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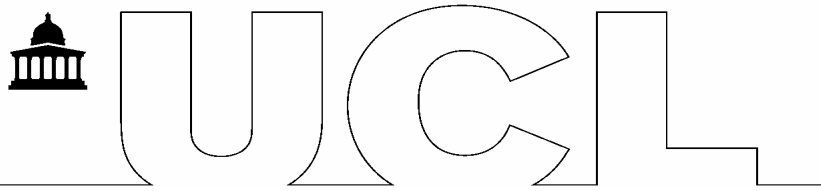

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Knowledge Based Entrepreneurship in the Czech Republic and Hungary: Results from 4 case studies.

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Knowledge Based Entrepreneurship in the Czech Republic and Hungary: Results from 4 case studies. [1] [2]

Abstract

This paper describes knowledge based entrepreneurship in the Czech Republic and Hungary, in particular the growth and development process of 4 firms are studied: Dekonta, an environmental services firm, Et netera, an IT services firm, both operating in Czech Republic, along with a data recovery firm, Kűrt, and a biopharmaceutical firm, Solvo, both operating in Hungary. The objectives of the case studies are to illustrate experiences of knowledge based entrepreneurship within a transition environment in terms of their different growth and development paths.

By carrying out in depth case studies using semi structured interviews with the founders, top management teams, core employees and key stakeholders in industrial associations I am able to explain the growth process of entrepreneurial knowledge based ventures. I assume an ecological view of the firm and examine the role of internal, strategic, network and external factors in this development process. I propose that the relative importance of these factors evolve over time from start up to maturity. Moreover, I anticipate that there will be complementarities between these factors in the spirit of Milgrom and Roberts (1995) and Von Tunzelmann (2003).

[1] This paper was carried out under the auspices of the *Knowledge, entrepreneurship, innovation, networks and systems* STREP project under the direction of Professor Franco Malerba, Universitá Bocconi, Milan.

[2] I am grateful to Kristina Kadleckivova, at the Technology Centre in Prague and to Karel Muller and Anna Kaderabkova at VSEM, Prague for their insights on the knowledge based economy in the Czech Republic, and Robert Bodocs at the ITDH, Hungary for information on the biotechology sector. Thanks are also due to participants of the KEINS project workshops and to Professor Slavo Radosevic for helpful comments.

This approach should help us better understand the complex nature of entrepreneurship.

The key contributions of these case studies are the application of an ecological conceptual framework to the development of knowledge based firms in Central and Eastern Europe, and so the viability of this model is tested within the transition environment. I follow the recommendations by Ireland *et al.* (2005) and introduce a temporal element in order to analyse the shift in importance of the factors impacting on firm development and growth, thus hoping to deal with some of the criticisms on existing entrepreneurial research.

1. Introduction

Firstly we must establish a definition of knowledge based entrepreneurship. So far the concept has been widely debated, but for the purposes of this paper we assume that knowledge based entrepreneurship refers to the transmission of knowledge that has been generated within the fields of science and technology in anticipation of commercial application. For the purpose of this paper I adopt Grant's definition of a knowledge based venture, whereby knowledge is the firm's most valuable asset.
The issue of knowledge based entrepreneurship is becoming more and more important in both advanced Western European countries and for the New Member States.
It is becoming especially important given the re-launching of the Lisbon Strategy in March 2005 with its renewed focus on growth, innovation and employment[3].

The four cases presented here describe experiences of knowledge based entrepreneurship in two of the New Member States, the Czech Republic and Hungary, within the IT and biotechnology sectors. The results explore the firms' growth and development path through an ecological lens by focusing the attention to variables stemming from the resource based view of the firm, strategic decision making, and networking activity. The impact of the external environment is also considered.

The outline of the paper is as follows: section 2 deals with the literature review, knowledge based entrepreneurship within the transition context is discussed in section 3, section 4 deals with methodology, section 5 presents the results, section 6 provides some policy implications.

[3] See http://www.euractiv.com/en/agenda2004/lisbon-agenda/article-117510 for more details.

2. Literature Review

This section shall present some relevant literature with particular reference to the influence of internal resources, strategy, relationships, external environment upon the growth and development process of the firm.

Internal resources

By employing the Resource Based View of the Firm which emphasises strategic choice and that each firm is a collection of unique resources and capabilities which form the basis of this strategy (Hitt *et al.* 1999), the case studies examine the impact of internal resources such as skills of employees, patents, and entrepreneurial and managerial talent.

Several examples of the impact of internal resources upon new venture performance can be found in the literature, Westhead *et al.* (2001) postulate that the entrepreneur's human capital may influence the firms' competitive strategies and performance. My case studies will highlight the importance of entrepreneurial vision in the growth process of the firms, in which entrepreneurial capabilities are encapsulated within.

As mentioned above, another important internal and intangible resource is human capital or the skills of employees, which consist of education, experience, and commitment of managers and workers. One example of the positive effect of a strong human capital level within the firm is the impact on the subsequent success rate of start up firms[4], and moreover in the case of industry specific human capital this can also help generate innovation. The case studies emphasise the role of skills in the growth and development process of the new venture, particularly at the time of start

[4] One example of this in the literature is Bates (1990) who examines the impact of the level of education of the entrepreneur and finds that education is positively related to firm survival.

up. For example, the composition of employee structure is largely made of up of employees with university degrees and with some type of previous industrial experience.

Equally we can expect technological intangible resources such as patents and trade secrets to be an important source of competitive advantage, and growth and development. As Strand (2006) points out that in accordance with the resource based view of the firm knowledge is one of the most value creating assets of the firm, and the application of this knowledge is at the heart of the value producing function. A firm's patent portfolio is an important aspect of this.

Another important aspect of the firm's internal resource is knowledge, which is an important element of the case studies. Grant's view of knowledge (1996) highlights the role of the individual as the key holder of knowledge and the role of the organisation in applying this knowledge, furthermore knowledge is regarded as the most strategically important of the firm's resources (p110). Grant also notes that the issue of transferability of knowledge is also critical, not only between firms but more importantly within the firm. Thus the easiness in which information can be communicated is vital, but this can be especially difficult in the case of *tacit* knowledge[5], therefore the role of *communities of practice* (which is characterised by a group of people who regularly meet to share and learn based on their common interests) can be useful in providing a structure for transfer of experience.

