvari and Moller, 2000; Bowey and Easton, 2007; Geurcini and Ranfagni, 2003, Mainela and Puhakka, 2006) with varying areas of interest, such as for example entrepreneurial social capital and entrepreneurship (Bowey and Easton, 2007) or international entrepreneurship (Mainela and Puhakka, 2006). Work within the IMP tradition, and understandably so, concentrates on firms with some form of developed resource and capability base and activity chain with multiple actors involved and some prior history of exchange relationships. Furthermore, through the need for great depth and detail there is a tendency in IMP research to focus on more fully developed firms because of the richness of data required. When exploring entrepreneurship in general and the entrepreneurial process in particular and when the focus is on very early stage firms there are a number of problems. Firstly, these firms may have few if any commercial relationships, depending on their stage of development, therefore they may provide very thin information on a particular issue being explored. This point is exemplified by the fact that "In the early stages of new venture development, it is the identification and acquisition of resources rather than deployment or allocation activities- that are crucial for the firm's long-term success" (Lichtenstein and Brush, 2001, pp. 37). Adding to this most of these types of firms stay very small (Aldrich, 1999). Secondly, newly formed firms, can take a long time to develop therefore causing delay in the capturing of data. They can also be difficult to locate as well as suffering great uncertainty in their actual survival through the well known liability of newness (Stinchcombe, 1965), therefore adding to the additional risk of early disbandment. Through the risk associated with these research sites and the need to gather rich data for IMP style work, studies into new ventures have been, at best, infrequent.

Similarly in trying to explore the development of new ventures within the IMP, although possible to infer, certain aspects are missing, particularly in the sense of how does a firm create a resource and capability base in the first place and (more pertinently) understand which resources and capabilities are necessary for them to be able to enter into their first exchange relationships with commercial end-users? Similarly, how do firms initiate fledgling activities to create a resource and capability base that leads to the creation of initial products and services that have exchange value? Finally, what affect has a new venture's context and other actors have on a firm in the very early stages of its development?

Such questions are broad and require and more depth than this paper can allow for. As such the focus of this paper is on the final question posed above and therefore sets out to empirically explore and understand the

impact of a new ventures context on the development of a new venture from a very early stage through to the point where it where it could properly consider entering into commercial exchange relationships. To account for this the paper starts by considering ideas within extant literature about the entrepreneurial imagination and what impacts upon the ideas of entrepreneurs. Following on from this a discussion of a new ventures context shall be outlined arguing what factors need to be considered in this area. Then the method section shall be presented and followed by an introduction to the context in which the venture was emerging in and the industry it perceived an opportunity in. Once these have been outlined a case study split into four separate periods shall be outlined that spans from 1999-2006. Finally a discussion on the impact of the context on the venture shall be presented and then some brief conclusions on contribution shall be drawn.

Literature Review:

The focus of this paper is upon the impact of a new venture's context on the development of a new venture. What is meant by this is that how a new venture develops and the plans, resource bundles perceived and required by the venture and the activities undertaken by the venture are greatly impacted upon by the context in which the venture exists. As such the elements that are of interest for this paper focus on two particular things- the entrepreneurial imagination and capabilities of the individuals involved in a new venture and the impact that context has on these.

Entrepreneurial Imagination- Its origin and the impact of prior experience:

To begin this discussion on the entrepreneurial imagination it is necessary to begin with a consideration of connectivity and knowledge. Loasby (2001b, pp. 403) presents as knowledge consisting of categories perceived and agreed upon but which are incomplete and also subject to change. No one has complete knowledge and an actor or individual only has partial and small amounts of knowledge at any one time. Furthermore what represents knowledge is open to interpretation about what certain categories contain and are likely to be understood differently by people with different backgrounds (Loasby, 2001b, pp. 405). Therefore, people can and do understand the representation of what knowledge is differently. Most importantly, knowledge is about creating connections between varying elements.

In considering this aspect of knowledge and connections it is necessary here to turn and consider the idea of connectivity and the entrepreneurial imagination. How change occurs in knowledge is through individuals imagining different connections that can be made between things and this can happen because different events (such as the direct perception of an anomalous chemical reaction) can alter our state of knowledge, which leads to variation within knowledge. Such variations can lead to, for example, individuals perceiving potential opportunities. In trying to understand what imagination is it can be viewed as a mental process where new connections lead to new representations (Loasby, 2001a). So when thinking about the origin of a new venture it is necessary to consider this element of imagination. For entrepreneurs that consider creating a new venture they must imagine the product or service that they will develop, the market that needs it and what it requires, the resources and capabilities needed, and the activities they need to carry out to exploit any perceived opportunity. Similarities to this perspective can be viewed in the entrepreneurial literature with the likes of Baron (2006) and Ozgen and Baron (2007). So the creation of connections between diverse information, events and so forth drives the discovery of opportunities.

However, there is variation, as mentioned above in the knowledge of individuals and ventures. A question now is what affects the connections imagined by an entrepreneur? To further flesh out this question it is necessary to now turn to the aspect of knowledge and experience.

Variation in Entrepreneurial Imagining- The role of Knowledge and Experience:

In discussing the different types of knowledge, Loasby, like those within the loosely based knowledge based view of the firm, plays upon the aspect of knowledge that and knowledge how (for example see Loasby, 1998, 1999) or in entrepreneurial research declarative and procedural knowledge (Aldrich, 1999). Emphasis shall be put upon the aspect of know how, encapsulated as capabilities, but it is worth noting that that the often denigrated knowledge that can be a key requirement within certain types of organizations, for example start-ups based on certain technologies, in particular in the Life Sciences (see Pisano 2006), whereby a deep theoretical knowledge is of absolute necessity prior to trying to exploit a perceived opportunity in this area.

Turning to the element of knowing how this is seen to be a crucial element that a firm needs to have, if for example they are to commercialize an opportunity, and fits into the productive opportunities that a new venture perceives. For example, firms may know that crude oil can be used for a variety of purposes but

knowing how to do this and being able to perform this is different to knowing that it can be done (Loasby, 1999). Loasby (1998) states that: “‘Knowing how’ ... is the ability to perform the appropriate action to achieve a desired result. It includes skill both in performance and in recognising when and where this skill should be applied” (pp.164). What is interesting here is that incorporated into this skills or abilities that an individual or firm has is also the ability to know when and where certain skills or abilities are needed. This, in a sense, also has an effect on the activities of the firm because when certain performance skills are needed will be affected by the knowledge and prior experience of those in a new venture. This will also affect the perceived salience of particular resources and activities during particular stages of development of a new venture (Lichtenstein and Brush, 2001). These ideas has resonance in the entrepreneurial literature with the likes of Shane and Venkataraman (2000), Shane (2000) on the variations of approaches taken by eight start-up firms in attempting to commercialise a particular piece of technology, and Baron and Ensley’s (2006) study of novice and repeat entrepreneurs. So as such experience can play a major part in the discovery and plans to create and run a business.

However, what also will have a major impact on the entrepreneurs and how they imagine the venture will develop and the activities that they undertake to develop their venture is the context.

Context and its impact on a new venture development:

Firms are embedded within particular contexts and these have an impact on the resources and capabilities and the activities that it carries out to develop. As such the elements that need to be considered here are the conditions of the context that new ventures are embedded in. These conditions include the amount and types of resources available to a new venture in a particular context at a particular point in time, the activities, aims and requirements of other firms and actors in a particular context, and the institutions that other actors within a context are affected by and use to judge new ventures.

Taking conditions and resources first; when considering the resources and capabilities that a new venture tries to acquire or develop it will be affected by what is available within a particular context and what other firms are competing for these particular resources and capabilities (Schoonhoven, Eisenhardt, & Lyman, 1990). The resources and capabilities available in a particular context at a particular time will affect a new venture’s growth and development.

Tied into the conditions of a new venture through time are also the activities of other actors. The activities to develop and grow other firms will in turn affect the resources and capabilities required by a new venture because these new ventures do not exist in a vacuum but are inimitably tied to other firms and their development and growth will be to develop a product or service that is needed or fits into the activities of other actors to develop and grow (Hakansson and Snehota, 1995). These activities could be impacted upon by a number of different elements including for example, changes or anticipated changes in supply and demand by actors that other firm’s are affected by, changes in technology, or it could be some form of change in regulation or policy to be imposed or anticipated to be imposed upon a particular context (Eckhardt and Shane, 2003). The activities of other actors and their future anticipated needs to grow and develop or the imposition of regulations or change in policy may give rise to opportunities for new ventures to potentially exploit.

