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FINANCING GAP AS CONSTRAINT FOR GROWTH OF HIGH TECH SMES - THE CASE OF START-UPS IN OULU

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High technology sector in Finland is currently in the middle of structural change. This change is also creating a lot of new high tech entrepreneurs. Many of these new companies are seeking fast growth and position in global markets. Especially interesting area is how the fast growth and internationalization of small high tech firms can be financed. What are the financial needs and options? Are there financing gaps? Are these gaps constraining the growth and internationalization of the companies? What is the role of public institutions? Target is to bring more clarity to these questions, because the success in this ongoing transformation is important for many professionals working in high tech sector, but also for the economy of Finland and local communities.

The change in the industry is influencing Oulu region very hard. There is a lot of expertise and competences in technology industry on a global scale, but quite little resources to finance this industry. This setting makes Oulu region an interesting area for studying financing challenges of high tech companies.

Empirical research is done as qualitative research by using case study research method. Semi-structured interviews are used to collect data from companies. The case companies are five young technology firms, which have been established in Oulu, Finland. All of these companies are utilizing strong local technology expertise and competences and targeting to grow fast to global players in their area of business. This study compares their financing challenges and solutions to the theoretical knowledge and earlier empirical studies in high tech financing area. Target is to find if their financing challenges differ from theory or the findings in earlier studies. The study is also seeking if there are any new solutions used to meet the financing challenges.

This study finds high tech SMEs as important contributors to economic growth. However, information opacity is limiting the financing options and causing financing gap. Empirical research in Oulu finds that financing has very critical role in the growth of high tech start-ups. In the early phases public support is critical for survival. In later phases, more local business angel resources and local venture capital funds would be needed. This is important for the growth but also for getting access to international funds. The results can be generalized to the other technology concentrations far from the world financing centers. The results can be used to enhance financing environment and services in those areas.

Keywords
High tech financing, Start-ups, Technology and Economic Growth, Oulu
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1 INTRODUCTION

High technology sector in Finland is currently in the middle of a wide and rapid structural change. This change has its base in changes in wireless technology area. Nokia has been the largest manufacturer of mobile phones already more than a decade. Nokia and its partners and subcontractors have been the backbone of Finnish high technology industry. Changes in global telecommunications business environment are now affecting Nokia and its position in the industry. Nokia has been adapting to the changes by changing its strategy. These changes have caused reduction in subcontractor network and employee layoffs in Nokia. The latest change has been the sale of Nokia’s mobile device business to Microsoft. The old Nokia centric structure in Finnish technology industry has come to the end.

Laid-off employees are bringing new global experience to smaller technology companies. This change is also creating a lot of new high tech entrepreneurs. Many of these new companies are seeking fast growth and position in global markets. High technology industry is not moving out of Finland, but transforming itself into new form. Instead of one big company and one technology area, there will be probably wide variety of smaller technology firms in different technology sectors.

One of the main challenges for new high tech firms is to find needed financing to develop the products and services and establish the operations like production and sales. This study is focusing to the questions around high tech firm financing. Especially interesting area is how the fast growth and internationalization of small high tech firms can be financed. What are the financial needs and options? Are the financial needs and options different in different phases of firm growth path? Are the companies getting the required financing? Are there financing gaps? Are these gaps constraining the growth of the companies? Are the answers to these questions different for high tech firms than for other type of companies? What is the role of public institutions? Target is to bring more clarity to these questions, because the success in this ongoing transformation is important for many professionals working in high tech sector, but also for the economy of Finland and local communities.
The empirical part of this study focuses on high tech start-up companies in Oulu region in Finland. Oulu has been one of the main cities, where Nokia has had its operations, especially R&D operations. This is why the change in the industry is impacting Oulu region very hard. This study targets to bring understanding on financing challenges of high tech firms in this kind of very special region. There is a lot of expertise and competences on technology industry on a global scale, but quite little resources to finance this industry. This setting makes Oulu region an interesting area for studying financing challenges of high tech companies.

Theoretical part of the study is done by collecting findings from relevant theory publications and empirical research papers on the area of small and medium-size enterprise (SME) financing. SME financing gap has been the subject of many research projects and there is material available also on the financing challenges of high tech companies. In addition, papers on the impact of financing to firm growth exist. As the challenges of Finnish high tech firms are in special focus, Finnish studies are also used. Empirical research is done as qualitative research by using case study research method. Semi-structured interviews are used to collect data from companies.

The case companies are five young technology firms, which have been established in Oulu, Finland. All of these companies are utilizing strong local technology expertise and competences and targeting to grow fast to global players in their area of business. This study compares their financing challenges and solutions to the theoretical information and earlier empirical studies in high tech financing area. Target is to find if their financing challenges differ from theory or the findings in earlier studies. It is also interesting to see if there are any new solutions used to meet the financing challenges.

The study of theory and earlier research finds high tech SMEs as important contributors to economic growth. However, information opacity is limiting the financing options and causing financing gap. External equity is found to be more important than external debt for high tech company financing. Reasons for this are market requirements for fast growth, high development costs and limited tangible assets. Finance challenges are found limiting the growth of high tech SMEs.
Availability of financing is contributing to the growth of technology firms. Public finance can help to overcome the barriers in financing. These findings are also in line with the learnings from practical financing support work done in the city of Oulu in Finland. The best firms are found to get financing, but especially more venture capital funding would be needed to support the growth of high tech sector.

The empirical research in Oulu shows the importance of public interventions in early phases of high tech start-up development. The public support is found to be essential for the establishment and the first development phase. There is however room for development in public support mechanisms. In later financing round business angel and venture capital financing has key role. This is also in line with earlier theoretical and empirical studies. This study finds that the amount of business angel and venture capital financing is insufficient in Oulu. The companies need to seek international financing and this is challenging for the entrepreneurs. More local funds would be needed. Local investors could also provide expertise and networks to reach international investors. This study also finds that the desire to retain control of the start-up may exclude venture capital and limit the growth of the company. These results can be generalized to the other technology concentrations far from the world financing centers. The results can be used to enhance financing environment and services in those areas.

This paper starts in chapter two from the significance of SMEs, and especially high tech firms, to economic growth. This chapter gives background and motivation to find the answers to financing gap questions in the following chapters. Next, in chapter three, the study presents the theory behind capital structure and financing decisions in small and medium size firms. This is followed by analysis of the special characteristics of SME financing and high technology firm financing in chapters four and five. Chapter six handles different financing options from SME and high tech SME point of view. After this, in chapter seven, the study analyses the impact of financing constraints to investments, growth and internationalization. Chapter seven also analyzes the benefits of public interventions. Chapter eight focuses to Finnish high tech firms by connecting the earlier research findings to the findings from practical financing support work in the city of Oulu. As this research has been started as Bachelor’s Thesis, the chapters from three to six and chapters 7.1 and 8.2 are also
part of Bachelor’s Thesis “Financing Gap as Constraint for Growth of High Tech SMEs.”. Research method and research data is presented in chapter nine. The tenth chapter concentrates to the analysis of the data.
2 HIGH TECH SMES AND ECONOMIC GROWTH

2.1 Theories of economic growth

2.1.1 Technology and entrepreneurship

Before starting to discuss about challenges in high tech financing, it is important to understand the effect of high tech companies to economic growth. Technology companies have had a lot of visibility in public discussions on last decades. Their success has been followed in economy media but also in general media. In addition to big technology companies, the focus has been in high growing entrepreneurial companies of technology sector. High tech companies and especially high tech SMEs have seen as driving force in economic development.

This public view is probably mostly coming from American success stories of high tech start-ups. Entrepreneurship has been valued high from the early times of USA. The fast growth high tech companies from small garage firms to world wealthiest companies has built a picture of technology as a source of infinite opportunities. Microsoft, Apple, Google and Facebook for example are models for many high tech entrepreneurs. Their example has shown how technology companies can bring wealth, prosperity and well-being to societies and economies.

2.1.2 History of economic growth theories

The economic growth and the role of technology have been in the focus of scientific studies already more than hundred years. Already early in the 1900 Schumpeter (1911) defined entrepreneur as an engine of economic growth. Schumpeter (1942) then specifies this more. He explains the spillover effects from innovations developed in entrepreneurial companies. He even finds correlation between the number of entrepreneurship and economic growth.

In the early decades of the last century, the dominant theory explaining economic growth was neo-classical growth model. This model was the main theory of economic growth until late 1980. Solow (1956) introduced the model known as
Solow growth model. He uses Gobb-Douglas production function to explain economic growth. This model is exogenous, where economic growth is seen to be defined mainly by external factors.

Since the late 1980’s the dominant theories explaining economic growth have been based on endogenous growth theories. Romer (1986) explains economic growth by factors inside the model. These models give technology a different role in economic growth.

2.1.3 Role of technology in exogenous growth theories

Exogenous growth models predict that economy grows to a certain level defined by external parameters. Decreasing marginal returns prevent economy to grow continuously. Technology level is taken as a constant multiplier, which defines the production level with a certain set of capital and labor assets. This means that long-run growth is determined by the rate of technical progress. (Solow 1956.) Solow does not explain what the rate of technical progress means. The model does not provide explanation for long-run growth.

Missing focus in the role of technology has seen as a reason why exogenous theories have been rejected by empirical evidence. Exogenous mode predicts that the level of production should converge between the countries with the same characteristics. However, the growth rates have varied a lot between the countries. This is the area where endogenous growth theories have proposed answers starting from the late 1980’s.