Organisational resources and capabilities include the firm's formal reporting structure and its formal planning, controlling and co-ordinating systems. One example of an important organisational resource is top level management. The strategic decisions made by top management influence the design and structure of the firm and

whether performance targets will be achieved. Managerial capabilities can also determine the type of organisational culture within the firm, such as the ability to build a strong team ethos. The cases presented here will reveal the importance of team culture and organisational design in the growth and development process.

Strategy

The cases also examine the role of strategic choice in the growth and development process of the firm as we can expect strategy to exploits a firm's core competencies that can gain the firm a competitive advantage and assist it to deal with its external environment. In the case of a new venture strategic choice is particularly important as it can help the entrepreneur to overcome uncertainty (Shane, 2003). Strategic choices relevant to the cases presented here are the decisions to internationalise and diversify. These two strategies have been selected by the firms in this study either as a means of survival or as a method of moving on to their next stage of growth.

Zahra and George (2002) find that entrepreneurs chose to internationalise in anticipation of first mover advantages, organisational learning, and acquisition of new knowledge or increased market shares. As for diversification, firms implement a diversification strategy for many reasons. Reasons pertinent to the cases here are mostly concerned with enhancing strategy competitiveness, such as increased economies of scope, market power and risk reduction. These can be transmitted into performance benefits. Empirical work by Hitt *et al.* (1999) identifies a curvilinear relationship between diversification and performance as after levels of diversification reach an optimal point performance benefits begin to tail off.

External environment: Government influence and entrepreneurial infrastructure

The impact of the external environment in the form of resources and constraints can also be expected to impact on the growth and development process of new ventures. In particular the role of Government regulations and entrepreneurial infrastructure are discussed.

For example, Begley *et al.* (2005) posit that it is important to know which environmental conditions are conducive to entrepreneurship as new, small firms are more prone to environmental forces, and these external features go on to shape firms' actions. They claim that environmental resources and constraints such as the availability of financing, market opportunities, government regulations and infrastructure affect the level of entrepreneurial activity. By using a large dataset with responses from 13 countries Begley *et al.* find that political and economic variables such as the extent of market opportunities, supply of skilled labour and supportive infrastructure are significantly related to the desirability of setting up a new venture. This all suggests that entrepreneurs are more likely to select growth orientated activities if they are confident that they have the capabilities for success, and if they believe that an institutional environment exists which will protect and allow entrepreneurial activities to flourish.

Van de Ven (1994) adopts an ecological approach that uses the population of organisations as its unit of analysis, stemming from Aldrich (1990) who points out that the ecological perspective emphasises that new start ups are dependent on the macro processes within and between organisations populations. Thus there are a variety of government regulations and institutional arrangements that facilitate and inhibit the emergence of new technologies and industries. According to this

population ecology perspective organisations that best fit into environmental niches survive and thrive.

Networks and relationships

Networks can be treated as a subset of factors within the external environment, but here they shall be treated as a separate factor, in the spirit of Hitt *et* al. (1999) who treat the internal, external environments and co-operative relationships independently. Alliances between firms have become an increasingly important aspect of strategic management and are playing a major role in the transfer of knowledge resources, (Parise and Henderson, 2001). The spread of alliances have become especially prevalent in high technology industries, with the motives for alliance formation stemming from the high costs of developing the technology and uncertainty in emerging technologies. The types of knowledge resources exchanged in alliances can range from intangible, tacit resources such as employee expertise or company brand name to tangible, physical resources such as equipment or products.

In this paper I assume that the firm's ability to utilise relationships with competitors, clients, government agencies and universities will enhance its competitiveness and thus assist in the growth process. Forming alliances is an important aspect of entrepreneurial strategy and allows entrepreneurs to speed up the entrepreneurial process by allowing them to tap into a source of already existing methods and knowledge. The entrepreneur can also gain access to assets without incurring large capital costs as well as share risk with alliances. Furthermore, a new firm can also gain a good reputation if it enters into an alliance with an established firm and thus improve its legitimacy.

Several works in the literature have highlighted the positive features of building network alliances for entrepreneurs, some of which are discussed below. Yli-renko *et al.* (2001) notes that relational resources can enable firms to gain access to resources and help them overcome their "*liability of newness*". Elfring and Hulsink (2001) state that this is especially important for high tech based firms as complexity and uncertainty in these ventures is particularly acute[6].

Peng and Qi Zhou (2005) examine how institutional changes within emerging economies impact upon firms' network strategies. They distinguish between business to government (B2G) and business to business (B2B) relationships and highlight as the transition process evolves firms move away from using personal networks to more formal rule based networks.

Baum *et al.* (2000) investigate how alliance networks affect the performance of Canadian biotechnology start ups. They hypothesise that if start ups are able to secure relationships with key actors they mitigate risks of newness because the knowledge, resources, stability and legitimacy that partners deliver compensate for disadvantages of organisational inexperience (p270). They distinguish between horizontal, vertical downstream and upstream alliances for biotechnology firms which include relationships with industry associations, clients, suppliers and universities. Interestingly their results show an insignificant correlation between industry associations and government laboratories and firm performance, but a positive and significant linkage between diverse networks and performance. Hence the results suggest a need for new ventures to cultivate a wide variety of relationships.

Both formal and informal network relationships can assist firms to successfully internationalise via the leveraging of complementary capabilities of

[6] It should be noted that there can be costs to developing network relationships, as Baum *et al.* (2000) point out. In their study of Canadian biotechnology firms they find that creating relationships can sometimes involve risks via the leaking of proprietary knowledge and inter alliance rivalry.

partner organisations. The use of relationships in the decision to internationalise is crucial in one of the cases discussed in this paper. Autio *et al.* (2002) find a positive role of networks in the internationalisation process, for young, telecommunications firms in Finland. They highlight that the nature of knowledge intensive sector means that the interaction and network model of entry is necessary. Their key results from longitudinal case study research demonstrate that the four firms actively sought and used global partners to gain access to new clients and markets, developing new products and to create isolation from competition. Crucial to this was achieving a central position within the network.

Complementarities

This Case Study assumes a multi level framework and therefore both internal and external factors are considered along with the complementarities between them. Thus, one of the aims of this Case Study is to explore the existence of complementarities between factors that contribute to entrepreneurial growth and development of the firm.