Furthermore, with regard to the context of new venture development and growth it is necessary to add in the aspect of institutions within a context that affect other actors perceptions of new ventures and the ability of new ventures to access resources and capabilities. In deciding to supply resources or work with a new venture an external actor will use certain criteria to judge the viability and value of a new venture. These criteria may be institutionalised within a firm or across a set of firms in a new venture’s context. What is meant by institutions is that they are forms of conventions that actors or firms use to “...try to make sense of other people’s experiences, and other people’s ways of behaving, in order to improve their own abilities to cope with uncertainty and complexity” (Loasby, 2001a, pp. 13). As such institutions help by allowing people draw on the knowledge and cognitive skills of others who have specialized in other ways of organizing their knowledge (Loasby, 2000). Institutions can have a large impact on a firm’s ability to acquire salient resources at particular times and that the institutions in effect within a firm or within a set of firm’s will affect the amount and types of resources that a firm can access and how they are developed as well as what is perceived as salient resources and activities. In turn the institutions used by a firm or a set of firms in a new venture context will also affect the types of activities that a new venture carries out to develop their resource and

capability bundle. Such concerns are also reflected in entrepreneurial literature, in particular in literature regarding how investment decisions are made by venture capitalists (for example Hall and Hofer, 1993, Fried and Hirsch, 1994; Shepherd, 1999; Shepherd, Ettenson, and Crouch, 2000, Zacharakis and Meyer, 2000).

As such a key aspect to new venture development is to be able to signal the legitimacy of the firm to other actors. New ventures, because of high levels of uncertainty surrounding them and not having an established position, can be perceived as risky in the eyes of other actors in a given context. Legitimacy can come through a number of varying sources including business plan construction and the legal incorporation of a firm (Delmar and Shane, 2004), inter-organizational endorsement (Stuart, Hoang and Hybels, 1999), and individuals involved in the firm's reputation and prior experience (Shane and Cable, 2002). As such a number of new venture activities will be directed towards the creation of a sense of legitimacy around their new venture proposition or new venture. The perception of legitimacy surrounding a new venture will also affect the outcomes of new venture activities to develop and grow. New ventures learn about and uncover institutions in a context through time and they learn about them directly (through interaction) or vicariously. Similarly, other actors are affected to an extent by institutions that inform their cognition and behaviour. Also institutions extend beyond signalling legitimacy and also the point of acquiring and accessing resources by new ventures they exist, for example, in the commercial exchanges of new ventures, whether formal, through contracts, or informal through implicit expectations of particular types of behaviour and outcomes.

In sum, the context in which a new venture is trying to develop and grow will affect the development of a new venture. The conditions of a given context at any particular point in time will affect the amount and forms of resources and capabilities available for a new venture to access. Tied into this the activities and requirements of other actors in a given context will also impact new ventures, which can be affected by a number of changes or potential changes including supply and demand, technology, regulations and policy. These changes or potential changes to activities of other actors will give rise to opportunities to new ventures. However, the perception of and ability to exploit perceived opportunities through time will be affected by the resources and capabilities of the new venture. Similarly, in effect in a given context are institutions which are used to judge new ventures. Because of the uncertainty and risk associated with new ventures, a number of activities may be towards trying to gain legitimacy in the eyes of other actors in a context. The perception of legitimacy will affect the outcomes of the activities of new ventures and how they develop their resource and capability bundle. However, institutionalised expectations extend beyond the decision to supply certain resources and capabilities or to work with a firm. They still will be in effect through time and can be formalised through the imposition of contracts or more informally through implicit or verbally communicated expectations.

In outlining all of the above the key thing of interest is to try and understand for and account for the impact of the context, in particular institutions in effect, and their impact upon a new venture's plans, activities and development over time.

Methodology:

To understand in depth and detail the complexity of the emergence and development of a new venture the method employed consisted of a single longitudinal exploratory case study (Yin, 1994, Roche, 1997, Stake, 2000) that utilized primary face to face interviews as well as documented e-mail correspondence, company business plans, government strategic papers and reports, commercial industry reports and newspaper reports. Data was collected over five years from 2001 to 2006, with the interviews taking place from January 2002 to July 2006. Such sources were utilized to provide multiple sources of evidence and richness to the data (Yin, 1994). The formal face to face interviews were in-depth, semi-structured interviews (McCracken, 1988, Arskey and Knight, 1999). This method was utilized because of the ontological, axiological, and epistemological positions of the authors (Hudson and Ozanne, 1988, Easton, 1995, 2002). The aim was to account for and understand the impact of the context on the development of a new venture. Sampling was theoretical in nature (Strauss and Corbin, 1990) and the data was sorted, categorised and analysed in accordance with the techniques advocated by Miles and Huberman (1994). The interview transcripts, which consisted of over 1,000 pages and were the primary source of data, were then broken down according to the different types of resources and capabilities, events and imagined future resource requirements, types of activities and outcomes, context and actors involved during each of the periods.

To make sense of the case it was divided out through either a major event or outcome occurring for the venture or the approach of a major event and the plans and anticipated activities that the venture would carry

out to deal with these types of events. These are often alluded to as critical events or incidents that occur to a firm over time, whether in looking at episodes in a relationship (Ford, 2002) or in the development of new ventures (Van de Ven, Poole and Angle, 1989). However, it was not the intention of the researcher to structure the research around critical events or incidents. The decision on periods of development emerged through natural breaks that the researcher interpreted from the data.

Levodex Case: Context for Irish Life Science Firms and the background to the Chiral Industry:

To understand the context in which this case analysis is to unfold it is necessary to briefly consider the two key areas in which this case study is embedded. The first is the arena of the Irish Life Sciences, whilst the second is the specific industrial area in which the firm was trying to exploit a perceived opportunity. This shall now follow.

Creating an Indigenous Irish Life Science Space:

The Irish Government through various state agencies, bodies and reports, for example the ICSTI Technology Foresight Report (April 1999), had identified that a major part of the future long term development of the Irish economy lay within the twin sectors of ICT (Information and Communications Technology) and biotechnology. The central aim was and is to move away from an over reliance on FDI and manufacturing toward the creation and development of a knowledge based economy. With these strategic focuses in mind the government allocated €2.54 billion through the National Development Plan (NDP) to be invested in scientific endeavour both public and private. Five primary recommendations (ICSTI, 1999) were made to the government to stimulate growth in this sector with the recommendation for a biotechnology start-up programme being the one of interest for this paper.

Central to this recommendation for the creation of a biotechnology start-up programme was Enterprise Ireland, which is involved in helping to develop and promote Irish firms so that can grow and achieve international success. This government agency, in the area of the Life Sciences, has been involved in a number of areas such as providing grants, offering advice, a mentoring service, advice on IP, helping in business plan development, supporting networking groups in this area, trade missions abroad, and investing in the creation of BioIncubation Spaces in Irish Universities. However, the most important activity was the investment into venture capital funding.

Venture capital funding in Ireland consisted of just over 20 indigenous funds with in general a tendency towards a lower level of funds (averaging around €20 million) across all the venture capital funds. As of 2005 the fund size in Ireland under venture capitalist management was €1.25 billion, with state involvement representing 11% of funds under management. In 2000, Enterprise Ireland invested in some already existing funds and helped establish new funds (15 in total between new and existing, which began looking to make initial investments between 2001 and 2003) with the express mandate to invest in seed and early stage projects. Enterprise Ireland invested €98 million in sum total into these funds (McArdle, 2005). Within these funds one was specifically established to invest in the biotech/life sciences area (Venture Fund 1 (€12.7 million (2002 figure) while another, Venture Fund 2 (€19.6 million (2002 figure) was established to focus on Life Sciences, and Enabling Platform technologies. A third fund, Venture Fund 3 (€8.4 million (2002 figure)), was established to invest in spin-outs from universities at the seed stage in the area of the Life Sciences, Material Sciences and ICT areas. However, it should be noted that at the time of the initiation of these funds a downturn, due to the crash of technology stocks and the slowdown of IPO's in ICT and biotechnology (making VC exits uncertain), had a negative impact on investments being made (Enterprise Ireland Seed and Venture Capital Report, 2003).