2.1.4 Role of technology in endogenous growth theories

In order to explain the continuous growth and differences between countries, Romer (1986) and Lucas (1988) developed a model where the rate of technological development defines endogenously the growth of economy. They proposed that economic growth is driven by technological development. Technological development is a result from research and development (R&D) efforts of profit maximizing agents. The investments in technological development and human
capital lead to higher economic growth. One implication of this is that because technological development differs between countries, the level of production between different countries does not need to converge.

Endogenous growth theories also provide explanation, why sustainable economic growth is possible. Romer and Lucas explain that technological progress is behind the long-run economic growth. They propose that the economic growth is correlating positively with the level of research and development.

The assumed relation between the level of R&D and economic growth has been also the main target of criticism against endogenous theories. This connection would mean that population growth increases R&D activities and this would then increase economic growth. This has been named as scale effect of endogenous growth model. There is however a lot of evidence that population growth actually decreases economic growth. (De Long & Summers 1991.)

The prediction of economic growth correlating with the level of R&D has been rejected by Jones (1995). He founds no correlation between the number of scientists and engineers and economic growth in France, Germany, Japan and USA. He defines so called semi-endogenous model, where he proposes that total factor productivity (TFP) is correlating with R&D growth, not the level of R&D.

2.1.5 Latest theories on technology’s role in economic growth

Ha and Howitt (2007) claim that the reason for endogenous growth theories to fail is in the changes the growth itself causes in the economy. They propose that the growing variation of products reduces the effectiveness of R&D. The result of this theory is that when this increasing complexity is taken into account, population growth has longer positive scale effect on long-run growth.

This second-generation non-scale model for endogenous economic growth remove the scale-effect from earlier endogenous models. The end result is that population growth increases R&D investment and human capital in R&D, but it also increases the number of new products and sectors. Additional R&D investment is absorbed by
new products and sectors and share of R&D in sector remains same. This means that the share of R&D investment should be used instead of value of R&D investment. (Ulku 2007.) This theory is also called as Schumpeterian version of the second-generation endogenous growth theory. This theory also assumes constant returns to knowledge like the original theory, but include the effect of growing complexity of innovation. (Pahlavani, Zamanian & Elyasi 2011.)

2.2 Positive externalities, the spillover effect

The public support for R&D investments is based on these endogenous theories. Already Schumpeter (1942) explained how innovations and technological development have positive externalities. This phenomenon is discussed in economic literature as technology spillover effect.

These externalities can come from production or from R&D phase of product development. Production externalities arise when innovations have effects on aggregate labour productivity. The firms enjoy these externalities when they use new goods. R&D externalities arise when new innovations can be based on earlier inventions and new knowledge can be obtained based on earlier knowledge. This has been described like ‘standing on others shoulders’. (Pessoa 2010.)

2.3 Empirical evidence of technology as an engine of economic growth

There are several empirical studies conducted in order to find evidence to the endogenous growth theories. Nadiri (1993) finds strong positive relationship between R&D investment and productivity. Innovation and R&D investment Nadiri finds to have also significant spillover effect to economy. He suggests that it is not just the level of R&D expenditures, which have the effect, but also the composition of R&D spending matters for economic growth. He proposes that R&D investment in the high tech sectors generate higher return as economic growth than R&D investment to other sectors. Later Falk (2007) shows the change in composition of R&D investment from low to high technology sectors to lead to higher growth of GDP.
Bassassini, Scarpetta and Hemmings (2001) find that industrial R&D investments are one of the most important factors in explaining the growth of production output and TFP. Zachariadis (2003) studies US industries and finds support for endogenous growth coming from growing intensity of R&D. He finds R&D intensity to affect technological development via patenting technologies and technological development to affect positively to the growth of output per worker.

Zachariadis (2004) finds R&D intensity having positive effects on productivity and output in manufacturing sector, but also on aggregate output of the economy. Interestingly he also finds that increasing R&D intensity can have positive effects also outside the county borders, in neighboring countries.

Griffith, Redding and Reenen (2004) also provide evidence on R&D intensity impacting positively to TFP. They propose two possible ways this impact happens. The first is the stimulation of innovation and the second is increasing capabilities to imitate the inventions of others. R&D investment as driving force in technology catch up is supported also by the studies of Ulku (2007). He finds that non-OECD countries can benefit more than OECD countries from increasing innovation in improving economic growth.

Ha and Howitt (2007) study US R&D intensity and find support for Schumpeterian growth theory, but not for semi-endogenous models. Madsen (2008) uses OECD data from long period of 1870 to 2004 and shows that technology spillovers happen between countries through several channels. He finds imports of intermediate product and geographical proximity as channels for international technology spillover, but also channels, which are independent of import or proximity.

Pahlavani et al. (2011) analyze both OECD data and non-OECD data and find strong support for non-scale endogenous growth models. In addition, they find that countries can have significant returns to their R&D investments and absorb technology spillovers effectively by large investments to R&D. They also show that economic freedom has strong effect to efficient utilization of R&D investments.
2.4 High tech SMEs and economic growth

Small and medium size companies are very important for the economies in the world. They are the source of innovation and economic growth. Already hundred years ago, Schumpeter (1911) described entrepreneur as key figure in economic growth. They are also important as providers of jobs for citizens. A well-functioning SME sector is essential for economic growth for many reasons. Most of the new jobs are created by SMEs. SMEs are the main force in transforming traditional industries to the high tech industries (Audretsch 2001). They are also very important in developing innovations. (Klonowski 2009.)

Many empirical studies have found SMEs contribute significantly to the creation of new jobs (Birch 1987, Baldwin & Picot 1995, Davidsson, Lindmark & Olofsson 1998). New jobs have very positive effect especially regionally and locally. They increase incomes and develop well-being, but also increase migration to the area and create new business activity. (Harrison 1994, Davidsson, Lindmark & Olofsson 1995.)

The most effective influence to employment and economic growth is coming especially from fast growing companies (Birch, Haggerty & Parsons 1997). There are even studies, which suggest that the economic growth driven by SMEs comes mainly from high tech SMEs. Wong, Ho and Autio (2005) find that only the companies with high growth potential have significant impact on economic growth. They use data from entrepreneurial companies by dividing companies to four groups by their growth potential. Brown, Fazzari and Petersen (2009) find very convincing evidence on importance of high tech SMEs. They show that in practice entire 1990’s R&D boom was generated by young firms in high tech industries.
3 THEORETICAL BACKGROUND OF SME FINANCING

3.1 Capital structure

The way how a corporation finances its assets, capital structure, is one of the base theoretical discussions in finance. Modigliani-Miller theorem created by Modigliani and Miller (1958) is the basis for research on capital structure. The conclusion of theorem is that it is irrelevant for the value of firm how the firm is financed. Put another way, capital structure of company is irrelevant for the value of the company. Value of unlevered firm, firm composed only of equity, is same as value of levered firm, firm composed of both equity and debt. This conclusion has then initiated a lot of discussion and research on the issue why capital structure is then important if it is not relevant for the value of company.

The second conclusion of Modigliani and Miller is that the cost of equity for leveraged company is same as the sum of cost of equity for unlevered firm and premium for financial risk. This means that when risk is shared between equity owner and borrower no additional value is created. Modigliani-Miller theorem describes capital structure in perfect capital market, where there are no taxes, transaction costs or bankruptcy costs, and there are no information asymmetries in markets.

3.2 Trade-off theory

In the real world taxes, transaction costs, bankruptcy costs and information asymmetries exist. Trade-off theory addresses these imperfections by focusing especially to taxes and bankruptcy costs. Kraus and Litzenberger (1973) claim that there is a trade-off between the benefits of debt and the costs of debt. Benefits mean mainly tax benefits of debt and the costs are financial distress costs, mainly bankruptcy costs. Kraus and Litzenberger propose that companies are optimizing the value of company by comparing debt benefits to debt costs. When the amount of debt increases, marginal benefit of debt decreases and marginal cost of debt increases. A company can find a balance in debt level, where it achieves the highest value for the company.
Trade-off theory has faced a lot of criticism. Myers (1984) finds that there is some evidence that trade-off theory works, but it is actually explaining capital structure only partially. Myers finds a lot of variation in capital structure between similar firms. There has to be some other parameters, which define optimal capital structure. Myers also proposes that capital structure is not static, but it is changing over time and by different needs of the company.

3.3 Pecking order theory

Myers (1984) and also Myers and Majluf (1984) propose pecking order theory to better explain the capital structure than trade-off theory. Pecking order theory was introduced already earlier by Donaldson (1961) and is one of the most influential theories in corporate finance. Donaldson suggests that corporations base their financing decisions on the cost of different financing options. The lowest cost option, internal financing, is used first. When more funds are needed the next cost optimal option is debt financing. The most expensive financing option is external equity and companies use it only when all debt options have been used and the cost of debt is higher than the cost of equity. Myers explains that the reasons leading to so called pecking order are based in information asymmetry between company management and external investors. If management knows better than investors that the project where they need funding has high return, they will choose internal financing. If internal funds are not enough, they will use debt. These decisions will benefit existing shareholders. External equity is used only if management believes that equity is overvalued. Fama and French (2002) compare pecking order theory and trade-off theory and find supporting evidence for pecking order theory. They find that the more profitable the firm is the less leverage it has.