Complementarities as a source of growth and development are discussed at the macro and micro level, within theoretical literatures and for case study purposes, some examples are shown below.

The concept of complementarities in the growth process at the macro level dates back to Hirschman (1958) and his theory of unbalanced growth. He notes that one of the key tasks to achieve economic development is to combine under utilised labour, latent entrepreneurship, wide variety of unused skills and modern technological techniques that can be transferred from advanced countries. He assumes that these resources are latent within the economic system, as opposed to absent or scarce. He also refers to the need for a binding agent to assist with the combination of

these factors. For Hirschman the key issue is to seek "pressures and inducement mechanisms" that will elicit and mobilise the largest amount of these resources (p6.) Fagerberg (2003) also notes how the innovation systems literature has adopted a more holistic perspective that focuses on interdependencies among various agents, organisations, and institutions.

Radosevic (2002) discusses the success of the firm ABB in penetrating the Central and East European market, which was due to several factors, which occurred simultaneously and had "mutually reinforcing effects or complementarities*"* (p1). Radosevic assumes that the depth of industry integration is dependent on favourable complementarities between management, firm and region specific variables. The ABB case study found that success was the result of several complementary interacting variables: visionary management and firm organisation as well as market and product location.

McGowan *et al.* (2004) show that the existence of complementarities is not limited to the engineering sector. They explain the success of the electronics sector in Central and Eastern Europe as the result of the interaction of several factors, including multinational company strategies and the actions of local and national governments.

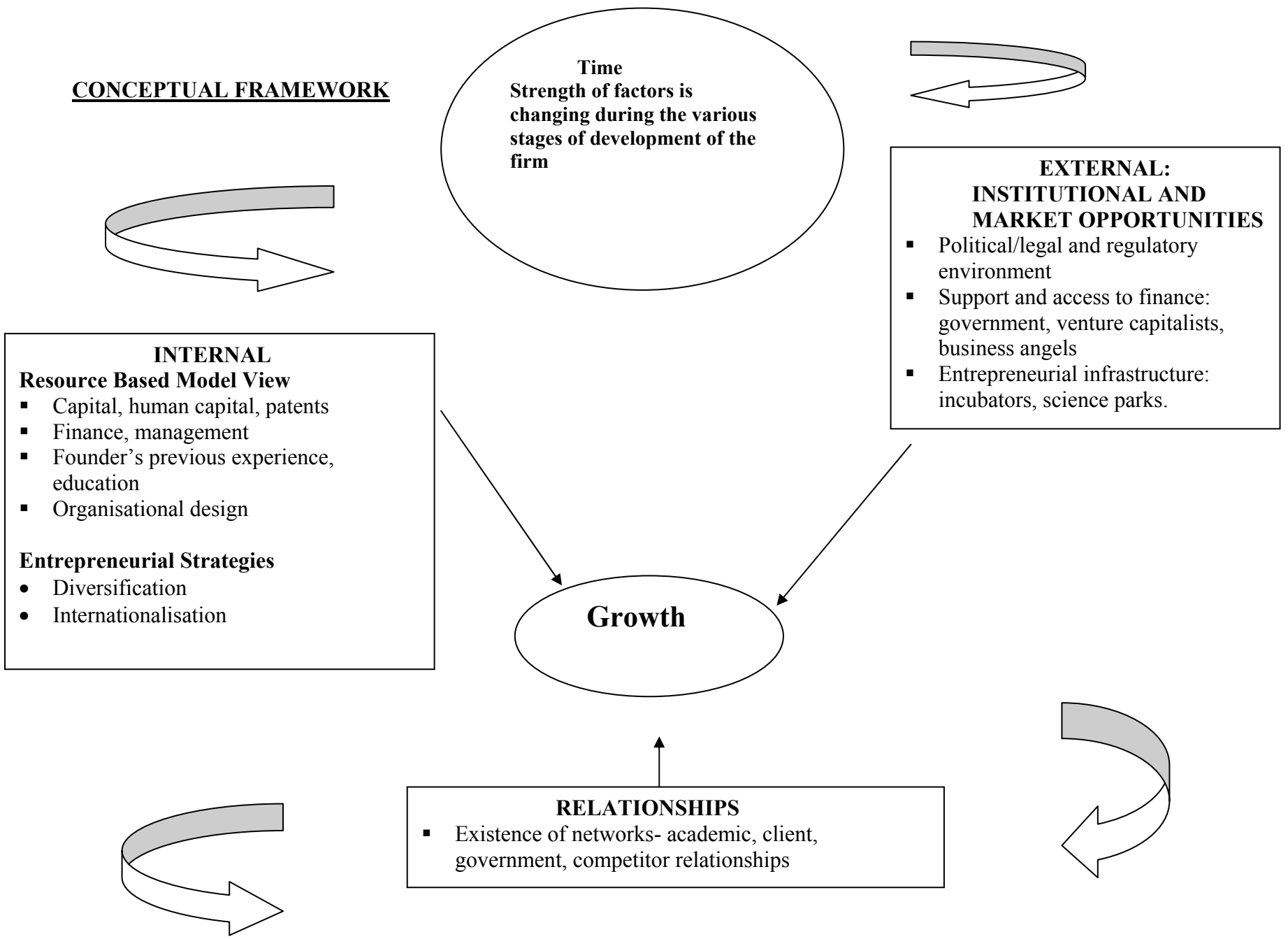
Milgrom and Roberts (1995) assume a more theoretical line and describe how enterprise effectiveness depends on a coherent and comprehensive alignment between strategy, systems and structure. They state that complementarities are situations in which marginal returns to one variable are increasing at the levels of other variables. They key feature of complementarities is that *"the choice variables tend to move up and down together in a systematic, coherent fashion in response to environmental changes*," (p185).

Contrastingly Von Tunzelmann (2003) examines network alignment from the macroeconomic viewpoint in the move from centrally planned to market based economy. For networks to become aligned different elements must pull in similar directions to one another, even when their purposes differ. He argues that for sustained growth there has to be *"sustained interaction between the foreign and the domestic functions, and between the macro, the meso and micro levels of the relevant networks,"* (p34).