The chiral industry and asymmetric chiral catalysis:

As well as this particular arena in which the new venture was located it is necessary to consider the scientific area which the firm perceived an opportunity to exist and the basic technology involved. The scientific area encompasses the area of chirality, which involves the production of chiral compounds in single handed form, which can be advantageous to firms because certain molecules can have undesired effects (for example Thalidomide) or have greater efficacy in single handed form. Another major advantage of the use chiral compounds exists in the potential cost efficiencies in the production of a variety of products.

To create the single handed form of a chiral compound two main options existed- resolution and asymmetric chemocatalysis. Although resolution is the most widely used method to create chiral compounds, due to the

relative cheapness of the materials in the form of resolving agents and the off patent status of most resolution methodologies, the future was seen to rest in the area of asymmetric chemocatalysis, which the venture at the centre of this case was focused on. Why the use of asymmetric chemocatalysis to manufacture single handed form of chiral compounds is desirable rests on the cost savings attached to their production and the environmental benefits that it can confer. Asymmetric catalysts can be bio or chemocatalysts. The area of particular immediate interest in the case to unfold is chemocatalysts as this is the main focus of the firm when they start operations.

Asymmetric chemical catalysts are created through the attachment of a chiral ligand to a metal centre. Once produced, the catalyst through use in a chemical reaction should help to create the single handed form of the desired compound. These catalysts can be C or P chiral, with P chiral holding potential advantages in the reaction rate and the purity of the compounds they can produce. The purity of the single handed form of a compound is important, particularly for the pharmaceutical industry. The value of these catalysts rests on their ability to induce the formation of a valuable chiral product by the most economic means. However, stumbling blocks to widespread diffusion of the field of asymmetric chemocatalysis has been the cost associated with these catalysts (particularly as they can use expensive metals) and the cost to licence some of the production processes, the newness of this particular area leading to relatively underdeveloped technology, and the dearth of available ligands and subsequent catalysts that can be used industrially. The problem of availability was beginning to change particularly in light of advances in high through put experimentation and high through put screening that has been revolutionising commercial research and development in this area. The firm at the centre of this study initially wished to use combinatorial machinery (high through put experimentation and screening) in concert with their expertise in the area of asymmetric catalysis to create libraries of ligands and compounds for industrial screening and use.

With regards to the commercial field of chirality, it is large and diverse and has been in existence for a sustained period. The use of chiral end products in single handed form has application in a number of sectors including the major areas of pharmaceuticals, agro-chemicals and fragrances and flavours. There has been increased commercial interest in this area due to a number of factors including potential cost savings, the need to get rid of undesirable effects or flavours of particular chiral molecules, the emergence of biotechnology, and the development of technology in the chiral field. However, the major driver has been the 1992 FDA guidelines on single handed drug manufacturing. This requirement has seen a major emphasis on the development of this area because of the requirements to produce many chiral drugs in single handed forms, and the potential to extend the patent of racemic (mixed) forms of mass selling drugs.

The chiral industry structure can be considered to consist of three basic levels with chiral platform technology providers, chiral intermediate suppliers and chiral end product users. The chiral platform technology suppliers' category is made up of a diverse range of actors ranging from the small focused niche companies to the large fine chemical manufacturers. Much of the new technology in this field emerges from academic institutions. Chiral technology suppliers will offer a range of products and services ranging from screening services, ligand libraries, pilot and batch stage products and particular types of catalysts. This particular field is relatively small and specialized in comparison to the two downstream areas and was worth in the region of \$1.8 billion in 2002.

The chiral intermediate sector is sometimes a little ambiguous but involves the manufacture of chiral intermediates using platform technologies. These chiral intermediates are then used to make chiral end products, like Advil or Prozac. The chiral intermediate sector will often take a platform technology and be able to scale-up its use. Similar to the chiral platform technology providers, a diverse range of products and services are offered with a key differentiator being the ability to produce at industrial scale. Companies involved in this field tend to be fine chemical manufacturers and offer these types of products in particular because of the demands of the pharmaceutical sector. As such a common trend has been the acquisition of platform technology providers or niche intermediate providers by fine chemical manufacturers. Finally, the end product users range across the pharmaceutical, agro-chemical and flavour and fragrance industries, with the greatest user of single enantiomer (handed) products being the pharmaceutical sector.

The firm at the centre of this case is attempting to initially establish itself as a venture in the chiral platform technology sector by using their expertise in the field of asymmetric chemocatalysis in combination with combinatorial technology to create chiral ligand libraries and catalysts for use in industry. They are attempting to set themselves up at the very start of a period where sustained attention, activity and investment was being made in the establishment of an indigenous and commercially viable R&D culture in the Irish biotech/Life

Science sector. Having outlined the indigenous and commercial contexts for the venture it is now necessary to turn and look at the development of the venture.

Period 1: Opportunity Discovery and Initial Activities to Exploit a Perceived Opportunity (October 1999-February 2002)

This section will cover the discovery of an opportunity and the initial activities undertaken to begin the process of forming a new venture and in particular consider how they saw themselves developing.

The new venture at the centre of this case is focused on the discovery and creation of asymmetric chiral catalysts for commercial use. The initial principle promoters of the firm were academic chemists without commercial scientific experience. One a lecturer, David Grant, in the Chemistry Department of a Dublin University and the other was one of his PhD students, Barry Keenan. The initial idea was to use combinatorial machinery, in the form of high-through put experimentation and high through put screening machines, together with PhD chemists and their knowledge of the specialised science in this area, to discover a vast array of chiral ligands/catalysts that could be used in industry. According to Dr. Keenan the

“...genesis of this idea was a conference that I went to in... 1998 and I saw a particular expert in the whole area of chiral chemistry give a talk and he had loads and loads of results. I was thinking to myself ‘My God, how many people did he have working on this.’ At the very end of the talk, he put up his acknowledgements and he goes ‘I would like to thank...’ and he just had one person who did all the work on this. I was going ‘Oh my God, whatever way he did this, this is the way to go forward.’ So then, I thought ‘Right there is room for someone else to do this here.’ That was the genesis of the idea.” (BK, 25/04/02)

Seeing the results from these combinatorial machines that had been adapted to chiral chemistry and the senior scientist’s (Dr. Grant) need to get access to these machines for his own academic research (at the time there was a lack of funding for academic science in Ireland) Keenan and Grant agreed to form a company in October 1999. The company, Levodex, was formed and registered in April 2000. The concept was based on *“... that you give us the machine and lets us do a pile of experimentation over 18 months, we will come up with something that you can commercialise. We will make a catalyst, my motto was ‘Have a machine, will get a catalyst.’ ” (DG, 11/08/04).*

The perceived advantage and opportunity to exploit rested on the fact that there were a very limited number of chiral catalysts in use in industry and there was a pressing need for these types of catalysts, particularly in light of the 1992 FDA guidelines on the production of chiral drugs. Although sought after, many of the discoveries had come from academic labs. According to Dr. Keenan

“Essentially the discovery of chiral catalysts has been done by people working in a lab manually doing one or two or three of very efficient experiments everyday... The thrust of our business will be to get robotic technology known as combinatorial technology and that can essentially do up to a hundred experiments a day, possibly more depending on the type of machine...So it significantly increases the amount of experiments you can do every day. I used the analogy before of playing the lotto. If you’re one chemist in the lab doing one experiment it is like buying one lotto ticket, whereas if you have this machine it is like buying 100 lotto tickets. So you have a far better chance of getting something useful... purely because you are doing more experiments.” (BK, 25/04/02)

To try to begin the process of developing their perceived idea they took part on a campus company programme in the university which they were part of. After taking part on this programme, in October 2000, they decided to construct a Scientific Advisory Board, with some of the most prestigious names in their particular field including a Nobel Prize winner whom the senior scientist had worked with and it also consisted of two members working in senior positions in industry. The construction of this board was based on a number of premises. The first reason was their expertise in this particular area, both industrially and academically. This board was perceived to be a major resource to the firm once they had started to try and exploit their perceived opportunity. They felt they would be able to help direct and give guidance on what areas to focus on to discover catalysts in this area with expertise of the scientists involved being the key factor in discovery and development. As Dr. Keenan, the junior scientist, stated