However, Fama and French find also some contradicting evidence. They find that small growth firms are not levered and the least-levered companies make large new issues of equity. In addition, Frank and Goyal (2003) find that pecking order theory fails with small firms, where information asymmetry is actually the highest. This is an interesting finding and will be discussed further later in this paper. Also Garmaise (2001) finds that pecking order can be reversed with the small firms and equity preferred over debt if venture capital fund has superior information on the firm’s
revenue opportunities. As continuation on this Garmaise (2007) proposes a pecking order for new firms where entrepreneurs prefer junior equity to debt.

3.4 Information asymmetry, adverse selection and moral hazard

Information asymmetry is an important concept in finance and it is affecting capital structure of companies. Information asymmetry is high especially for small private owned companies. (Brav 2009.) Information asymmetry means that one party is more informed than other is. This is in conflict with neoclassical economics, which assumes that all parties have the same information (Modigliani & Miller 1958). One consequence of information asymmetry is another famous concept in finance, adverse selection. Akerlof (1970) explained adverse selection by classical example “The Market for Lemons”. Akerlof clarifies by his example of used car market that information asymmetry is causing undesired results in the market.

The term adverse selection is originated in insurance business. There is typically information asymmetry between insurer and insured. Insured has more information on the risks and this results the insurer with higher risk to buy more insurance than insurer with lower risk. Because insurer has no information on the risk differences, insurer cannot move the risk to the insurance prices.

Insurance example has been used also to explain another economic theory, moral hazard. Insurance can cause the better informed insured to take even more risk, because the costs of risk are paid at least partly somebody else. Moral hazard can happen in different corporate financing activities, when management of the company may take actions where they are rewarded by benefits, but the risks are taken by investors. All these concepts and theories have effect to SME financing challenges discussed more later in this study.

3.5 Principal-agent problem

The consequences of information asymmetry have been studied widely in context of principal-agent problem. The concept of principal-agent problem refers to the difficulties of one party, principal, to motivate another party, agent, to act at desired
way. For example, investors have challenges to control the actions of company management. The attempts to achieve control of the agent are causing agency costs. Jensen and Meckling (1976) defined the concept of agency costs and analyzed its impact to corporate financing and firm capital structure. Jensen and Meckling find that the agency costs exists and they are real costs, which have to be taken into account in financing calculations as any other costs.

Fama and Jensen (1983) highlight the importance of control of agency costs for the success of company. It is not possible for principal to ensure at no cost that agent makes optimal decisions from principal’s point of view. There will be cost for monitoring the actions of agent and cost for forcing agent to make the desired actions. In addition, there will be difference between agent’s decisions and decisions, which would maximize the welfare of principal. Also this has to be calculated as agency cost. (Jensen & Meckling 1976.) Different levels of agency costs in different financing options are affecting the financing decisions of companies. High agency cost is increasing the cost of financing option for the company.

### 3.6 Financial growth cycle

Companies can be thought to have different stages when they grow. Companies in different stages in growth cycle have different financing needs and options. The first stage is when a firm is established. The firm is very small. There is no track record of business and possibly no assets for collateral. The second phase can be thought to start when firm has already some track record and it has formal business plan with growth potential. Medium size firm has already grown its business successfully, full-scale production and marketing is in operation and also collateral is available if needed. Large firms have known risks and track record, has typically international operations and wide variety of options for financing. (Berger & Udell 1998.)

When company grows through these stages, it creates track record of business. Information availability grows when moving through growth cycle. In addition to these information related changes, the amount of collateral typically grows. These changes are bringing new sources for financing. (Berger & Udell 1998.)
Typical financing option in the first phase is initial insider finance from owner, family and friends. In some cases there may be also some angel financing. In the second phase, there are new options for financing like venture capital financing, trade credit and loans from financial institutions. In the third phase, there are more opportunities for debt financing, because of collateral available. In addition, public equity is typical source of funds. Large companies with known risks and track record have then also other options like commercial papers and public debt. (Berger & Udell 1998.)

3.7 Capital structure substitution theory

Other alternative explanations for capital structure of companies have been also expressed. One of those is quite recent theory called capital structure substitution theory (CSS). Timmer (2011) suggests that companies modify their capital structure in order to maximize earnings per share. This is done because earnings per share are known to be used very actively by analysts, when they estimate the values of a company. One reason is also that company management has incentive to maximize share price in order to maximize the value of management stock options.

Capital structure substitution theory assumes that companies can freely modify the capital structure. Company management finances share repurchases with debt and continues this as long as the cost of debt starts to drive earnings per share down. Timmer finds also empirical support for the theory.
4 SPECIAL CHARACTERISTICS OF SME FINANCING

Are small and medium size enterprises different from large companies? Are there differences, which are affecting the availability and cost of finance? Most important difference is information opacity. Information on small firm business operations and financial state is not publicly available. Contracts of small firms are not public and they are not reported in press. Small firms are not typically issuing public securities. Many small firms do not have audited financial statements. These issues mean that the quality of the firm is not visible outside. Small firms have difficulties to convince external financier on the quality and investment opportunities of the company. (Berger & Udell 1998.)

Small companies are getting external financing almost exclusively from private equity and debt markets. Information opacity is an important reason why the access to public equity and debt is limited for SMEs and importance of private finance is higher than for big firms. Another reason is that the costs of public equity and public debt are significant. These costs are mainly fixed costs and this is why the use of finance from public markets is not reasonable for small companies. However, because of information opacity, contracts required for private equity and debt are often very structured and complex. (Berger & Udell 1998.)

Guariglia (2008) finds that investments of small companies are significantly constrained by access to external sources of finance. Beck, Demirguc-Kunt and Maksimovic (2006) find that small firms use significantly more different informal options for external finance, but those sources are limited. They also find that small companies use relatively more other financing options like trade credit or leasing finance. However, there is also contradicting evidence as Fluck, Holtz-Eakin and Rosen (1998) find in their empirical research that informational opacity is not making it difficult to obtain external finance, especially debt, for small firms.

One main characteristic for small firms is that they are mainly managed by the owner and seldom by a hired manager. Substantial amount of funding is also provided by owners, members of management team, friends, relatives and other insiders. This means that there are no agency problems between main owner and management. On
the other side, this brings other problems. Owner’s assets are much undiversified and he may avoid risk and is not able to maximize the value of the company. Avoiding risk may lower the agency costs of debt. Debt is also often more preferred than equity by owner-management because of the desire to keep ownership and control of the company. (Berger & Udell 1998.) Desire to retain control and information asymmetry between owners and firm outsiders together is found by Brav (2009) to lead to higher debt ratios in private companies than in public companies.

Brewer (2007) finds that information asymmetry is a challenge also for private debt investors. Investor has to distinguish good firms from bad firms and this is very costly. These costs may grow relatively big compared to possible profits from the loan. This leads to fewer loans provided or even decisions not to provide loans for small companies. Manove, Padilla and Pagano (2001) suggest that banks do very little screening and require use of collateral instead. This is especially true in case of small firms. Berger and Frame (2007) propose credit scoring technologies as tools to lower costs of information gathering. However, the options for debt financing are limited. Hall, Hutchinson and Michaelas (2004) propose that SMEs can get loans in practice only from lenders in the same country where the company operates.

One way for small companies to get external financing is to use personal assets of inside owners. Financial conditions and reputations of owners are often very important for external investor. It may be easier and more valuable for investor to get information on creditworthiness of entrepreneur than on the company. The owner often has longer credit history and assets to pledge. (Ang 1992.)

Berger and Udell (1998) find that small companies are more vulnerable than large companies for fluctuations in the macroeconomic environment, like shocks coming from real or financial sectors. The reason for this is also in information opacity. Initial public offering (IPO) markets typically shut down when stock market values fall. Financial distress in banking sector and specially bank crises lead banks to reduce their credit risk and limit lending. This may have critical effect to small firm lending because of limited options for alternative source of funding and commercial bank being often the only source of debt financing. Financial distress gets banks also
to tighten their collateral requirements, which is causing insuperable challenges for small companies.

Kashyap and Stein (1995) also find evidence that the tightening monetary policy reduces bank lending and this has the biggest impact to small banks. This impact then focuses to small companies, because small banks are often specializing to small companies. Stiglitz and Weiss (1981) suggest that information opacity together with adverse selection and moral hazard problems leads to the situation, that rising loan interest rates in case of financial distress is not the solution. Banks cannot raise the interest rates for small companies because they fear that bad companies are more willing to pay higher rates. Stiglitz and Weiss call this fail of the market as equilibrium credit rationing.
5  SPECIAL CHARACTERISTICS OF HIGH TECH SME FINANCING

Are the high tech SMEs different from other SMEs? Are these differences affecting the need and availability of finance? Berger and Udell (1998) suggest that firms with high risk and high growth opportunities, and assets being mostly intangible, are using more external equity than external debt. Equity investment is mainly coming from business angels and venture capitalists. Low risk and low growth SMEs with more tangible assets are mostly relying on debt on external finance. These companies have typically also steadier income flows. The sources of debt financing are mainly commercial banks. Kelly (1997) also points out that the service of debt requires cash flow. This is often very limited in early phases of high tech start-ups. For these reasons equity financing fits better for fast growing high tech companies as opposite to other SMEs. High tech firms differ also from other SMEs in the way that external finance is important already in the establishment phase. (Gabrielsson, Sasi & Darling 2004.)