One interesting point that Radosevic (2002) makes is on the life expectancy of complementarities, which is particularly pertinent to the transition environment. For example, low labour costs and access to markets may eventually wane or be erased. The case studies here, indeed illustrate that the role of internal, external and network factors, and the complementarities between them. The cases also show how the factors follow a life cycle and their relative importance varies over time in the growth and development process of firms. As Bygrave (1993) points out if we want to understand entrepreneurship research methodology must be able to handle non linear, unstable discontinuities over time.

The literature review presents us with the following conceptual framework, this is shown in the diagram below.

CONCEPTUAL FRAMEWORK



3. Knowledge Based Entrepreneurship in the Transition Context: Opportunities and Constraints.

The Case Study results will highlight the incidence of opportunities and constraints arising from the transition process for the knowledge based entrepreneur in the field of waste management and environmental consultancy, IT services, Data Security and biotechnology. The table briefly highlights some of these opportunities and constraints available to the knowledge based entrepreneur in the Czech Republic.

	Opportunity	**Constraint**
Czech Republic	Cultural memory of being an advanced industrial European economy	Very unlimited underground private economy
	Legacy of strong human capital base	Highly integrated into CMEA
	START and ZARUKA-policies to assist start ups	
Hungary	Legacy of strong human capital base	Problems with company registration
	History of foreign openness	Poor availability of finance
	Relatively decentralised system	

4. Methodology

Shumpeter suggested that the best way to understand the role of entrepreneurship in economic evolution would be to aim for a better integration of theoretical and historical work on the subject. *"Carefully analysed historical cases are the best means of shedding light on these things, of supplying the theorist with strategic assumptions and banishing slogans*," (Shumpeter, 1947). As Ireland *et al.* (2005) note entrepreneurial researchers often have to deal with very small samples (due to the high exit rates of entrepreneurial ventures and highly specialised nature of their sector). Furthermore, as my conceptual framework is based on a multi level

framework, which would be difficult to include in a quantitative study, case study methods are the appropriate approach. In particular, Flick's (1998) *"circular model"* has been implemented which involves in brief collecting data, interpreting, going back to the sample, more collection, comparing, and interpreting.

Also triangulation[7] (as recommended by Flick) has been used, for example of number of interviewees from each firm were selected, along with stakeholders from industrial associations were selected to minimise bias and to gain an overview of the sector. Furthermore some triangulation between methods was used, for example the questionnaire included Likert scales for measuring particular variables along with some semi structured, open ended questions.

Initially desk based research has been used to collect preliminary firm information from company websites, trade journals and bodies such as Chambers of Commerce, Czech Invest and Industry Associations.

The second stage in February-April 2006 involved semi-structured interviews with the firms were carried out, with the top management team (and in 3 out of 4 cases the Founder[8]) and a wide variety of employees from various divisions, such as Project Manager, Technology Director and Engineer. The questionnaire covers the following issues: financial sources, evolution of the firm, relationships, strategy, and performance. Some questions relating to determinants of growth were measured by a 1-5 Likert Scale. A similar approach was adopted by Colombo and Delmastro (2004) in their study of new technology based firms in Italy.

[7] In this context triangulation is defined as the combination of methodologies.
[8] A separate questionnaire was prepared for the Founder.

As I adopt this ecological approach we are able to better understand the complex nature of entrepreneurship. The research questions have been formulated with the recommendations by Ireland *et al.* (2005) in mind, making use of the resource based view of the firm and network theory in order to devise important and interesting questions (p118). Furthermore, although my study is not longitudinal I attempt to introduce a temporal element by posing questions which relate to both the present time and at the event of start up. I also take that the view that entrepreneurship is a phenomenon that cannot only be explained by individual characteristics of entrepreneurs, but one that needs to consider external factors too. This is a similar viewpoint to that of Shane (2003), who argues that research so far has focused either on the individual or exclusively on the external environment, and therefore there is a need for a broader conceptual framework.

Case Selection

The selection criterion was based on firm size, age, sector and innovation record. We also adopted the definition of a knowledge based firm from the assumptions of Grant (1996) whereby firms apply knowledge to the production of goods and services, and knowledge is the most strategically important of a firm's resources.

The selected firms meet our criteria as they are all relatively small (the largest firm employs 120 staff), with the oldest firm being only 16 years old, also they all are involved in a strategic sector[9] and all were established to pursue a new technological invention or service. Moreover, firm success depends on the knowledge of core employees, as knowledge is a means of competitive advantage.

[9] For example, Bartholomew (1997) claims that biotechnology is a key strategic technology for growth. This is mirrored in the Hungarian Government's decision to name biotechnology as a priority sector.

5. Results

Internal Environment

For all of the four cases[10] internal resources were crucial in the growth and development process of the firm at the time of the start up, with skills of employees, entrepreneurial vision, and innovation featuring heavily, as the quotes below reveal.

"Good staff, young smart people, and flexibility is the key to our success," (Project Manager, Dekonta)

"We have a unique knowledge base" (Business Development Manager, Solvo).

"We concentrated on the technology not design and media" (Marketing Manager, Et netera).

*"*Our staff are generally young and vibrant, with good qualifications such as MSc and MBAs, some are specialists in business consulting, engineering, financial services, or licensing" (Founder, Kűrt).

These results are reflected in the combination of entrepreneurial, management and industrial experience which the General and Managing Directors possess, along with the qualifications of core employees, for example, approximately half of which hold university degrees, some of which with specialisms in geochemistry, hydrogeology, IT engineering, economics, and biochemistry. In general, the core employees spoke very highly of the managerial capabilities of the founders and top management team.

[10] Details of the four firms are available from the author.

Table 3: Determinants of Growth from the Internal Environment[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Skills of employees	4	4	5	4	5	5	5	5
Entrepreneurial Vision	4	3	3	4	5	4	4	5
Innovation Efforts	3	3	4	4	5	5	4	5

[1]These factors are measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based an average ranking of responses to the following question: What is the importance of the following factors influencing the growth and development of your firm?

Table 3 reveals that the role of internal environment is changing over time in the growth and development process. For example at Dekonta, there is a decline in the importance of entrepreneurial vision. Instead the role of strategic choice and use of network relationships are relied upon for growth and development opportunities (see tables below).

In contrast, in the case of Et netera the role of skills has declined but the importance of entrepreneurial vision has increased, this is reflected in the decision of the founders to surrender the day to day running of business operations to a Managing Director and Finance Director, allowing them to focus on the technical and creative sides of running the business.