“So the analogy I use is that any old joker like me could go out in a boat with a fishing rod and look for a fish because I am not a good fisherman I may catch a fish if I am lucky. But a good fisherman if he went out with a boat and a fishing rod would know where to look and would have a good idea where to find the fish and have a good chance. Now if you combine that good fisherman with a big net, you can be damn sure he is going to get something. So what we have done is we have combined loads of really good fishermen and we are combining them with a big net in the combinatorial machine. So, we are hoping that we are going to get these catalysts.” (BK, 25/04/02)

However, as well as helping with the scientific side the SAB was seen to be of use on the commercial side with their advice and contacts. Finally, the SAB was seen to be a resource when they began to search for finance because *“...their purpose is to make us look good, I suppose, and it is an impressive thing to say that we have this expertise at our disposal.” (BK, 25/04/02)*

Initially the amount of resources they wanted to acquire was to be quite small. They wished to acquire a small amount of money (£30,000-50,000 Irish pounds (approximately €38-64,000)), to acquire a basic machine, rent space in the senior scientist's lab, and use a PhD chemist to carry out experiments but on the advice of another academic entrepreneur they decided to scale up their idea, and constructed a business plan in July 2001 that set out how they were to look for the substantially larger amount of €5 million over a 4 year period. With €2 ½ million required over the first 18 months of operation and another €2 ½ million after this period to bring them to year 4 (Levodex Business Plan, July 2001, pp.4). Only at the end of year 4 was profitability expected.

Having constructed their plan and made a number of changes to their idea they began to look for initial small scale funding to further develop their idea and give them time to begin to look for substantial funding and through introduction they met with a director of a incubation unit in a Business School of the University they were trying to spin out from. They were accepted onto this programme in January 2002 gaining €76,000 in matching grant funds from Enterprise Ireland and the Business School. The one stipulation was that they had to hire a recent MBA graduate as their CEO. For this role they chose Paul Cranford, who had a background in engineering in the Middle East but was not a scientist nor had he ever worked in the pharmaceutical industry. Similarly he had no experience of working with a start-up firm. His job, it was envisaged, was to bring a commercial focus to the firm and lead it through to funding.

With the financial requirement of an initial €2 ½ million for 18 months they planned to raise this level of finance through venture capital or Angel type funding. However, although very optimistic they did anticipate that there might be some small resistance to the level of money they were looking for- *“...in an Irish market context, that is a significant amount of money for a start-up company who is not up and running... the nice derogatory way of putting it is kind of ‘Hang this is one guy in a suit and two guys in a white coat’ and that’s it.” (PC, 05/07/02).*

How they imagined that they would generate revenue from this was through two-channels- proprietary research and research alliances (Levodex Business Plan, July, 2001, pp. 3). What the new CEO, Paul Cranford, imagined happening was that 2/3rds of their people would be working on research alliances and 1/3rd of their people would be working on their own in-house research. With regard to the research alliances they believed that they would be working with fine chemical and pharmaceutical companies “to discover new products and processes...” and they “...will receive initial up-front research funding, agree milestone payments, and royalties form future successful commercialisation” (Levodex Business Plan, July 2001, pp.3). What they envisage happening was that they would have, by year 5, 10 research alliance projects continually going on in a community of 12 to 13 clients. These research alliances as such would fund and feed into their own in-house research.

How they planned to organise the firm was to have a CEO, COO/Business Development Manager, and CTO with four research teams made up of three scientists with each operating their own combinatorial machines that would carry out up to 100 experiments a day. The senior scientists were envisioned to have at least 2 years experience and the other two scientists were to be PhD qualified. These teams would be informed on research by the SAB. Paul Cranford was to be the CEO, Dr. Keenan the COO/Business Development Manager and Dr. Grant the CSO/CTO. Accordingly, they envisioned having *“By the end of year one there will be 20 people employed by the end of year 3 it will be 33 and by the end of year 5 it will be approaching 70. ...90% of the people, the direct hires, will be PhD chemists...there is a support team that initially starts off*

with 4 people and builds to 10- the management, marketing, sales, accounting, Business and Legal so the idea is that you have about 60 directs and 10 indirects” (PC, 05/07/02)

However, although they had ambitious plans and were optimistic about gaining funding that still had to approach potential investors. At this point it is now necessary to turn and look at what occurred in the next period of development of Levodex.

Period 2: The Search for Funding through Venture Capital: (January 2002-April 2004)

The second period of the development of the new venture in the main focuses on the search for funding in particular through venture capital and as such this section shall focus on this particular element and the impact that it had on the shaping of Levodex.

To understand the context into which Levodex was trying to raise capital from it is necessary to briefly consider how Irish venture capitalists assessed opportunities in the Life Sciences. As mentioned, in the context section, the venture capital industry in Ireland was small with most specialising in investments into the area of ICT. In the Life Sciences only three recent funds were particularly focused on investments into the Life Sciences. These three funds, at the time, had between €10-20 million to invest into potential opportunities into these areas and had been established between 2001 and 2003. The funding was gained from a mix between state investments, investments from high-net individuals, and institutional investors. Although there were other funds in Ireland in this industry there was a tendency for co-investments with a larger fund or an international fund preferring a local investor and also one with experience and specialisation in this area to assess the opportunity and to co-invest with to help mitigate risk. As such it is necessary to look at how these three funds, (Venture Fund 1, 2 and 3) assessed opportunities in this area.

According to representatives from each of these funds they see investments into this area being in general long-term and potentially risky investments with a typical investment into this area taking between 5-7 years to mature but realising that they could take longer. Although they have a long checklist for weighing up an investment they all considered three main things- the management team, intellectual property (IP) or potential IP, and market opportunity and financial considerations.

The first consideration was the management team. As one of the venture capitalists stated-
“...what we would predominately look at is the people, the management team, particularly if they have delivered before, if they have international experience you would like to see all that good stuff and if they are generally good presentable people and can impress you.” (AMG, 28/11/03)

So because of the nature of these types of ventures being high risk they look for an impressive management team. This is for a number of reasons including the need to have faith in an individual/individuals understanding how to develop a venture, understand how the commercial life sciences work and be able to commercialise the ventures products/services, and also because of the high likelihood that they may have to go out and look for another round of funding from other sources and that such investors would further scrutinise the management team. However, they also realised that there was a genuine lack of available experienced management in this area in Ireland.

The second consideration was IP. Accordingly *“...if the product is scientific, the best way of showing it is intellectual property. If it is the old days in IT, I kind of the say the old days, the 90s, the late 90s, sometimes it was first mover advantage that was the hot thing. In our area, it is a lot cleaner; it is intellectual property that is the cornerstone.” (AMG 07/05/04)*

They will not invest in a start-up in this area without some form of defensible IP, in part because of the risk of imitation and the potential for loss of key staff and also as an additional guard against risk because of the potential resale value of the IP if the investment falters.

Finally they will look at market opportunity and financial considerations. *“So what we say is that the company has to have the potential to generate revenues of 100 million in five years, not that they will generate them but that they have the potential to that.... It has to be a significant market.” (AF 10/06/04)*

Although when the venture capitalists assess the potential market opportunities and the potential for revenue, they look at proposed market entry strategies and realistic evaluations for the short to medium term period (over 3 to 4 years) of market penetration and potential revenue that can be captured. Tied with market opportunity is planned market strategy. They also consider the amount of finance required, what further funding will likely be required into the future and how long it is anticipated that it will take for the firm to develop. On the flip side, these investors guarded against certain things such as lack of IP, inexperienced management teams, unrealistic business plans and a limited market opportunity with the requirements of high levels of finance with no clear exit opportunities. They also were wary of distorted beliefs about their technology, scientists being too wedded to their technology because the technology could be sold from the firm, and also the over-reliance on Scientific Advisory Boards. As one of the venture capitalists stated *“In these advisory boards you do kind of see... often what you see is these advisory boards have great names on it but how often have they met? They have never met, they are purely just names on a sheet and that is no use”* (AMG 28/11/03) They were also wary of over-long business plans (80-100 pages) with a lack of focus, they looked for a plan that told a story as efficiently and precisely as possible.