Angel financing and venture capital financing is relatively small part of small firm financing compared to other financing options. However, the size does not give the right picture of its importance. Angels and venture capital firms focus specifically to small companies with significant growth opportunities. These are often high tech firms, whose growth success is heavily dependent on angel and venture capital finance. The importance should not be measured by the quantity of investment, but by the success of the companies getting the finance. (Berger & Udell 1998.)

During the 1990s emerged new phenomenon called born global firms. These small and medium-sized, often high tech companies, are following different route to growth and international markets than mainstream firms. They do not build the company in stages starting from small domestic operations first, but are going first or simultaneously with domestic operations to global markets. (Luostarinen & Gabrielsson 2004.) Oviatt and McDougall (1994) define born globals as companies, which seek competitive advantage by utilizing global scale right from the beginning. Benefits are coming from the optimal use of resources and fast rising sales. Härkki and Huotari (1995) find that this kind of growth strategy is typical especially for high tech companies.
Yip (1989) suggests that many changes in international markets have made this different growth and internationalization strategy possible. Important reason for this strategy is that high technology firms often need to make very high investments, which cannot be covered by selling to domestic markets only. Alahuhta (1990) proposes that these companies do not have time to go through the traditional stages of growth. They need to be very fast to utilize the opportunities in global market.

In addition, Baum, Calabrese and Silverman (2000) find that companies seeking aggressive growth in global markets need significantly more finance than traditional companies. This is increasing the financing challenges of high tech firms. Because of this, availability of financial resources is crucial for these companies (Luostarinen & Gabrielsson 2004). Alahuhta (1990) states this same observation by suggesting that the requirements of rapid globalization put extreme high pressure on finance of these firms.

Gabrielsson et al. (2004) summarize the needs of fast growth high tech companies for financial resources by three points. The first point is that these companies have high R&D costs, but no cash flow. The need for finance is growing in major steps rather than gradually. The third characteristic is the need for large amounts of working capital because of rapid growth. These issues emphasize the significance of finance as enabler of growth. Additional challenge for financing high tech growth companies is that they often are depending on a single product, which makes them vulnerable and add the riskiness of the investment (Jolly, Alahuhta & Jeannet 1992).

Important sources for financing fast growth strategies of high tech companies include financing from founders, business angels, venture capital, initial public offerings, subsidies from government and strategic investments from bigger partner companies (Acs, Morck & Yeung 2001, Gabrielsson et al. 2004). In their research of Finnish high tech companies Laanti, Gabrielsson and Gabrielsson (2007) find that funding from government organizations is important source of finance in the development phase of high tech companies. Almost all firms in their study received funding from TEKES, the Finnish National Technology Agency. They also find that soon after development phase both public and private venture capital funds are involved in financing the growth and rise to a position as an important source of finance. They
suggest that the availability of finance is one of the main reasons for the success of many globally operating Finnish wireless technology companies. Gabrielsson et al. (2004) find that public money is important also in later phases of development. They list the Finnish National Fund for Research and Development (SITRA), the Finnish state owned credit institution, KERA and the Finnish Ministry of Trade and Industry as public investors for Finnish high tech firms.

Papadimitriou and Mourdoukoutas (2002) find three other good examples how governments can help high technology firms to overcome the obstacles in finance. The US government has supported the growth and operating of venture capital sector by financial support, tax benefits and laws. The Israeli government has provided direct financing and created funds for technology firm finance. The Irish government has act as active investor and administered seed capital funds for high tech start-ups.

Laanti et al. (2007) highlight the importance of multiple sources of financing. One additional way to get support for growth and internationalization is partnering with other companies already having international knowledge and experience. Also Håkansson and Snehota (1995) find that international partners and networks of founders and firms help to overcome financing challenges. Näsi (1995) proposes global customer, supplier or other stakeholder as a good source for finance.

Gabrielsson et al. (2004) see that companies has to make a decision on the finance strategy, which suits for them. For some companies the expertise brought by business angel, venture capital fund or other external financial institutions is crucial and for some others the strengthening of internal resources is better option. External partners help company to focus in utilizing the competencies they have, but on the other side, they are expecting high returns on the investment.
6 FINANCE OPTIONS FOR HIGH TECH SMES

6.1 Insider finance

In the beginning of high tech start-up company, financing has to be found from owners, relatives, friends and other insiders. Financing from owners include also loans and credit card debt of owners. Relative size of insider finance, including both equity and debt, is typically highest in the early phases of the firm development. However, the share of internal finance can grow again later in some companies if retained earnings are used to increase the equity of principal owner. (Berger & Udell 1998.)

The funds from insiders are critical in the start-up phase when the information asymmetry is at the highest level and other financing options are hard to find. Insider funding is also essential for getting external finance. External investors are requiring investments from principal owners in order to limit adverse selection and moral hazard problems. (Berger & Udell 1998.) Often the first month’s financing is also supported by so-called sweat capital. It means that owners and management team work for the firm without salary. (Näkkäläjärvi, Sasi & Gabrielsson 2006.)

Insider finance is often limited. High technology firms typically have high R&D costs in the development phase and practically no incoming cash flows. This means that development phase can seldom be financed without external financing. (Gabrielsson et al. 2004.) Relation between internal cash flows and investments is typically used in research as a measure of financing gaps (Hall 2002).

6.2 Loans from financial institutions

Bank loans from commercial banks are the most used external financing for small companies in the early phases of firm development (De Maeseneire & Claeys 2012). Berger and Udell (2002) find that SMEs are often very dependent on the banks as their main source for external finance. Berger and Udell (1998) find that external debt level is high already with very young companies. This seems to be in contradiction with the financial growth cycle. Breger and Udell however explain that
this debt is not external in the economic sense. The loans are often personally guaranteed by insiders.

Debt is preferred over equity mainly for two reasons. Information asymmetries are bigger with small companies than large firms. Owner managers have also incentive to keep ownership and control of the firm. (Berger & Udell 1998.) Challenge in debt financing of small companies is that they typically have little assets suitable for collateral. The younger and smaller the company is the less it has assets to pledge as collateral. Assets also are typically intangible and not suitable for collateral. (Scholtens 1999.) De Maeseneire and Claeys (2012) find that firm’s ability to pledge collateral is the most important factor in loan decision for small companies. They propose that financial institutions should develop solutions based on bank-borrower relationship rather than based on collateral.

Relationship lending is one way to ease the access to external debt. Small companies typically develop a long relationship with commercial banks. Bank provides many financial services to the company, like deposit and credit services. These services provide a lot of information for bank on cash balance, transaction activity, payroll data, etc. Based on this information, bank can have better understanding of the financial health of the firm. This gives the company an opportunity to narrow the financing gap caused by information opacity. (Berger & Udell 1998.) Berger and Udell (2002) suggest that relationship lending is one of the most important technologies to overcome the challenges of information opacity.

The constraints of debt financing are even bigger for high tech SMEs than other type of SMEs. Assets of technology companies are often intangible and not suitable to be pledged as collateral. (Berger & Udell 1998.) In addition, Giudici and Paleari (2000) find that banks have often limited competences to evaluate business potential of high tech companies. This leads to different status of external debt for high tech companies compared to other small companies. Berger and Udell find that small high tech companies typically obtain equity financing from business angels and venture capital funds rather than external debt. This is contradicting with pecking order theory and financing growth cycle. Gabrielsson et al. (2004) find that R&D investments in high tech firms are very high already in the beginning and there is not
enough debt financing available to fund them. This leads to the use of external equity financing. Hyytinen and Pajarinen (2005) find evidence for this in their study of Finnish high tech firms.

Brown et al. (2009) confirm the earlier by finding that R&D intensive firms are less leveraged than other SMEs. They list several reasons why debt funding is not suitable for R&D intensive firm. First, the returns are uncertain and volatile (Stiglitz 1985). Second, high risk of investment brings adverse selection problems (Stiglitz & Weiss 1981). Third, debt financing can lead moral hazard problems because of possibility to replace high risk projects with low risk projects. Fourth, high debt ratios could make high tech investments too sensitive for financial distress (Cornell & Shapiro 1988). Fifth, limited amount of collateral restricts debt as a viable funding option (Berger & Udell 1990).

Hogan and Hutson (2004) propose an interesting reason for high tech firms having less debt than other firms. Typically owners want to keep the control of the firm and use rather debt than equity. Owners of high tech firms however seek the highest possible value of the company, and getting to this target requires more and faster financing than debt markets can offer. The owners are ready even to give up the control of the firm in order to achieve the growth targets.

6.3 Angel finance

Business angels are wealthy individuals, who are interested to invest directly to the equity of small companies. Angel financing is not intermediated, but it is an informal market for finance. Angels focus especially to companies with high growth potential. Because of high wealth of angel investors, the capabilities of an angel to invest to a small firm are often in line with firm needs. One angel is often enough for a small company. This minimizes information production challenges. (Berger & Udell 1998.) In some cases, more angel financing is needed. Angels can also operate as a small group in order to fund bigger investments. (Prowse 1998.) Other typical characteristics of angel financing include that angels often invest to local firms where they have more knowledge. They also typically participate in several financing rounds. Angels can participate actively in consulting role in order to support the
growth of their investment. Angels however bring less expertise to the company and require less control than venture capital firms. (Berger & Udell 1998.)

While angel financing is informal, there are however some goals to formalize it. One reason for this is that there are significant information costs, which are limiting investment activity. One way to overcome these challenges is to create angel networks. By using these networks, angels can lower the information costs and increase the investment options. Typically these kind of networks are operated by some non-profit organization, for example university. This kind of gatekeeper can play a very important role in connecting angel investors with companies looking for financing. (Berger & Udell 1998.)