At Solvo, the role of skills and innovation efforts are still crucial but it appears that the role of entrepreneurial vision has declined somewhat. The decision to take up venture capital from an outfit called Fast Ventures may possibly have diluted the vision of the founders.

Finally at Kűrt the importance of internal factors has increased, this is reflected in the founders' attitude towards employees and their continued dedication to the day to day running of the firm. As the firm's strategic direction points out "the

main components of our commercial success is the excellent treatment of our employees", the firm has a very clear commitment to its employees and offers incentive systems such as personal development and training, scope for promotion, and family friendly programmes.

Organisational design[11] is also another crucial aspect of the internal environment.

Table 4: The changing role of Organisational Design[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Organisational design	3	3	3	4	2	4	3	4

[1]This factors is measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based on an average ranking of responses to the following question: What is the importance of the following factor (organisational design) influencing the growth and development of your firm?

Table 4 shows the importance of organisational design increases in 3 out of 4 of the cases, with the average ranking of this factor remaining static at Dekonta. One important organisational characteristic at Dekonta is the managerial ability to build teams. Some divisions attend "away days" with top management to help create good team working practices.

The other firms have all undergone some type of organisational re-design. At Et netera there was a conscious decision by the founders to surrender responsibility of running the business to a Managing Director and a Finance Director in 2000. The founders in the own words were "burned out" as they were *"*trying to do it all´ but did not have any financial management experience. The hiring of this new top management team freed them for decision making.

The hiring of new top management has also been important at Solvo. In 2005 a Business Development Manager was hired which has allowed strategy to become

[11] Organisational design refers to the structure of the organisation, relationships between departments and the flow of work between departments.

more business orientated. More recently, there has been a change in vision for the firm- as one interviewee pointed out "the vision no longer just comes from the lab". Kűrt is in the middle of an organisational re-design programme. The plan is for the Data Recovery department to be segmented which will look after operations in Hungary, Germany and Austria. This new division will have its own function board. There are also plans to have new functional teams such as systems integration, and quality management. This development has been initiated by one of the founders, Sándor Kűrti, who has now become President (moving from his former position as CEO) and is currently developing his own board of experts. The importance of managerial capabilities at Kűrt is also clear, managers regularly encourage employees to propose creative ideas, which the Board then makes a decision on whether to take the proposal further.

The literature identifies patents as being a crucial aspect of the firm's ability to sustain a competitive advantage (Strand, 2006).Patents did not appear to be crucial at Dekonta, although they have two. The interviewees attitude did not exhibit a great deal of enthusiasm for the patenting system in the Czech Republic, and one commented that it was difficult to patent a new idea. As the Managing Director pointed out:

"It's not so important for us to patent, its more important for us to develop rapidly, so we are one step ahead of our competitors"

This is not surprising as one of Dekonta's key advantage is to offer complex services as opposed to patenting.

As for Et netera, they are yet to patent any of their technologies.

In contrast, interviews revealed that patents are of particular importance at Solvo, who have 14 to protect their core technologies, within Hungary and the US. Their initial patents were for diagnostics and ABC Transporter[12] proteins but they have shifted focus now to a closely related field in ABC. Solvo patents with domestic and European universities. Solvo have not experienced any commercial benefits from these patents, but they are crucial to their activities.

At Kűrt the founders entered the domestic market with an innovative approach to data repair and recovery, which was subsequently patented by Janos Kűrti. However there appears to be a general disinterest in patenting at present,

"But now we don't want to publish our know how," (Head of R&D, Kűrt)

Strategy

Each of the cases demonstrates the importance of strategic choice in the growth and development of the firm, and its evolution through the life cycle of the firm. The quantitative section of the firm asked the respondents to evaluate the relative strength of the decision to internationalise in the growth of the firm both at the start up, and now. The results are shown in table 5 below.

Table 5: The changing role of internationalisation[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Decision to internationalise	1	3	2	2	4	4	4	5

[1]This factors is measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based on an average ranking: What is the importance of the following factor (internationalisation) influencing the growth and development of your firm?

[12] ABC Transporters are a family of membrane transport proteins that require ATP hydrolysis for the transport of substrates across membranes.

At Dekonta there has been a conscious strategic decision to internationalise gradually as illustrated by their decision to open subsidiaries in Romania, Poland, Slovak Republic and Serbia and Montenegro. Moreover, they are now seeking to expand their international operations by entering into negotiations to start a joint venture in Turkey, they hope that this will provide them with a "gateway to the East", hence the increase in ranking of internationalisation. So far the impact of internationalisation has been positive as the General Manager points out:

"Internationalisation is starting to help the growth and development of Dekonta".

In contrast to the experiences of Dekonta, Et netera has made a decision not to internationalise, hence the low ranking in table 5 above.

At Solvo, the role of internationalisation in the growth process has been crucial at start up and at the present time. Solvo is a "Born Global" as there was a lack of domestic market opportunities in Hungary, as demand from the life sciences sector is still low. Thus Solvo decided to "drive the market" and thus they enjoyed a first mover advantage. Solvo's major clients are large pharmaceutical firms from US, Japan and Western Europe, such as GSK, AstraZenica, and Pfizer.

"We were pushed into the international market by a lack of domestic clients… The Pharmaceutical sector is generic in Hungary, we had to internationalise to survive". (Chief Operations Officer- Biochemist, Solvo).

Kűrt has experienced an increased importance in internationalisation, as illustrated in table 5 above. Initially Kűrt sold its services through its partners, which were mainly

located in Europe, and at first did not want to take risks in international markets, so they first opened subsidiaries in Germany and Austria, the most advanced European markets. After the international exposure in these two markets with positive results in 2005 Sándor Kűrti decided to "sharpen the focus" on to four major regions: the US, Eastern Europe, South East Asia and North Africa. Sándor's vision is for the firm to operating in at least 30 countries by 2010.

Kűrt is also planning to create a global information security institute with the aim of unifying various security standards, determine risk factors, and define required security levels for every industry as well as disseminate best practice. Several potential partners in the US and Europe have already been found. The interviews at Kűrt revealed that their ambitious internationalisation programme is part of their overall growth strategy. This is in addition to the implementation of new technologies such as new software products to enable corporate information security, classifying corporate information value and developing information insurance products.

A diversification strategy has been employed at 3 of the 4 of the firms.
At Dekonta one interviewee mentioned that a diversification strategy had been used as a means of survival, as the volume of work stemming from the Czech Republic is likely to decline.