To finish, it is worth noting that these funds were only beginning to look for initial investments, they would only invest with co-investors, and that they would put into place investment milestones such as commercial, managerial, and technological milestones and would also take a place on the board of directors. How they found opportunities was through introduction, being approached by a start-up, or through approaching start-up themselves. They all attended technology show-cases run by networking groups such as First Biotech and BioConnect Ireland. They were often approached by other Irish venture capitalists with investment opportunities because *“It is a small enough network in Ireland and a lot of venture capitalists don’t have the expertise in this sector. So if they see something they would introduce it to us...”* (AMG 21/11/03) and that *“...we hear what firms are talking to which VCs.”* (AF 10/06/04). Finally what they see themselves doing is that as well as providing financial capital that *“...they will be bringing the science to the table and we will try and bring the commercial focus.”* (AMG 28/11/03) and they look to continuously influence and mould the firm to maximize their investment.

Levodex Approaches Venture Capitalists and the discovery of IP:

After entering the incubation programme that they were accepted onto in January 2002 they begun the process of establishing themselves by looking at their plans and then the process of making contact and approaching Irish venture capitalists for the initial amount of €2 ½ million. Although they approached 14-15 representatives from Irish funds and gained follow-up meetings, which they attributed in part to having a Nobel Prize winner on their SAB, they had a very difficult time gaining any sort of real interest in their new venture. They were told *“...’realistically you probably wouldn’t want to give 50% of your company away... So that means you are valuing the company at €5 million and you don’t even have a product. So that is quite a lot.’ So that made us think about things.”* (BK, 25/10/03)

And that *“... Hard nosed people were saying to us ‘Well that was dotcom guff, you know. That is all over now, give us a product’ ”* (DG 11/08/04)

So from these initial meetings they quickly realised they needed some sort of product/IP because without it they would not receive any funding. So to try and overcome this problem they began to think about what type of projects the senior scientist had in his lab. What they came up with, in June 2002, was a piece of work that two previous PhD students had worked on and modified, which was a route or method for making what is known as p-chiral ligands and with the modified method they had they believed they could potentially produce a very large number of these type of ligands. These p-chiral catalysts were preferred because they have a better chance of making the kind chiral substance that was required by industry and with potentially greater purity, and that these types of p-chiral catalysts were rare and highly desired by industry. In comparison, the direct competition to this new venture only had a very limited number of c-chiral catalysts that were induced using separate methods. However, the method that they had developed was only working at a very rudimentary level and would need to be greatly improved to produce a vast range of catalysts that they perceived it might be able to do.

With the discovery of this piece of IP they decided to add this piece of IP to their business proposition and returned to reframe their business plan.

Reframing of Business Plan and the Re-Approaching Venture Capitalists and the Development Initiative:

The business plan of the firm grew from an initial four page outline to 79 pages. Covering the usual elements of business plans (market, management, operations and organization structure, finance) how this plan differed to the previous period was that it now included the addition of a piece of IP, and outlined how this was to generate revenue as well and financial estimates including expenditure and revenues to be accumulated with and without research alliances. What they believed the key things that differentiated their venture from other chiral platform technology firms was the people involved with the company, in particular their SAB, and their potential piece of IP. They were still looking for an initial €2 ½ million in funding.

Having redrafted their plan they went out to meet potential investors in the autumn of 2002 and began to seriously engage with potential investors at the start of 2003, which centred on the three funds interested in investing in ventures in the Irish Life Sciences. Although they had serious interest with two of the venture funds (fund 1 and 2), whom carried out intensive due diligence, they ultimately decided not to invest in Levodex in the summer of 2003. Key to this was the amount of money being sought for a potential piece of IP that was no where near fully optimized. Similarly there was a perceived problem with their management team and their lack of experience, in particular their CEO.

With a narrowing set of options Levodex came up with an alternative plan which they termed the development initiative. They formulated this in the spring of 2003. What this focused on was the development and optimization of their potential IP and would involve the venture purchasing a single train of combinatorial machinery, hiring two chemists, and renting space in a lab and office. For the development initiative they were to look for €700,000 for a twelve month period that was to be based on proof of concept. With this refocused plan they began to re-approach the market. Although they approached fund 1 and 2, the only one that had any serious interest from was Venture Fund 3. They met this fund at a networking event and had begun to engage with them in April 2003, however the fund only became interested when they came up with the development initiative mainly driven by the fact the fund only wanted to invest up to €750,000 for any round of funding. However, negotiations dragged out due to two reasons- uncertainty around their science and the opportunities in this area and their management team.

To overcome the problem on the fund's doubts in the scientific area they managed to use members of their SAB to help with this issue. Firstly, they arranged a meeting between the principals from venture fund 3 and one of the industrial chemists on their SAB, who held a senior international role in a major pharmaceutical firm. Secondly, they also arranged a visit to meet senior scientists in the UK in a major pharmaceutical manufacturer. However, the key problem of the management team was the major stumbling block and the fund was in particular concerned about the CEO.

"The VC's we were... are speaking to had been saying all along "Listen we have to get someone with industry experience in as the CEO and your team doesn't have that and we need to get that onboard if we are to invest." (BK 25/10/03)

By August 2003 the funding from the incubation programme was running low and the CEO was no longer being paid a wage and with no deal in sight and major concerns for the investors around his position he decided to leave in October 2003.

At this stage the firm was in trouble with no CEO, dwindling funds and only a small office space to work from. However, Levodex had a small piece of luck. During this period they are introduced to a very experienced Irish individual, Brendan Egan, who was looking to take on a project on a part-time basis in Ireland. He had worked internationally in senior commercial positions in the pharmaceutical industry for 30 years, and had recently been a key individual involved in the start-up and sale of a biotech venture in Belgium for a significant amount of money. This individual was introduced to them by a member of the organizing committee of BioConnect Ireland (an Irish academic-start-up-industry networking organization) and was known to the principals in venture fund 3. After a small period of negotiation he agreed to take on the role of CEO once they were funded. With this agreement in hand a term sheet for investment was presented to Levodex in December 2003, which was agreed and finalized in April 2004. The investment was to be for €655,000 with Enterprise Ireland (Irish government agency) providing up to half of the money for this investment. For this the venture fund took 30% equity, and took a place on the board of the directors. The investment was for proof of concept and included technological and commercial milestones including raising the level of efficiency of the potential IP, demonstrate its use for industry, appoint a CEO (who was waiting to join on funding), and the sourcing of potential customers.

Levodex New Horizons:

With the new CEO, Brendan Egan, in place, he believed that certain things need to be accomplished. Firstly, he believed that they needed to fine tune their business plans with more realistic assumptions on the revenue and financial sides. He also saw developing the science being key “...*validating the science. That is what it is all about*”. (BE 07/05/04)

To access the critical resource of funding they perceived that they would need to be out and on the road looking for further finance by Christmas 2004. To get this resource they were considering a number of additional routes besides looking for venture capital. Some of these routes included looking to individual private investors, looking to licence out parts of the technology or look toward a co-development deal within the fine chemical or pharmaceutical industries. A final route was to look for EU grants or other types of grants, which the CEO had experience of applying for and receiving, and had contacts in place to help pitch for grants. Furthermore, with the development of the technology being key he did not envisage any real sales in the short-term although when necessary he saw himself using his network of contacts to help Levodex. He wanted to keep the operation of the firm small scale in the first year or two because the venture he perceived being at least two years pre-revenue and so he wanted to keep the overheads low. In the longer-term he was considering how the venture could move down-stream producing at scale a variety of chiral compounds and move the venture up to being a chiral intermediary supplier. Having discussed to second period it is necessary to now focus on the third period of the development of the venture.

Period 3: Activities to Prove the Concept- Commercial and Technological Development (May 2004-November 2005)

This section will look at three inter-related areas- technological and commercial development and the continual search for additional funding. This section will start by looking at the commercial development of the venture during this period.

Attempting to Establish Commercial Relationships and Outcomes:

Levodex began this period in June 2004 by taking part on an Enterprise Ireland Trade Mission to the NIH in the U.S. where they got to meet with senior decision makers from major fine chemical and pharmaceutical firms with the hope of looking for investment into their technology or future partnerships with these firms. They were ultimately unsuccessful and what they learnt was “...*it wasn't just enough to tell them that P-chiral was great and we can make lots of P-chiral potentially they wanted to know what ligands have been made and show them how good they have been*.” (BK 16/06/04)

However, from these contacts they did eventually manage, in August 2005, to gain a future supply agreement with Wyeth to supply any discoveries of the venture for the firm to test.