Because of constraints in debt financing of small high tech firms, angel financing has a big role in funding the first steps of the company. When insider financing runs out, companies often turn to business angels. Moral hazard problems are big especially when high tech firm has large investments compared to insider financing. In this kind of situation angel financing is one of the best options to overcome moral hazard problems. Taking business angels in to the firm means giving up some control of the firm, but it also helps the owner to share the risk of the firm with less risk-averse investors. (Berger & Udell 1998.)

Gabrielsson et al. (2004) find in their study of Finnish high tech companies that some companies are using business angels already from the beginning. The required development costs are high, but the companies are lacking cash inflow from the operations. They find that the funding and support provided by angels is often crucial for the success of the company. Alahuhta (1990) finds that the success of high tech company often requires high investments already in the establishment phase of the company.

6.4 Venture capital

Venture capital market is intermediated unlike business angel market. Venture capitalists operate as intermediaries collecting funds from investors and directing those funds to companies. Venture capital firms screen promising firms for
investment, make investment contracts and monitor the investments. They also make plans how and when to do exit from the invested company. Most attractive exit is typically done by initial public offering, IPO. Other exit options are selling to other companies or to initial owners of the company. Venture capitalist is an active investor and participates internal decision making of the company, especially in strategic planning. (Berger & Udell 1998.) Venture capitals use considerable amount of resources for monitoring the company (Gorman & Sahlman 1989). It is typical that venture capital firm specializes in some industry in order to develop required expertise for monitoring the investments and participating the decision making (Norton & Tenenbaum 1993).

Venture capital firm invests typically companies in a bit later phase, when the product or service of high tech company has already proved its potential for example by test marketing or piloting. Venture capital firm then finances full-scale production, marketing and international operations. However, in high technology areas, initial technology and product development costs are sometimes so high that venture capital financing is needed already in earlier stage. There is still often angel financing round or rounds before venture capital fund makes the investment. (Berger & Udell 1998.)

Venture capital financing is a good way to overcome problems coming from information opacity. High level of external financing in high tech firms causes moral hazard and agency problems. Active monitoring and participation in internal decision-making are effective tools for reducing information opacity and problems caused by it. (Berger & Udell 1998.)

When there are constraints in debt financing of SMEs, venture capital is often the solution. Limitations of bank financing are raising the importance of venture capital financing. High tech entrepreneurs also know that banks are not optimal providers of finance and select venture capital firms instead. (Berger & Schaeck 2010.) Lerner (1995) suggests that venture capitalists suit better than banks to finance small companies with little assets for collateral, because they have capabilities to monitor effectively the investments. Black and Gilson (1998) find that venture capital firm as investor enhances also possibilities for other types of finance, like external debt. In
Venture capital firms are seen as a main force for driving growth in high tech sectors (Lerner 2001). Berger and Schaek suggest that the availability of venture capital is important for the success of European SMEs. Cressy (2002) proposes that venture capital may be a solution to finance growth, which is often increasing the risks. Equity financing from venture capital lowers debt ratios and thus riskiness of the firm.

Gabrielsson et al. (2004) support the idea of an important role of venture capital expertise in developing high tech firms. They however point out that venture capital typically demands high returns for their investments so the cost of this type of funding is high. Also Sahlman (1990) finds evidence that the cost of venture capital financing is very high. De Maeseneire and Claeys (2011) find that the cost of funding is the main reason for companies to avoid venture capital finance.

Gabrielsson et al. (2004) also suggest that high tech firms with targets in growth to global markets should consider also international venture capital in addition to domestic venture capital. In addition to the funds, they bring also expertise to operate in global markets. The success in fast growth to global level seems to require access to global finance sources and financial management especially in high tech sectors. In their study of Finnish high tech companies, Gabrielsson et al. find that Finnish firms are lacking truly global venture capital investments. Venture capitalists look at the profit opportunities of the company, but also capabilities and skill level of management. This means that entrepreneurs seeking financing from venture capital fund need to focus also to finding right talents and human resources for growth.

6.5 Public equity

Venture capital firms often target initial public offering and help the company to get public equity through IPO. The problem with public equity is that it is a very expensive financing option for the company. Costs are coming from due diligence, distribution and securities registration. Because these costs are mainly fixed, listing of small company does not make sense economically. Minimum size of assets of listing company is about ten million dollars. High tech company, which achieves this size and successful IPO is typically considered as a winner. In practice, only minority of
venture capital backed companies achieve this. (Berger & Udell 1998.) Successful IPO means that the pricing targets of the company are achieved. Buckland and Davis (1990) suggest that this is difficult for small companies because of information opacity problems. These problems lead to underpricing in IPO.

Papadimitriou and Mourdoukoutas (2002) also highlight the difficulty of achieving IPO for high tech start-ups. Listing requirements are tight and they estimate that the fees to fulfill all the requirements are for example 2 million dollars for raising 25 million dollars. Cressy (2002) suggests that governments should lower these barriers in order to get more high tech firms to public equity markets.

There are also new kind of stock exchanges established especially for small enterprises. For example First North was established by NASDAQ OMX first in Copenhagen in 2005. These exchanges are targeted to lower the barriers to public equity for small companies. The requirements and costs of listing are significantly lower than in listing to real stock exchanges. Listed companies cannot call itself as public companies.

6.6 Public debt

Public debt is even more expensive option for high tech SMEs than public equity. Debt costs also include large fixed costs. Minimum practical size of assets for entering public debt markets is hundreds of millions dollars. The minimum size of the issue is also at hundred million dollar level. (Carey, Browse, Rea & Udell 1994.) This means that we are then not talking about small firms any more.

Also for debt, there are new options available. For example First North Bond Market was opened in 2012 by NASDAQ OMX. It has similar requirements as First North equity market. Target is to lower the barriers to get debt funding from public markets for small and medium size companies.
6.7 Other financing options

Retained earnings are often important source of finance for SME. They are used also as assurance for external finance. However, in the case of new high tech SMEs, this source is typically limited or non-existing. (Berger et al. 2004.) Retained earnings or cash flow are important also for high tech SMEs, but it would require for example running consulting business for cash flow parallel with new technology and product development.

Other possible sources of funds are business partners, customers or suppliers (Näsi 1995). Gabrielsson et al. (2004) find that some companies are using bigger partner companies as supplements for missing venture capital finance. They find also that in some business areas it is possible to get financing from customers as advance payments for products or services. Trade credit is very important additional source of finance for all companies, also for small high tech firms (Berger and Udell 1998). Trade credit can be expensive compared to bank loan, but often optimal for financing working capital. It also helps in information opacity problems, because borrower and supplier are getting information to predict cash flows. (Ferris 1981.)
7 FINANCING GAP AS CONSTRAINT FOR GROWTH AND PUBLIC INTERVENTIONS

7.1 Consequences of financing gap

As analyzed in earlier chapters, there is evidence that SMEs and especially small and medium size high tech companies are experiencing financing gap. Companies have difficulties to obtain the finance they would need for the investments. (Luostarinen & Gabrielsson 2004.) On the other side, high tech SMEs have important role for economic growth (Birch et al. 1997). To connect these two, the question is if financing gap is a constraint for growth of SMEs? Are there reasons to remove these constraints? How this should be done?

Breakley and Meyers (2000) find that internally generated funds are close to 90% of total investment of firms. There is also empirical evidence that the cost difference of internal and external finance is big especially for small firms (Carpenter & Petersen 2002). Carpenter and Petersen find that typical firm retains the earnings and uses relative little finance from external sources. In addition, there is empirical evidence of correlation between cash flows and investments. Based on these findings, Carpenter and Petersen suggest that internal finance is constraining the investments and growth in most of the small firms. Another finding is that those few firms, which manage to get external equity financing, are growing clearly faster than could be possible with internal finance. These firms are not having correlation with internal funds and growth. Carpenter and Petersen see this as evidence that internal finance constraint has been removed by access to external financing.

Several empirical studies show that financing constraints have bigger impact to investment of small than large firms (Carpenter & Petersen 2002). Berger and Udell (1998) suggest that the obstacles of getting access to external finance are preventing small firms from entering in many positive net present value projects. Beck and Demirguc-Kunt (2006) find evidence that financing obstacles are constraining especially the growth of small firms and this prevents these firms from growing to optimal size. They propose imperfect financial markets and weak financial institutions as reasons for these constraints. Improving financial institutions would
make them better to support firms getting access to finance. Also Demirguc-Kunt, Love and Maksimovic (2006) show that firms face lower obstacles for growth in countries with well-developed financial markets.

Schiffer and Weder (2001) approach the question by comparing reported obstacles of different size firms. They show that small firms report consistently higher growth obstacles than bigger firms. Beck, Demirguc-Kunt, Laeven and Maksimovic (2006) find statistically and economically significant relationship between growth obstacles and firm size. They show that size and age of the firm can be used as reliable predictors of growth obstacles. Beck, Demirguc-Kunt and Maksimovic (2005) on the other side show that these obstacles have almost two times higher effect to annual growth of small firms than growth of large firms.

Klapper, Laeven and Rajan (2006) find that limited access to finance is a barrier to entrepreneurship and even restricting the establishment of new growth companies. They also find that inflexible regulation and market imperfections slow the growth of established firms. Similar results are found also by Beck and Demirguc-Kunt (2006) when they show that both the entry and the growth of firms is facilitated by access to external finance.