"We have diversified into other activities so we can survive, that support the main activities (site remediation) like our landfill, incinerator and waste projects" (Project Manager).

During the first 5 years of the firm Dekonta began with a focus on bioremediation but following this, a whole package of various technologies are now being offered.
At first they concentrated on biotechnology of contaminated soil only, and slowly step by step Dekonta has started to change the direction of its development, they have diversified services to a wide range of physical and chemical services. They have also constructed a bio filter for contaminated air and water.

Et netera so far has not adopted a diversification strategy and they have been focusing on their jNet Publish CMS, Content Box and Pay Centre Products[13].

Solvo has also adopted a diversification strategy. When the firm started out their R&D efforts were supply led and driven by the laboratory. However, during the last three years they have moved from a drug diagnostics to transporter technologies, new reagents and in vitro models. This decision has been largely pushed by demands of their clients- the large pharmaceutical companies. Recently there has been an explosion in the understanding of Solvos' technologies amongst the pharmaceutical arena and hence clients' needs are being introduced into their development programmes.

"Initially everything was supply led and we drove the whole story, but now big firms are considering our technology in the development programme so now our services and products are more demand led" (Chief Operations Officer- Biochemist, Solvo).

Furthermore the founders are in talks with the US Food and Drug Administration to develop a personalised medicine platform[14] and attempting to break into other

[13] However, the Technical Director revealed that a current R&D project is working on a Project Content Storage system, which will provide solutions for storing media content e.g. articles, web pages, images and videos.

dynamic areas such as screening for fee process service on compounds for firms without labs. Now they are on their second phase of broadening their product portfolio to cover new technologies such as in vitro systems and animal models.

Interviews revealed that Kűrt is diversifying its product and service portfolio with new technologies such as software enabling corporate information security, security of physical security infrastructure, classifying corporate information value and developing information insurance products. The Kűrt team is currently completing the development of their new Data Insurance Technology, which they will use to revolutionise the global market.

It is apparent that Kűrt has undergone this diversification strategy in response to events in the external environment. In 1998 Kűrt moved from just repair services to prevention, as they anticipated the Millennium Bug problem, so they began a programme to try to understand the reasons for IT catastrophes.

It should also be noted that Et netera has adopted a strategy of "Managed R&D". In 2003 they formulated a 3 year growth plan, which they managed to achieve earlier than planned. Thus in 2006 the founders decided to implement a new approach, which was to have a more systematic and more official method of carrying out R&D. As a result, the founders have now incorporated R&D into their vision. Their aim is to be a natural choice for clients and experts in the field, by developing and marketing their own technologies and earn respect from experts, which could be potential clients of the future.

[14] This involves developing medicine that works on smaller proportions of the population. This tool enables the scientist to ascertain whether a patient will respond to a drug and assess its potential success rate.

External Environment

The literature review considered the role of the external environment upon entrepreneurial activity as the external environment can present a number of resources and constraints such as market opportunities, government regulations and infrastructure.

Results from the case studies illustrate a number of instances where we can see the impact (sometimes positive, other times, negative) of the external environment on the growth and development of the new venture, which largely agrees with existing work in the field by Begley *et al.* (2005), among others.

Table 6: The changing role of the External Environment[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Political/legal environment	4	4	2	2	3	3	2	4
Demand (domestic)	5	4	5	4	2	2	5	5
Demand (foreign)	1	4	1	2	4	5	2	5
State of Macroeconomy	4	4	3	2	1	2	5	4

[1]This factors is measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based on an average ranking.

The General Director of Dekonta pointed out that they are highly dependent on the Government's behaviour and any changes it makes to regulations, hence the relatively high ranking of political and legal environment in the table above.

"The Government spends 80 per cent of funds that are spent on the market e.g. for fire services, and Emergency Response Service, so the Government is a very important client." (General Director, Dekonta).

Also the Government is active in encouraging R&D. Dekonta has had five R&D projects funded by the Czech Ministry of Finance, Trade and Industry.

"The Government is good at promoting research- they pay us grants to carry out research for instance in our lab at Dretovice." (Technician)

Moreover, the Government is also responsible for creating the initial demand for environmental services through its privatisation process. As the Managing Director notes,

"In 1992 the Government adopted the privatisation process of industrial companies and that the Government will take responsibility for the remediation of these firms, on a contract basis. This (decision) generated 1-2 bn Euros worth of business and helped form environmental services firms. This generated a lot of work in the field of remediation of contaminated soil. New activities in environmental services were needed, and it was the Government who created this demand."

However, the Government can pose some hindrances to entrepreneurial activity via excessive red tape. As one Project Manager points out,

"The State can be stubborn and not open to new things. We have developed a new technology for contaminated soil, but we are not sure we are able to operate this technology, but it's a long approval process to get permission and persuade them. The state is a key player,"

Also of interest from the external environment is the increasing importance in the role of foreign demand in the growth process of Dekonta. As the Czech market is becoming saturated (in 2005 they were very few new tenders from the Government) foreign demand is becoming more important, and this has been mirrored in their internationalisation strategy, which was discussed above.

Interestingly, the role of the external environment for Et netera is not especially vital, apart from the domestic demand element. Initially, demand from domestic firms was crucial for the firm's big break. A project for Annonce, a free ads newspaper, enhanced their profile and reputation and helped them gain other high profile clients such as Eurotel. One important external aspect was the IT Bubble in 2001. This led to an increase in investor activity and Et netera was in fact put on the market. The founders talked to investors but decide against seeking sources of external finance. However, the IT bubble did change the founder's thinking: it helped them realise they could be freed from decision making, and hence the decision to hire a professional top management team.

The external environment is not particularly important for the growth and development for Solvo, bar the foreign demand element. As mentioned above Solvo is a "Born Global". Coupled with low domestic demand from the Hungarian life sciences sector this means that the role of foreign demand increases over time for Solvo. Interestingly, the role of political and legal environment is not ranked as critical, which could be deemed as unusual for a biotechnology firm.