However, of greater importance was the development of contract work with Pfizer and the venture's dealing with a firm called Stylacats. Beginning with Pfizer, the venture, as mentioned, had assembled an SAB that consisted of eminent academics as well as two industrial chemists. One of the industrial chemists, Paul Nesson, worked for Pfizer and headed up the process development centre in Pfizer. With this contact in place the venture were able to get to meet a number of decision makers in Pfizer and from this they managed to gain a small piece of contract work, to run through March and April 2005 in Pfizer to test a number of their catalysts on a specific step in the production of one of this firm's major drugs to see if any cost savings could be made. Although ultimately they did not succeed by just working with Pfizer it provided a major coup for Levodex because

“...*from our perspective it was great validation to work with a large company such as Pfizer to validate our technology, in the sense that it was worth their time to try our technology and also validated our business model*”(BK 25/11/05).

Furthermore, in May 2005, through the other industrial chemist on their SAB they managed to sell a small quantity of material to DSM for trial in one of their chemical processes.

The other significant commercial activity of Levodex during this period was their interaction with a firm called Stylacats. This firm was a start-up based in Liverpool that was started in 1999 and was initially started on the commercialization of a catalyst called Triphour. This firm had taken on considerable amount of venture funding and were in trouble when they met Levodex. In January 2005, Stylacats were looking to get Levodex to produce a particular product for them but no deal could be agreed and shortly afterwards Stylacats went

under. However, from these dealings they ended up contracting in the sales director from Stylacats, Barney Cummins, to act in a part-time capacity as their sales director.

Technological Development and Grant Funding:

A key problem during this period rested upon the development of their key technological resource which was meant to be further optimized and producing a number of catalysts at a high level of purity for industry to try. This was aggravated by the lack of financial resources that the start-up had, which left the venture with two inexperienced student chemists, who were finishing their PhDs and had taken time off to work for Levodex, and the CSO David Grant (the senior academic who was one of the original promoters), who was working in a part-time capacity, to develop the technological resources. During this period they had only developed one catalyst at a high level of purity (called EE) and seven at much lower purity levels.

To try and help in the development of this resource the venture looked to access grant funding and also incorporate other potential pieces of technology into the new venture. The first grant they looked for, in September 2004, was a Fusion Grant being offered by InterTrade Ireland to stimulate interaction and trade between Northern Ireland and Southern Ireland. The grant offered funding of £66,000 over two years that covered the funding of a graduate/researcher to work in a firm in either the North or the South and with an academic institution in either the North or the South offering a mentoring role to the graduate working in the firm. To access this financial resource the venture contacted a well known researcher, Professor Darren Boyle, in a major University in Northern Ireland. His area of speciality was in biocatalysts. From the development of this relationship they decided to jointly apply in May 2005, for the EU Marie Curie TOK grant for €600,000 that would be based on Professor Boyle and the Northern Irish University transferring their knowledge on the use of enzymes (biological agents) to make chiral molecules and Levodex transferring their expertise on the use of high-through put experimentation and its application into the Northern Irish University. To achieve this they used a contact of the new CEO, who had won substantial grants for a number of firms including the firms the CEO had been involved with, to help draft and push through the application.

In November 2005 they received approval for this grant. This also led to the inclusion of the products of Professor Boyle into the firm, who had a range of biocatalysts ready for commercial sale, which came in sample trays, and could easily be made into intermediate products. They signed a licensing agreement with the Northern University around the same time they received the grant approval. They also appointed Professor Boyle to their SAB. Furthermore, with a product that was market ready they believed that short-term revenue would accrue from this particular resource. Finally during this period they identified a potential competing technology that could possibly create p-chiral ligands being developed by another academic in Dartmouth University and negotiated a licensing agreement in August 2004 that involved Levodex trialling, developing and commercialising any potential ligand from this competing method.

Further Financing- Dealing with Venture Capitalists and the choosing the BES Route:

In turning to financing in this period, outside of the search for grant funding the venture was also looking for further types of funding, whether to be supplied from the pharmaceutical/fine chemical industry, venture capital, or through private individuals. After finding a lack of interest from the industry side in co-development deals, they decided to consider following the venture capital route once again but this time looking for funding from venture capitalists for the relatively small amount of €1 million. The focus on this search occurred in May 2005, just after finishing on their project for Pfizer and supplying DSM. This search for further finance was also occurring whilst they were in the process of submitting for a Marie Curie grant. However, problems with their initial investors occurred because this fund, Venture Fund 3, wanted Levodex to bring in an international venture capital fund as co-investors but the actors in the venture were not keen on this route because they felt that for such a small amount of money this type of investor would not be interested. As such after protracted negotiations Levodex decided to pursue private investors through a Business Expansion Scheme (a scheme run by the Irish Government to get people to invest long-term, up to five years, into certain allocated sectors and that provided tax relief for investors into these schemes). At that time the maximum that could be raised by a firm through this scheme was €1 million. Levodex's plan was to look for a number of private investors to put money in with a minimum investment of €20,000. They planned to launch this scheme during Christmas 2005 and during this period they redrafted their business plan. This plan included the additional elements of all the commercial work they had carried out, the development of their technological resource with information on how it worked and their results, their expanded technological portfolio through the addition of the biocatalysts from Northern Ireland and the licensing agreement with Dartmouth, as well as the grant funding that they had received. It also included a detailed business model and how revenue was to be

generated in short, medium and long-term and an imagined pricing structure with catalysts at a variety of quantities. It also outlined how they were considering manufacturing their catalysts at scale by outsourcing manufacturing to China to a firm that the CEO had many dealings with in his career since the mid-1980's. However, to deliver on this plan they needed products to supply and at this stage they had a very sparse product line.

Period 4: Developing the Product Line for Commercial Relationships and Levodex's Imagined Future Horizons (December 2005-July 2006)

This short period will focus on the key problem faced by the venture during this period, which is the development of their technological resources. Although there were other activities during this time (such as for example the BES scheme which they completed successfully by March 2006, and the application and access to another grant in April 2006 and developing an alternate distribution channel with an agreement with a chemical brokering firm called Camida) the key problem facing the development of this venture was the development of their technological resources because without any further advances in this area the venture could not develop, this is particularly in light of the fact that they had estimated that they would be generating €1.5 million in revenue for 2006 (Levodex, BusinessPlan, Q4, 2005). To achieve this they needed to develop further research alliances and to enter into alliances they needed to create a range of sample ligands (these are the main element that are used to make chiral catalysts) that would come in chiral toolkits (a tray with a number of samples for firms to test). After nearly two years of funding they only had eight samples, with only one working at a high level of purity. So the key activity was to develop their product line.

Shaping the laboratory and developing the product line:

A major problem faced by Levodex was that their research team consisted of two inexperienced chemists and a CSO/CTO who could only put 20% of his time into developing their p-chiral process. Also all came from an academic rather than an industrial background. To help overcome this they decided to hire in an industrial chemist, George Frost, in March 2006 to develop the venture's technology. Frost was a vastly experienced chemist who had successfully started and sold his own fine chemical firm, worked on and solved key chemical problems for a number of major fine chemical and pharmaceutical firms and had been involved with a variety of firms. He had over 30 years experience in industrial chemistry. He actually had worked in a consultancy role for Stylacats in the UK and was referred to Levodex by the sales director of Levodex. As the CEO stated "*...he is a damn good industrial chemist as distinct from an academic chemist*" (BE 06/06/06).

As such it was agreed that the new lab director would be in charge of the lab on his own with the CSO having some input but in the main the new lab director running the scientific side of the company. So what the new lab director did was to create a focus in the lab where they had targets, set deadlines, and have a clear reporting structure as well as, most importantly, developing product that was commercially desirable for industry, that they could make, and also scale up. The lab director also became involved in hiring people for the lab and looked to tighten up the recruitment process in particular looking to take on people with industrial experience, and hired a very experienced industrial chemist to work in the lab and help direct the chemists taken on with all the grant money that they had received. As the lab director saw it on entering the venture and developing their technology "*...we are just ready to start. Up to now they have talked about it but they have nothing, no ligands available.*" (GF 04/07/06)

Similarly he perceived the biocatalysts, which had existed in a number of forms for 25 years, as being, "*...a wonderful solution for which there is no problem*" (GF 04/07/06). Also they still had received no samples from Dartmouth to work on, two years after their licensing agreement. So the key thing was to systematically develop their patented process and to develop some product that the market had a need for. What they settled on was to produce a catalyst known as DiPamp, one of the few p-chiral catalysts in use and which they perceived there was a substantial demand for.