Becchetti and Provato (2002) provide empirical evidence for relationship of financing constraints and firm growth using data from Italian SMEs. They find that firms less than 50 employees and access to external finance grow more than two times faster than same size firms with limited access to external funds. In addition, government subsidies are resulting to higher growth rates. They suggest that financing obstacles are making market to fail and projects in some firms are financed, as equally profitable projects in constrained firms are not. Their results are consistent with hypothesis that SME’s access to external finance has significant effect to economic development.

Beck, Demirguc-Kunt and Maksimovic (2008) find that financial and institutional development to ease the access to external finance has significant effect to growth, especially in industries, which are dependent on small firms. Beck and Demirguc-Kunt (2006) propose that improving the financial institutions and business
environment is the best way to help small firms to contribute to economic growth. This means for example enhancing the capabilities of institutions to offer financing and improving the stability of the institutions. Ayyagari, Demirguc-Kunt and Maksimovic (2008) suggest financial sector reforms to relax the constraints of SME finance and facilitate their growth. These reforms should target for example to lower the cost and availability of debt financing by reducing the collateral requirements. They also find finance as one of the binding constraints associated with firm growth. In addition, they highlight the importance of macroeconomic policies in affecting the financing environment of small firms.

7.2 Justification for public interventions

SMEs are important for economic growth. They are however vulnerable and many of them manage to survive only a few years and never achieve the growth and success. When this is connected to the positive externalities of investments in high tech companies, public authorities everywhere in the world are building support activities for high tech SMEs. (Klonowski 2009.) Several governments have increased their support on R&D expenditures targeting economic performance by the help of science and technology (Pessoa 2010).

Support for public interventions is also based on the understanding that remarkable imperfections exists in the market. These imperfections prevent private sector to correct market imbalance. These imperfections are found to be especially large in finance of the high tech SMEs. (Di Giacomo 2004.) Wallsten (2000) suggests that public intervention is needed in order to guarantee the optimal support of R&D by private sector. Otherwise, R&D investments are likely to stay below optimal level. The reason for market imperfections is in information asymmetries. Raising debt and equity for R&D is very expensive because of information asymmetries. (Myers and Majluf 1984.) These problems are typical especially for small firms and for high tech SMEs (Berger & Udell 1998).

Lerner (2002) crystallizes the justification of public interventions on two assumptions. Firstly, private sector is not capable of providing needed capital to new firms. Secondly, governments can identify investments, which have high social
return. Most governments seem to believe that they can affect the rate of technological development by their policies and actions. They use many kind of instruments to increase the creation and utilization of innovations. R&D subsidies are one of the most used tools. These subsidies are targeting to patch companies’ tendency to underinvest in innovation and R&D. Other tools used by governments, in addition to R&D grants, are tax shields, direct loans and loan guarantees. (Cressy 1996.) De Maeseneire and Claeys (2012) state that governments should resolve market failures and especially make sure that no collateral or guarantees are required.

In addition to providing direct support for investments, these grants also generate certification effect. Public grant enhances firm’s access to private financing options. The grant from competent government officials certify the company to be worth of investment also for private investors. The grant works as a tool to decrease information asymmetries. (Meuleman & De Maeseneire 2012.)

This theory is also supported by Lerner (1999). He finds public R&D grant having positive impact to company’s possibilities to attract venture capital (VC) financing. Lerner (2002) suggests that public venture capital programs are in very important role in certifying firms to private investors. He claims that these programs encourage technological spillovers. Lerner notes that the certification effect is the most valuable in technology-intensive industries, as financial measures are not usable. Feldman and Kelley (2006) find also empirical evidence supporting certification theory. They show that receiving a R&D grant increases company’s funding form both private and other public sources. In addition, public grants enhance company’s possibilities for strategic alliances.

Meuleman and De Maeseneire (2012) use in their study a control group in order to show more clearly how much of additional external financing is received because of the certification effect. They find strong evidence that public subsidies increase long-term debt raised by companies. The effect is not so strong for short-term debt. Interesting finding is that the certification effect for external equity financing is strong only for start-up SMEs. The certification effect is strongest when information asymmetries are highest. This is typical for high tech start-ups. Public interventions increase R&D efforts, increase output and help companies to get external financing.
but in addition, they also increase growth of employment and number of patents (Meuleman & De Maeseneire 2012).

Private venture capital industry has limitations. They support in practice only very small part of technology companies. Private VCs concentrate on only few industries, like information technology and health care industries. There is a herding phenomenon in private VC industry. There are many promising firms and even industries, which are not getting the attention they would deserve. (Lerner 2002.)

Positive externalities of technology are also an important justification for public interventions. It is unlikely that the company making investments can capture all the benefits. This is why investments will be below optimal level. This leads to the conclusion that public officials should make investments and encourage private investments. (Lerner 2002.) Griliches (1992) estimates that the gap between private and social return is somewhere between 50% and 100% of the private return.

7.3 Opposing arguments

There is also a lot of skepticism in the community of economists for public interventions. New high tech firms are known to suffer from uncertainty and information asymmetries, which give possibilities for opportunistic behavior by entrepreneurs. Why would public officials be used instead of specialized financial intermediates? It is argued that specialized financial intermediates are the most efficient way to address information asymmetries. They can analyze the firms before the investment and monitor the firms after the investment. These firms are private venture capital companies. (Lerner 2002.)

De Meza (2002) claims, that the efforts of public financing programs may be counter-productive. It is not reasonable to believe that public programs can overcome these problems caused by information asymmetries, if private specialized companies cannot do it.

Even if we assume that the positive external are significant and government official have capability to identify the firms for investments, the public programs may not be
able to solve the problem. The political system may not be optimal to direct these programs. Politicians or some powerful interest groups may be able to direct the subsidies to benefit themselves. These distortions are most likely in programs, where a central group makes independently decisions on very visible grants. (Lerner 2002.) Another example of public funding failure occurs when officials direct the support to the firms, which are likely to succeed. Then they can claim credit on the programs. (Wallsten 2000.)

Cressy (2002) notes that billions of dollars are used globally by governments every year on loan and equity guarantees, venture capital trusts, loans, government grants and governments equity investments. The target is almost entirely small high tech firms, which are seen suffering most on financing shortages. Cressy claims that there is no agreement among economists that these interventions are needed. The economists are also often disagreeing on the types of interventions that should be used.

De Meza (1999) is very critical on public interventions and suggests that governments should not fund high tech firms, because they are already receiving more than enough private financing. He even uses term ‘overlending’ to describe the situation, where government support may lead. De Meza claims that support of small business loans together with over-optimistic entrepreneurs can lead low quality firms getting external finance. He is challenging the theory of credit rationing by Stiglitz and Weiss (1981). De Meza suggests that loan market works and no subsidies are needed. He proposes that it is just a good thing that over-optimistic low-wealth entrepreneur cannot get loan from financial institutions.

7.4 Proposals on how to implement public interventions

Lerner (2002) provides four key recommendations how public sector should implement the interventions. The first recommendation is that public officials should build relationships with private venture capital industry. They should learn and utilize many effective methods and best practices VCs are using. The second point is that public sector should focus on technologies, which are not in the focus of private investors. This would certify the companies and industries, so that they would
receive also private funding. Public sector should also provide follow-up on already funded companies during downturn.

The third advice is that public officials should be active in guiding the company also after the investment. The fourth recommendation is that officials should follow VC companies’ example in careful analysis of the entrepreneurs they are planning to fund. The selection process should also analyze the experience of the management team, existence of clear market strategy and strong desire for private funding. Cressy (2002) however claims, that the idea of mimicking the practices of private venture capital may be difficult to implement in practice. For example, the long-term commitment of government for funding the company may be politically impossible.

Lerner (2002) warns about companies, which are receiving grants from different public sources, but newer show any tangible results. These companies can explain the missing results by the high-risk nature of the industry and avoid accountability for long time. The problem is that previous grant is often seen as proof of good quality company regardless of the real achievements. Lerner also points out that it may be difficult to analyze the competences of company managers to lead entrepreneurial firm. Long experience as consultant or as employee in large companies may not prove success in the leadership of small start-up.

Overall, careful evaluation of the company, technology opportunity and business is imperative before funding decision. Regardless of how innovative the technology is the business issues and commercialization opportunities have to be analyzed carefully before the decision. Public programs should also consider weather proving the concept of start-up firm requires testing on the market before further investment. Some public programs have had too much focus on pre-commercial R&D so that the program has actually delayed the commercialization. This may be critical in fast moving high tech industries. (Lerner 2002.)

Cressy (2002) concludes that if governments continue these activities to subsidy financing of high tech firms, the effectivity of these activities should be continuously evaluated. Evaluation should make sure that there is no abuse of public money and the focus is in real financing gaps.
8 HIGH TECH SME FINANCING IN FINLAND

8.1 Public support for high tech SMEs in Finland

Finland is widely seen as a country, which has a lot of companies based on high technology (Luostarinen & Gabrielsson 2004). There is also experience from earlier years, especially from wireless technology sector, where many companies have experienced rapid growth and globalization (Laanti et al. 2007).

In Finland, high tech industry has been important for economy and well-being already several decades. Finnish government, cities and other public agencies have established several support mechanisms for high tech SMEs. Supporting the growth and internationalization of small technology firms is seen important. Many newspaper articles on small technology companies also give the picture, that public opinion is positive for small technology companies.