In contrast, table 6 above and anecdotal evidence from the interviews illustrate the importance of the external environment for Kűrt. In 1989 COCOM regulations ended which relaxed the restrictions on importing technology from the West. This

drove Janos and Sándor Kűrti to found Kűrt Corporation. At first their business relied on Janos's patented inventions for computer storage repairing technology. So changes in the external environment provided them with a market opportunity to specialise in data protection and the recovery of damaged computer data[15]. External events in the form of the 9/11 disaster led Kűrt to lose their partners, as firms in the US acquired them as they now wanted to take charge of their own data security. This change pushed Kűrt's decision to build their wholly owned companies in Germany and Austria.

Networks and Relationships

The case study research also aimed to highlight the importance of networks and relationships in the growth and development of new ventures. The results reveal that the firms are using a number of diverse relationships with universities (vertical upstream, Baum *et al*. 2000), government agencies (sponsor based linkages, Lee *et al.* 2001) and competitors and clients (business to business relationships, Peng and Qi Zhou, 2005).

Table 7 below illustrates how the role of networks has changed over time.

[15] The inventions manipulate magnetic signals that fall in the micrometer range at the time.

Table 7: The changing role of networks[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Quality of relationships	3	5	4	4	5	5	4	5
Quantity of relationships	4	5	3	3	4	4	4	3

[1]This factors is measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based on an average ranking of responses to the question: How would you assess the role of relationships in the growth and development of the business?

From Table 7 above illustrates that the role of networks (measured by the quality and quantity of relationships) is static over time for both Et netera and Solvo. Beginning with Solvo both the quality and quantity of relationships have been ranked highly, with average scores of 5 and 4 respectively. Solvo have a number of important relationships, in particular with academic institutions. One of which is with the German Institute of Nutrition, where they have designed several project proposals together. One of their key relationships is with the University of Szeged, where Solvo carries out the bulk of its screening work. They also have relations with Debrecen University for several funded projects[16]. In addition they enjoy a close relationship with the Hungarian Medical Centre, in particular with Professor Sarkadi, who is President of Solvo's scientific Advisory Board[17].

Solvo prides itself on developing long term relationships with its clients, in order to be aware of their clients needs, and incorporate them into the development process. In particular it enjoys a special relationship with the pharmaceutical firm Pfizer, one of Solvo's major clients. Solvo also has a number of "business to business" relationships (Peng and Qi Zhou, 2005), or *"partnership based linkages"*

[16] The University of Debrecen benefits from a new life sciences centre and houses some of the best medical facilities in Hungary.
[17] Many of Solvo's inventors come from this Centre.

(Lee *et al.*, 2001) in particular with ACTANA Pharma (Germany). Solvo has written scientific publications with them, and ACTANA has been influential in Solvo's R&D programmes in the past 2-3 years. They have also carried out a comparative study of their technologies.

At Et netera the role of the quality of relationships is ranked quite highly with an average score of 4, the quantity of relationships is slightly less important with an average score of 3.

Interviews with the Technical Director revealed that Et netera has 2 types of relationships: 1 set of "business to business" relationships with competitors which involves a small amount of information sharing and another very important type of relationship with partners, such as Sun Microsystems and Tridion.

The partnership with Sun Microsystems has been very beneficial for Et netera as helped them win several Government projects. Et netera also enjoys relationships with local schools and universities, and occasionally hosts AISEC Career Days, which provides an advert for the firm in attracting potential new employees. They are also trying to develop a CMS and Java course at a local university for the future.
Lastly the Et netera case is good illustration of the use of "government to government relationships" (Peng and Qi Zhou, 2005) or "sponsorship linkages" (Lee *et al,* 2001) with Government bodies. For example, they have successfully applied for EU structural funds to finance staff to attend courses. They now also work with Czech Trade Department and have recently received fund for marketing materials**.**

Both the quality and quantity of relationships have increased in importance for Dekonta, as table 7 reveals. From the interviews with the core employees and top

management team it became clear that networks play a very important role in the growth and development process of Dekonta.

For example:

"Dekonta reacts to new problems with another firm." (Environmental Engineer)

"We collaborate with competitors with good results" (Environmental Engineer)

The Dekonta case is a good example of the use of horizontal alliances (Baum *et al,* 2000) with rival firms. In this context the interviewee noted that one of Dekonta's competitors Earthtech use Dekonta for contaminated soil projects, due to their strong reputation in this field. The top management team also emphasised how networks were vital to the growth of Dekonta:

"We use other firms' methods- we learn from their losses or wins…we are in a small country we have to be friends with everybody, it's a necessity!"

"Relationships are crucial in our growth and development process" (Managing Director)

Furthermore, it should be noted that Dekonta is making use of its partners and relationships to internationalise successfully, for example it is using ELC to open its subsidiary in Turkey. Examples of this strategy have appeared in the literature, for example, Autio *et al.* (2002).

Lastly, the experiences of Kűrt show that while the role of quality of relationships has increased over time, the role of quantity of relationships has declined.
The founder revealed that they have focused on building a large network of contacts in both the business, technology and political spheres, for example Kűrt is a member of the prestigious InterGuard Security Alliance in the US, and from this they have been able to invite global experts on to the Kűrt Board. The founder has also been Vice President of the Hungarian Association of IT companies, which allows him to keep up to date with events in the sector on a regular basis.

Kűrt also has a special relationship with University of Vesprém which helps them *"access fresh brains" (*Marketing Director). Kűrt is an attractive employer as the firm is famous for its healthy workplace atmosphere. Kűrt also has initiated "Knowledge Island", which is a programme that allows students meet up to and participate in real life projects, for example they carry out market research and help make tenders.

They hope that this initiative will help them "provide future employees for Kűrt" (Marketing Director), as successful students are invited for sandwich placements. Kűrt anticipates that by collaborating with universities they increase the chance of getting government finance, as the firm lacks the know- how in scientific projects but Kűrt can provide the management skills and finance knowledge.

"It's is a fair deal, we started collaborating in 2000 and we hope it will be long term and valuable," (Founder, Sándor Kűrti, Kűrt[18]).

[18] Sandor also lectures regularly at local universities such as Central European University in Budapest and is a member of the advisory board at the University of Vesprem.

Kűrt has a long history of working with the University of Vesprém, between 2001-2004 they carried out a large scale project together with the purpose of developing scientific procedures that could be used for creating modern information security procedures, and the methodological foundations for IT systems security.

Thus the evolution of the quality of relationships and their growing importance is perhaps embedded in the strong relationship with the University of Vesprém.