Their interest in making DiPamp was for a number of reasons. Firstly, DiPamp was off patent and therefore was attractive to industry because there would be no more royalty payments to be made to the firm that had held the patent. Secondly, DiPamp is one of the few p-chiral ligands that is used industrially and is well known on the market. It is seen as a very good ligand but a major stumbling block has been the issue of supply. This is because the ligand is extremely difficult to make and expensive requiring a large number of

steps in producing it. Thirdly, in making this catalyst through their patented process they could show the use and versatility of their process. Finally, the price of purchasing DiPamp has traditionally been high because of the cost to make the ligand and the limited supply. Levodex believed that could charge up to €50,000 a kilo, the going market price.

Throughout this time period they had to focus on optimizing their process and then focus on producing DiPamp. By the end of the period they found they were able to produce DiPamp at pilot scale (100 gram batches) and could produce it at scale but did not because they lacked space in the lab to produce in kilogram form. On top of this Levodex found that they were able to create analogues (slight variations) of the Pamp family, which was novel to the market and could be used for testing by fine chemical and pharmaceutical firms. At the time this period ends they were considering how to properly price DiPamp and in what volumes to produce it.

Levodex- Future Horizons:

At the end of this period they had a new lab director, they now had five people working in the lab, and commercially available and optimized p-chiral products developed from their process. They also still had their part-time CEO, they had a part-time sales director, had recently taken on a part-time finance manager, had on contract when required a specialist for grant applications, as well as an expanded SAB (which met all together for the first time in May 2006), a board of directors, and they also had a contract in place for manufacturing in China as well as an agreement for distribution with a chemical broker. The venture had developed slowly over time, with in total 11 people working for the firm with five working in a part-time capacity. They rented a small office in an innovation centre and they still rented lab space in a university laboratory. They had received from April 2004 to July 2006 over €2 ½ million in various forms of funding and were only now about to properly approach the market with products to sell.

The central concern for Levodex was to attempt to build more value into the firm with the 3-5 year plan being to sell the venture. They anticipated the purchaser to most likely be a fine chemical firm. How they perceived value to be added was through a large increase in sales revenues, which were to accrue through the establishment of relationships within the fine chemical and pharmaceutical industries. They also wanted to move into the production of chiral building blocks. The CEO was looking to have the firm valued at €20 million by the end of 2007. The firm also envisaged raising more finance so that they could fund the building of a stand alone laboratory and to purchase more equipment. However, the amount to be raised was to be a far more significant amount than previously had been accessed and was foreseen to be in the region of €10 million that was to be raised either through Irish venture capital or through European venture capital. The European route was preferred because the CEO had many contacts and lots of experience in dealing with funds in Europe. Therefore the key activities of this period encompassed the continual process of building value into the firm so that they achieve a significant valuation so that when they go for further financing toward the end of 2007.

To achieve any of these goals they needed in the main to continue to further develop their technological resources and further develop commercial relationships to generate revenue. They had a manufacturing agreement in place, developed an alternate distribution channel, and begun the process of developing their R&D capabilities. They were also considering in the longer term of ways, besides their biocatalysts, in which they could move into the production of chiral intermediaries. However, to for these ambitious plans to be realized, whether through raising significant investments from venture capital or the eventual sale of the firm “...we need a revenue stream. We need the whole model fully tested, the infrastructure is there, the whole thing works... They wouldn't be buying the company simply for its technologies. They would be buying a turnover. You would need to have a significant turnover between €20 to €30 million” (BE 06/06/06)

Discussion- Context and the Entrepreneurial Imagination- Planning, Activities and Resources Acquired and the development of Levodex

It was presented at an early stage of this paper that a key capability a new venture required was the ability of an individual(s) to make novel connections between diverse elements which gave rise to an opportunity. Although the connections made and the subsequent plans with regard to resources and capabilities required to exploit a perceived opportunity can be infinite in variety key to their enactment and development beyond the

imagined was the ability to convince others to provide the resources and capabilities to help exploit a perceived opportunity (Garnsey, 2002, see also Penrose 1959/1995, Witt, 1998). This is because most new ventures start with few resources and for them to begin to exploit a perceived opportunity they must convince resource providers to supply or work with a new venture.

With this in mind, it was necessary to explore how potential resource providers consider whether to supply or work with new ventures. As such, throughout each of the periods a number of decision criteria were in operation throughout each stage of development of Levodex that had profound effects on the shaping and direction of the firm. During the first two periods of the case the key resource sought were financial resources, in particular in the second period. This involved both government agencies and venture capitalists. During the third and fourth periods the key resources providers extended beyond venture capitalists and included the EU and so forth, but with a key focus upon establishing relationships with commercial end-users. Each of these actors used different, although complimentary, decision criteria to judge whether to supply particular resources to Levodex. The sets of actors that will be focused on here are the venture capitalists and commercial end-users.

The venture capitalists, as outlined used the criteria of management team, IP, Market opportunity and financial considerations. Commercial organizations looked to use general but often tailored market institutions regarding product, price, supply and distribution. These sets of criteria were derived from the present and planned future activities and requirements of these actors. As shall be briefly discussed below these had a major impact on Levodex and its plans, the resources and capabilities it required and accessed, and the activities that it undertook.

Venture Capital Institutions and their impact on Levodex:

Taking the initial two periods, which ranged from 1999 to April 2004, the main set of criteria that had the greatest impact on Levodex were those of the venture capitalists, which were particularly prevalent in period 2. They impacted upon the plans of the firm and their imagined activities as well as the actual resource and capability bundle that the venture ended up with at the end of period 2. As described previously in period 1 the initial promoters of Levodex imagined rapid growth and development with the acquisition of financial resources to be spent on setting up the new venture and executing their plan to exploit their perceived opportunity. This involved a relatively large sum of money, staff and capital expenditure on high end combinatorial machinery, lab and so forth. Because of their plans and the high level of risk involved they were limited to searching for venture capital. Through the way in which this particular sector worked the venture capitalists that they ended up dealing with were all local, specialised fully or in part in the Life Science sector, and because of the Irish context for start-ups in this area they were all newly established funds.

Taking these key actors that Levodex were imagining and actually dealing with during these periods it was seen that the venture capitalists' aims were to make what they considered the 'best' investments possible, taking as much equity as possible for the amount of money invested as well as reducing risk and uncertainty around investments to an 'acceptable' level. To meet these requirements, in particular the reduction of risk, the venture capitalists used sets of institutionalised decision criteria to frame their decisions upon investments in the Life Science area consisting of Management team, IP, Market opportunity and financial considerations. What is interesting about what emerged from this particular case was the dramatic effect that these decision criteria had upon the venture at the centre of the case. These criteria lead to the replacement of a CEO, a complete change in the plans and growth strategy of the venture, and the discovery of IP. A summary of these changes can be seen below.

Table 1: Institutions and Effects on Levodex's Resource and Capability Bundle and Future Plans- January 2002-April 2004

Venture Capital Institutionalized Decision Criteria	Levodex: January 2002	Levodex: April 2004
IP	None- to be generated by combination of machinery and expertise of Promoters	P-Process- proprietary method for producing and developing p-chiral ligands

	and SAB	
Mkt/ Financial Requirements	Substantial Market. €4 million +, for 4-5 years for technological development and rapid growth	Substantial Market, €655,000 for 1+ year for proof of concept and incremental growth
Management – Prior Experience/track record	None	New part-time CEO with vast experience to direct activities and develop firm

Commercial End-Users and Market Institutions and their Impact on Levodex

In the latter two periods, April 2004-July 2006, institutional criteria are also in effect. Although seemingly in the background and idiosyncratic in nature, in the sense that different criteria exist within different commercial organizations that the venture wishes to interact with and create some form of relationship with. However, what can be seen is that general market institutions, which are then tailored to individual firms, are in effect. These encompass product, price, supply and distribution. This can be seen from the desire for a variety as well as purity of ligands for commercial organizations, their stability in reactions, the ability to scale, the requirement of fine chemical and pharmaceutical firms to keep costs to a minimum and the costs of use of these forms of technology in comparison to other forms (for example resolution), issues around cost and supply in bulk and where they could access these ligands. Again these general requirements may be tailored to individual commercial end-users. Together with the milestones set for investment they greatly shape the activities of the venture directing the venture towards the development of their technological resources and capabilities that are directed towards the market, which will allow Levodex enter into commercial relationships and generate revenue.