New technology start-up firm can get subsidies for example from ELY Centre, The Foundation for Finnish Inventions, The Finnish National Technology Agency (TEKES) and Finnvera. TEKES also supports the later growth phase by loans. In the growth phase, Finnish high tech SME can also get equity financing for example from Suomen Teollisuussijoitus Oy, Teknoventure Oy, Finnvera and Butterfly Ventures Oy.

There have been also studies on Finnish high tech SMEs and by Finnish researchers. Gabrielsson et al. (2004) suggest even more active role for governments in supporting small companies, which are seeking the growth. This support is especially important at these times of financial uncertainty. Financing options for small high tech firms are very few especially in weak financial state. They warn that missing support from governments may increase the risk of losing the spirit of a generation of entrepreneurs.

Gabrielsson et al. (2004) study Finnish high tech SMEs. They find that finance strategy selection and finance management capabilities can be very critical in defining if the company will have successful growth to global technology company.
or if it will end up with an outright failure. Their suggestion is that governments support the firms especially when business conditions difficult. The support should be up-to-date to meet the current needs of the business environment.

This subject is very visible in public discussion especially today in Finland. The transformation and change in wireless technology sector, including the change in Nokia’s position and strategy, has a dramatic impact to Finnish technology sector. Because of the impacts to the state economy, Finnish government has established actions in order to soften the economic consequences. One of the actions has been ICT-2015 working group headed by former Nokia executive, Pekka Ala-Pietilä. The workgroup is presenting several actions to support the growth and success of high tech SMEs in Finnish ICT-sector. (Ala-Pietilä 2013.)

8.2 Learnings from Oulu

There are currently hundreds of small and medium size high technology companies in Oulu region. About one hundred of those are currently working in international markets. BusinessOulu has been helping SMEs in Oulu region to get financing. This work includes finding the right financing options for the companies and expert support for applying financing for example from ELY Centre and TEKES.

Before this study, a meeting was arranged with BusinessOulu financing experts. The purpose was to test the idea of research subject and find guidance and direction for the study. This discussion gave a lot of background information on challenges and critical issues in practical financing support work. The discussion helped to set focus of the study and gave ideas for interesting research questions. The following is a summary of that discussion.

There has been a change in the need for external financing of high tech SMEs. The typical way of developing a company has been earlier happening in small steps over several years. Focus of the companies have been first in domestic markets and then developed slowly towards international business. Financing has been mostly based on internal financing. Today the success of many high tech companies requires
immediately access to global markets and this is generating need for external financing already in the early phases of the company.

Both public and private funds are used to get external financing for high tech start-ups in Finland. Typical sources for public loans and subsidies are ELY Centre, The Foundation for Finnish Inventions, TEKES and Finnvera. Private debt financing sources are private banks and insurance companies. Public equity financing institutions are Suomen Teollisuussijoitus Oy, Teknoventure Oy, Finnvera and Butterfly Ventures Oy. Private equity financing comes typically from business angels and form private venture capital funds (VCs) like for example Inevi Capital Oy, Hyvinvointirahasto, IP Finland Oy, Aura Capital Oy and CapMan Group.

There can be seen three phases in the financing of a high tech start-up company. In the beginning, the main source for financing comes from the entrepreneur and from circle of acquaintances. In addition to that, subsidies from ELY are used. In the second phase when the company needs more external funding, TEKES loans are often used. TEKES financing is typically a financing package, which includes for example owner’s equity, internal financing and bank loan together with TEKES loan. There can be also angel financing included in the package. In the third phase, when the company is seeking growth for example by starting export, the level of investment is at million-euro level. In this phase, TEKES financing is still used but also venture capital funds are important.

Main experience is that good projects and firms get the financing. When the company has the substance, meaning they have competent management, competent employees and a good business idea, they normally get the funding at some way. Maybe the most important thing the company has to have on place is real understanding on business environment they are working. The real substance and competences are obviously keys for success for any company, but they are also keys for getting the funding for growth.

One of the best ways for a small company to get funding for growth is to build some cash flow beside building the plans for growth. Owners and management can run consulting business or do subcontracting for other firms on parallel, when they are
developing their own products. Cash flow from consulting and subcontracting reduces the need for external financing, but also helps in getting external financing. Internal financing may be crucial in getting positive financing decision from TEKES. It is also easier to attract business angels or VCs when the firm can show that it is already generating cash flow.

The role of public financing is important. Most of the high tech start-ups apply for financing from ELY Centre, and TEKES loans are used in practice in all cases when a company has managed to grow to successful business in global markets. In addition, public VCs are playing key role, when debt financing is not enough for taking needed growth steps.

On the private financing side, business angels are important source of equity financing. There have been also some cases of funding from private VCs. Private banking has limited role in financing high tech startups, because of missing collateral in most cases. Availability of loans from private banks is also very dependent on global economic cycles. The availability and the terms of loan can tighten fast when banking sector faces challenging times.

Question can be raised, that do the promising companies always get the funding? There have been cases where external financing decisions have been negative in spite of high expectations by company and financing experts. In those cases, the growth of companies have been slow. It can be argued if the decisions were right or not. Of course, there have been also positive decisions, which have not leaded to success.

There are two areas in high tech firm financing in Finland, where the development would be needed. There are a few VCs investing into Finnish high tech SMEs, as a newcomer lately Butterfly Ventures Oy, but more would be needed. VCs would bring funds but also expertise to new technology firms. The other needed development would be the speed and flexibility of public financing institutions. Both the delayed financing decisions and delayed payment decisions are often causing unnecessary challenges for the companies. Laws, regulations and different rules of institutions are also creating together such a set of traps for new companies that sometimes also good projects and companies are left without needed funding.
Financing support work done by BusinessOulu has also raised interesting topics for research areas. During the years, hundreds of technology companies have been established and they have followed different paths in financing their growth. However, there is no information collected on those paths. Financing data of firms is confidential and not normally published or collected by external parties. Either VCs are not releasing the information on their financing decisions. There has been also more interest to big publicly traded companies than to small start-ups. It would be beneficial to research what have been the paths successful companies have passed and what kind of differences could be found compared to failed companies. It would be good to learn what have been the most important issues in different phases. What was the situation like when business angel joined the company? What changes did the business angel bring to the company? The sources for this information are the funded companies, but also business angels.
9 DATA AND RESEARCH METHOD

9.1 Research method

9.1.1 Qualitative research

This research is using qualitative analysis to find answers to the research questions. Qualitative research is used to interpret and understand human behavior. This type of research is often used to get in depth understanding in social, cultural or political aspects of people or different organizations. When quantitative research is often used to test theory and hypothesis, qualitative research is concentrating in elaborating and detailed examination of available data. Suitable methods for qualitative research are the methods, which enable collection of different opinions on research questions. This kind of research methods are for example different interviews, participant observation or analysis of the documents. (Hirsjärvi, Remes & Sajavaara 2013)

In this study, theoretical background and earlier empirical studies are first analyzed. Qualitative research is then used to understand the reliability and validity of theories and previous research in the context of this specific research setting. Qualitative research can also bring out new aspects or findings. Qualitative analysis may introduce new research topics and open opportunities to verify these findings later by quantitative research.

9.1.2 Case study and semi-structured interviews

Case study method has been used a lot in the research of social sciences and management. It has been used also in many studies on business and organizational issues. Case study is holistic method, which can be used to analyze real-life phenomenon. Case studies can be used to reveal detailed, in depth information on the research subject. Case studies is a good method for finding factors and issues, which can be valid also in others situations and in different cases. Case study targets to find out how things happen and what may be the reasons behind in the case at hand. (Yin 2003.)
In this research, there are different case companies, which are studied using semi-structured interview. Semi-structured interview is often used to collect qualitative data. Semi-structured interview is a verbal interview, where interviewer has a predetermined structure or list of questions to run the interview. The discussion in the interview is however not limited strictly to answering the questions. The interviewer uses the structure as a guide to the discussion, but allows some freedom for the interviewee to present his views on the topic. The questions are open-ended and give interviewee the possibility to freely express his opinions. Main task of the interviewer is to keep the discussion on the research topic. Informal setting of the interview also helps to achieve successful results.

9.1.3 Selection of the case companies

The companies for the research were selected by special criteria in order to keep focus in the research and enable finding the answers to the research questions. The companies should be based in Oulu region in Finland. They should be young, start-up type companies. They should be utilizing high technology expertise and knowledge. They should be targeting for growth and global markets. They should have already some financing rounds behind and plans for additional financing.

9.1.4 Data collection

The data was collected in semi-structured interviews. The interviews were arranged in September, October and November, in 2013. The interviews were agreed by mail and by phone calls. Four of the interviews were face-to-face interviews and one was conducted over the phone. In all interviews, the same interview plan was used. The interview plan is found in the appendix. The interview plan was not shared before the interviews. The plan was however presented to the interviewee in the beginning of the interview in order to help focusing the discussion.

The length of the interviews varied between twenty and forty minutes. The interviews were recorded by portable voice recorder. Recording was then transcribed later in order to make analysis work easier and to ensure the data quality.
The interviewees are all founders or co-founders in their companies. In company one the interviewee is working as CEO. He has a long career in Nokia before entrepreneurship. The interviewee in the second company is also working as a CEO. Before the foundation of the company, he was an owner and entrepreneur in another business sector. In the third company, the interviewee worked earlier as CEO, but moved after venture capital financing round to the position of Chief Scientific Officer. His background is in a mid-size technology firm in Oulu region. The interviewee in the fourth company has had a long career in Nokia and works now as CEO. Also the interviewee from company five is coming with Nokia background and holds currently CEO position.