My case study findings corroborate the results of Baum *et al.* (2000) amongst others, who finds that relationships can provide contact with social, technological and commercial sources of competitive advantage.

Complementarities

This section shall deal with any potential complementarities between the internal, external and network factors.

Table 8: Evolving Complementarities[1]

	Dekonta		Et netera		Solvo		Kűrt	
	Initial	Now	Initial	Now	Initial	Now	Initial	Now
Internal environment	3	3	3	4	4	4	4	5
External environment	3	4	3	3	3	3	3	4
Networks and relationships	3	5	3	3	4	4	4	4

[1]This factors is measured on a 1-5 Likert Scale, with 1 being the least important, to 5 being the most important. The scores are based on an average ranking: How would you assess the role of the following factors in the growth and development of the business? Internal environment encapsulates skills, R&D capabilities, entrepreneurial vision, organisational design, innovation efforts, specialisation, cost leadership and internationalisation. External environment encapsulates state of macroeconomy, demand, political/legal environment, and entrepreneurial factors. Networks relate to the quantity and quality of relationships[19].

Firstly, we can see that both Dekonata and Et netera enjoyed complementarities initially, with internal, external and network factors all ranking equally in the growth and development process. However, over time these complementarities disappear and divergence occurs between factors, in particular at Dekonta. One could hypothesise that this misalignment could be caused by the sudden decline in the domestic market, and hence the sudden decision to internationalise in geographic markets further East. Alternatively other factors from the external environment could be preventing them from growing further, such as difficulties in accessing external finance or poor entrepreneurial infrastructure. Thus we can

[19] The figures can be interpreted as follows: by taking the example of Dekonta under the "initial" heading we can see that the internal, external and network factors are all equally weighted as 3 in the growth and development process, and we can say that complementarities between these factors exist. Under "now" we can see that the weighting of these factors has changed and thus divergence has occurred between factors.

conclude that Deknota was forced to internationalise and previous synergies between factors are no longer operating.

In contrast, at Et netera emphasis on the internal environment and resources has increased over time, reflecting a break down in synergies amongst internal, external and strategic factors. The enhanced importance of internal resources is shown by Et netera's decision to hire a Human Resources Manager to better market Et netera as an exciting workplace, and overcome its difficulties in hiring skilled employees. Also the importance of internal resources highlights the relevance of the decision to hire a new Top Management Team and make changes to the firm's organisational design.

Solvo has not experienced synergies or complementarities between internal, external and strategic factors. The table above shows how Solvo has relied on internal resources both initially and at the present time. It is possible that Solvo is immune to the external environment due to its excellent human capital base, strong innovation and patenting record and its solid relationships with both academic institutions, and clients. Furthermore, one of the founders has strong linkages with the external environment, in particular through lobbying activities and via linkages with the venture capital sector[20]. However, to build up possible complementarities in their growth and development process Solvo may need to place greater emphasis on the external environment, for example by building up sources of domestic demand. Nevertheless, so far from the case of Solvo we can conclude that complementarities are not always necessary for successful growth.

Kűrt has experienced a divergence in growth factors with the role of internal and external factors becoming more important over time. Network factors have remained crucial during the life cycle of the firm and Kűrt has made good use of relationships with firms in the US and EU, along with University of Vesprém and Northern Virgina Technology Council in order to create a global R&D institute in the area of Information Security.

6. Policy Implications from the Case Studies

The results from the case studies provide us with several policy implications for developing knowledge based entrepreneurship in the transition environment. A re-occurring theme within the case studies has been access to finance either a mistrust of external finance or a lack of availability of finance. This can lead to a stifling of entrepreneurial development and may prevent knowledge based ventures from reaching their full potential. Policy making needs to focus on helping entrepreneurs overcome their reluctance to seek and accept external finance. Furthermore policy making needs to ensure that external sources of finance are available for viable entrepreneurs by creating a range of financial packages for SMEs to include micro credits and venture capital. In the case of the Czech Republic the START initiative to provide subsidised loans for first time entrepreneurs should be developed further to include tailor made services for knowledge based entrepreneurs. As for Hungary, these services could be implemented under the umbrella of the Hungarian Foundation of Enterprise Development. An example that could be imitated is that of Finland with their *Finnvera* programme, which is a SME finance agency which runs a micro loan programme for both existing and new micro enterprises, and

has so far financed the business development of 2741 entrepreneurial ventures with the aim of promoting business survival.

Emergent skills gaps are also an issue for two of the cases, thus in order for the labour force to respond to the changes in structure of the economy and labour demand programmes to ensure life long learning need to be implemented. Provision of either formal or informal training should be available from employers. More focus is also needed to reverse the brain drain that is occurring in some sectors[21] to support existing programmes such as the Marie Curie International Reintegration Grants. This could be done by offering SMEs financial assistance to recruit and retain home grown talent.

Training for potential entrepreneurs is also crucial for the success and development of new knowledge based entrepreneurs. A case study by Lituchy *et al.* (2003) on Japanese and Czech female entrepreneurs found that those entrepreneurs with some business training (especially if received abroad) can affect the success of the start up through improved know how in obtaining loans and selecting and motivating employees. One of the founders in the cases presented here has acquired an MBA and some of his employees are taking Management courses at the Open University in order for them to gain entrepreneurial skills. Education providers need to take the need for entrepreneurial/business skills into account when designing new programmes and diplomas.

Difficulties in entering international markets have been mentioned as a barrier to the growth and development of knowledge based ventures, thus policy making should focus on boosting the competitiveness of these ventures, possibly in the form of subsidised loans for export promotion or specialist internationalisation training for

[21] For example, Solvo is experiencing difficulties in recruiting scientists.

managers. In the Czech Republic the MARKETING programmes has been initiated to help SMEs gain international market information and attend trade fairs, but possibly their remit needs to be extended in order to include financing options and training, as mentioned above.

In order to conclude this section a final suggestion is made: the creation of "one stop shop" to cater for the specific needs of knowledge based entrepreneurs could help founders and top management teams overcome some of the barriers associated with these sectors, and provide tailored assistance to include sources of finance, training, and export promotion[22].

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[22] From August 2006 a new legislative agreement will come into play in the Czech Republic whereby a "one stop shop" will be created for entrepreneurs to register their business, however it is not clear that this agency will also provide other services such as market information and information on training etc.

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