Although seemingly not as dramatic or as explicit as Levodex's interactions with venture capitalists a number of key changes to the activities of the venture and subsequent changes to the development of the resources of Levodex. These criteria, as well as the influence of the milestones of investors set, lead to the sidelining of their senior scientist and major changes in their lab, the development of product(s) that is of interest to the market and the initial foray into the issue of pricing, and the supply of toolkits for industry. This also leads to the acquisition of manufacturing capabilities for bulk supply and the initial consideration and the creation of an alternate distribution channel. A summary of these effects can be seen in table 2 below.

Table 2: Market Institutions and their affect on Levodex's Activities and Resource and Capability Bundle May 2004-July 2006

Firm and Market Institutionalized Decision Criteria	Levodex: May 2004	Levodex: November 2005	Levodex: July 2006
Product and Services-Variety, Purity of product, stability and ability to scale	None- P-Process-proprietary method to produce and developing wide variety of p-chiral ligands	P-Process: 1 ligand at high purity and 7 other sample ligands at lower purity. Biocatalysts Dartmouth Ligands (but none so far received)	Same as in previous period but with the addition of DiPamp and analogues toolkit. Have ability to tune and manufacture at scale
Price	None- ideas about pricing but subservient to requirement of having a product	Yes- have a pricing structure around services, biocatalysts and planned future prices for p-chiral ligands (although still need to produce great variety). Derived from interaction and market	Same as in previous period but with addition of DiPamp toolkits and other market requirements (e.g. testing, amount etc)

		research	
Distribution and Supply	None but plan to do directly	Yes- Directly and have plans around manufacturing	Yes- Directly and outsourced manufacturing agreement with Chinese Firm Camida- alternate distribution channel.

It is also worth mentioning that the criteria of the end-users were present from the beginning of the case because the plans and imagined activities of the venture from the start were aimed towards servicing the needs of these particular actors but the venture was at a great distance from the market during these particular early periods. However, before they could actually begin these activities they needed, in this particular case, to meet the institutionalised criteria of the venture capitalists.

Looking across these actors whom Levodex were trying to gain resources from and the criteria used to judge Levodex, a number of further points of interest arise. Firstly, it is worthwhile considering the dramatic effect that they had on the activities of the venture. These criteria direct, as mentioned above, them to the find IP, find a suitable CEO, find a commercial chemist to direct their lab and develop their technological resources and capabilities leading to them developing their products specifically with market needs in mind. The outcomes from these activities, undertaken because of the sets of institutions in place lead to great changes to the resource and capability bundles of the venture and the activities that they can and plan to carry out.

Linked to the above point is that these institutions have a great effect on what they imagine they can and will do. In a sense they shape and direct the entrepreneurial imagination, where they temper and change how they perceive to serve the market, what imagined future resources and capabilities and activities are required, and the rate in which they believe they will grow. So the novel connections based on ‘have machine will discover’ made by the promoters at the start of the case and their initial plan are radically altered by the institutions in effect directing the venture towards certain types of activities and developing certain types of resources and capabilities. It is worthwhile considering these changes in light of Loasby (2000) who stated that “Institutions are frictions which, like frictions in mechanical systems, by restricting movement may make controlled movement possible... It is by preventing the exploration of many possibilities that institutions economise each individuals scarce resource of cognition and focus the attention of that individual on a particular range of options” (pp. 299). It might be apt to add that these ranges of options are affected by actors within a context whom the new venture is trying to acquire resources from and with whom they interact with.

A final point worth considering specific to the case is that institutions in effect used to judge the venture across the four periods are complimentary but differ in their expectations of the abilities of Levodex. The actors in period 1 and 2 of the development and growth of Levodex, in particular the venture capitalists, judged the venture on its market potential. Therefore the activities of the venture were directed towards communicating and proving its market potential. All of the key actors, with whom Levodex were dealing with in this period, were directing the venture towards developing and proving its market potential (for example the venture capitalists, Enterprise Ireland, the campus company programme). Whilst the second set of criteria, although complimentary to the first set, was about delivering on this potential to the market. So potential is not enough what matters in these periods is having the technological resources and capabilities, having desired products and services in place, being able to supply in bulk and deliver on time. So the first set was about proving the existence of a potential market and that the venture had the capabilities to serve this market while the second set was about delivering to and actually serving the market. Interestingly, in this case Levodex needed to meet the set of criteria used in all periods or else the venture would develop no further, the case ends with the venture tackling the problems of meeting general market institutions, which involved specifically developing their technological resources and capabilities.

In sum the conditions of a context at any point in time, including resources available the actors who control access to those resources, their activities and aims and their criteria for access to those resources have a major shaping affect on the imagined and actual activities of a new venture and the resources that are imagined and actually acquired. What is interesting about this case is that by following a new venture from a very early stage it becomes apparent the dramatic effect these institutions have of the development and growth of this

particular venture. They direct and shape the plans of the venture; they funnel the activities of the venture towards acquiring/developing certain types of resources and capabilities which then in turn affects the future horizons of the venture. This is so because the resource and capability bundle that a venture has directs the path in which it will develop.

Conclusion:

This paper had set out to empirically explore the impact of a context on the development of a new venture over an extended period of time. The contributions of this paper rest in a number of areas. The first area of contribution is derived from the length of time that data was collected for this longitudinal study and the stage of development of the venture at the time when this process was first undertaken. In collecting primary data on a venture over five years from its very early stages of development this work deviates from the traditional and understandable path taken that generally take firms that have been in operation for a number of years. However, a slight problem exists in looking at ventures that have been in existence and operation for a number of years have to an extent been already successful (Aldrich, 1999). Therefore what is gained is a fuller picture during the actual development and growth process as it occurs from a very early stage of a venture with indeterminate outcomes and which has not already been in operation for a number of years. Such studies are rare in this field and difficult to accomplish. It is only recently that longitudinal studies with extended periods of primary data collection on these types of ventures are beginning to emerge, for example Karlsson and Honig (2009), Dutta and Thornhill (2008) which are not taking ventures in operation and existence for a number of years or reliant on historical statistical data.

Another contribution of this paper emerges with regards to the aspect of the impact of venture capitalists on the development of a new venture. Venture capitalism has been investigated from an array of perspectives such as for example the criteria of venture capitalist investment (for example Shepherd, 1999, Zacharakis and Meyer, 2000), the investment process (Zacharakis and Meyer, 2000), and the effect of venture capital on new ventures post investment (Hellman and Puri, 2002). What is interesting about this work is the account provided that shows the effect that these particular resource providers have on a new venture prior to investment and also takes it from the perspective of the venture and accounts for the impact this has on the activities and resources that a new venture develops.

For the IMP, this research, through its focus and being an extended piece of empirical research into the development of a new venture is a contribution. As well as this, it offers for an IMP researcher some small piece of guidance when considering looking at the context of new venture development and what needs to be considered that can impact on the development of new ventures. This includes consideration what the aims and activities of other actors that have an effect on a venture under investigation are and more importantly identify specifically targeted actors and the criteria they use for judging these types of firms. Having accounted for this it is then of use to outline the effect that these can have on the resources and capabilities developed or acquired by the venture under investigation. Furthermore, developing the above line of reasoning, when considering the actors and institutions or criteria in a context, what this then points to is that to develop a deeper understanding of how these may affect a new venture it is worth considering types of legitimating activities directed towards the resource and capability bundle of a new venture and the symbolic value derived from the resources that these legitimating activities are directed towards. Although, through space constraints these legitimating activities were not fully highlighted, it is possible to see that a number of the activities towards gaining certain resources and capabilities is based around legitimation, for example the SAB, the symbolic value of their some of their technological resources, the small pieces of contract work and so forth. However, although many limitations and gaps exist within this work it is the authors' belief that for the IMP this is a relatively novel and new area and that there are many opportunities in the field of new venture development to explore empirically with ideas and concepts developed within this tradition.

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