9.1.5 Validity and reliability

Validity in research means that the data collection results are corresponding accurately to the real word (Joppe 2000). In this research, the interviews were conducted by using the same interview plan, by same person and in similar interview settings. The case companies were selected by the same criteria. Interviews were transcribed in order to improve data quality. The analysis and findings are based on the collected data. Reliability means that the results are consisted over time (Joppe 2000). The interview plan was used to guide interviews. The plan ensures that the results would be same in the similar interview setting and environment also over the time.

The relevance of validity and reliability in qualitative research has been discussed and even challenged. However, validity and reliability can be used to evaluate also the quality of qualitative research when they are understood more widely than in quantitative research. Validity and reliability need to be seen as trustworthiness, rigor and quality of research work. (Golasfhani 2003.)
9.2 Research data

9.2.1 Company 1

Company 1 is a 2010 established start-up company specializing to medical devices. The background of competences and experience in company is in Nokia. The company is working with the first product and targeting to global markets. They started with proof-of-concept device, continued to the first production version and now they are selling the first real mass-production version of their product. They have used different product versions to collect market feedback, get the required certifications and get good reference customers for their product. The sales of the products have created some revenue, but not enough for financing the growth. After the first product, they plan to widen the product portfolio to other medical devices.

Company 1 financed the beginning of the company and the first development work by funds from owners. After that, they got loans from the Foundation for Finnish Inventions and TEKES. Very important financing on the second financing round came from some business angels. Company 1 has seen it important to have several small financing steps in order to raise the valuation of company step by step higher and enable bigger financing in the next round.

Collected financing has been used to develop the next product version, but also to build sales and marketing channels and search for global partners.

Financing arrangements have required a lot of time and work from the management. Financing has been enabling the continuous development and growth, but the speed of growth is clearly depending on the amount of financing. They see that the amount of financing is defining the time from start to the level when income financing will play major role.

Public funding has been playing important role in the beginning of the company. However, they see more possibilities on public support side especially in providing services or low cost resources for start-ups. The cost of hiring one new employee is so high and the needed work varies so much that public support would be
appreciated. The entrepreneur proposed an idea to utilize unemployed work force of the region.

The next financing rounds will be larger and there is need to get also venture capital financing. However, the company does not seek the business expertise from venture capital firms. The view is that it is difficult to find business angels with high enough resources and that is why venture capital is needed. The financing is planned to be used especially to marketing and building distribution network. It is clear that income financing does not enable fast enough growth and internationalization.

9.2.2 Company 2

Company 2 is a start-up company based on innovations on network security and device-to-device connectivity area. Their idea was developed several years before establishing the company. Released resources and competences from Nokia enabled the owner of the idea to establish the company in 2011 and start making the plans reality. The company has patented their inventions and developed already some product versions. The sales has started fast and is already providing significant cash flow. The company has started the sales directly in several countries and is targeting global sales. Their targets are especially to achieve strong position in US, Europe and Asia. In spite of the patent protection, they see it important to be the first on the market in order to succeed.

The company started with owner financing. The next phase of consisted of a debt financing packet build together with TEKES, Finnvera and one commercial bank. This financing round was focusing to product development. There was also second round with TEKES right after the first one. In addition to this packet, they received a grant from ELY Centre. This time the focus was more in building the basement for international sales and distribution. The company entered also into “Young Innovative Companies” financing program by TEKES, which enables relatively high financing grant if all targets are met. Important part of financing has been also business angel financing. In addition, company 2 has been able to finance significant part of the operations by income financing.
Company 2 has very aggressive growth plans and those plans are supported by very bold financing targets. They are currently offering a B series of shares without voting rights in order to collect external funds. After this round, the plan is to go to Nasdaq First North junior stock market. Final financing target is then public listing in four to five years. The guiding principle is clearly to retain control of the firm. There are no plans to seek venture capital financing, because of fear to lose control. In addition, business angels are active in company and passive owners have been bought out.

Company 2 has been able to arrange enough financing to implement their growth plans. They see that more money would have made the growth faster. On the other side tight financing has had also positive side as limited funds have required careful planning and decision making.

Company’s aggressive growth plans require a lot of new financing. Majority of the funds from the coming financing round will go to sales and marketing. The company see that it is very important for them to build distribution network and strengthen their brand as fast as possible. The sales is growing, but is still far from sustainable level. Especially the volatility in sales is a worry.

9.2.3 Company 3

Company 3 is a 2007 established welfare technology company. It is developing a groundbreaking medical device based on an innovation developed by initial owners. The innovation is based on scientific studies, which the company is doing together with several universities. The background of the entrepreneurs is in Nokia and other high technology companies in Oulu region. The company has started the sales of the first version of their product in 2010 and is currently launching the sales of renewed version. The sales have more than doubled every year. About half of the sales are coming from Finland and the share of international sales is growing fast. The focus is currently in Scandinavia and in Central Europe. The growth targets are very aggressive. The company plans to achieve global sales and 200 thousand euros in revenue in few years.
This level growth targets require a lot of funding. According to the entrepreneurs, lower growth targets would enable to achieve break even earlier, but they have decided rather become a global player in the industry. The first financing came for the entrepreneurs and right after that from the circle of acquaintances. Part of the early phase financing was also a loan from TEKES. After the first financing round, the company got funds from several business angels. In 2010 came in the first venture capital firm. After that, company 3 managed to make agreements also with some other Finnish venture funds. This financing round and the support from the investors enabled the company to seek financing also outside the borders of Finland. In 2013, they secured several million euros financing from some of the leading European venture capital funds.

Company 3 has not been scared to lose control of the firm. Their financing strategy has focused to the fastest possible growth and broadminded options to finance the growth. Earlier business angels and the first venture capital firms have enabled the success in venture capital financing. Their networks, financing experience, continuing support and additional investments also in later financing round have created trust to the company. The company has had the idea, that the money is not enough as such, but also expertise, knowledge and networks are needed. Especially the new investors have brought expertise to achieve the next financing round.

The invested capital has been used in the early years mainly to product development and scientific research. The money used to marketing has been minimal. Marketing and brand building has been managed to carry out by PR-operations, like publicity in press or in other media. However, in 2013 after the latest venture capital financing, the company is starting to develop sales, marketing and distribution. These investments are needed to enable aggressive growth and internationalization targets. Increased financing gives the company also possibilities to order international scientific studies to support the sales efforts.

Company 3 has had very limited financing in the beginning. The entrepreneurs see that additional capital in the beginning would have helped, but it also has its downside. Tight budget forces to focus to the essentials and only the good ideas will live.
The company has managed to get financing, which is not usual in relatively small places like Oulu. However, their growth targets will require more. Company 3 estimates, that there will be one more venture capital round and then public listing. If the financing plans will not succeed, the company will not reach the position as a global player.

Company 3 has been successful in financing, but they see still areas to develop in Oulu region. More Finnish and especially local venture capitals would be needed. For many local entrepreneurs reaching the international venture funds is an impossible task.

9.2.4 Company 4

Company 4 is a start-up developing a high tech innovation for sport activities. The idea was developed in 2010 and company established in 2011. The first version of the product started selling in 2013. The sales is already bringing in some cash flow, but because company is targeting fast growth, external financing is needed. Company is planning everything from product development to sales and marketing so that the growth is possible. Also this company is utilizing the competences and experience developed in Nokia.

Initial financing came from the entrepreneurs, but business angel financing was secured already in very early phase. Public financing in the form of Ely Centre grant, TEKES loan and grant from The Foundation of Finnish Inventions has been also used. The funds have been used to product development, but also to sales and marketing. Company 4 has had the idea that it is important for the future of firm to invest in visibility and marketing from the day one. They have found that this strategy is helping also in attracting investors.

The company has started the sales and distribution network building in several countries right in the beginning. This is requiring more financing. The company has also product development needs, but distribution network development and sales and marketing is requiring most of the funds. Next financing round is under planning.
The target is to get venture capital financing, because of growing investment needs. Also international venture capital funds are considered.

Company 4 has managed to finance the operations, but it has required a lot of work. More money would have helped, but the current level has been acceptable. Public support in the form of financing and different services has been essential in the early phases. Without it, the company would not exist. Entrepreneurs have however found it very challenging that grant money is often paid afterwards, against the receipts. They would hope grant rules to be more flexible in order to better support start-ups.

9.2.5 Company 5

Company 5 is a new 2010 established technology firm specialized in the area of internet and social media marketing. The business idea is based on a disruptive innovation owned and patented by the entrepreneurs. The background of the entrepreneurs is in Nokia and other technology companies in Oulu region. The product includes both device and related service. The device sales are bringing the majority of revenue in the beginning, but the plan is to move more to service side in the long run. The company is still in the very early phase in its development. The concept has been tested on the market and the first product version developed. The company has however started already the sales in several countries in additional to Finland.

The company operations were financed in the beginning by the entrepreneurs and the acquaintances. Also the grants from Ely Centre and Innovation Mill were used. The development of the company got speed in 2013, when they managed to get some venture capital financing from public fund. In addition, income financing is starting to help, but the significance of it is still minimal. The company has not used debt financing.

The financing is used for product development, but also for sales and marketing already from the beginning. The company is targeting to grow and internationalize fast. In future, the majority of the financing is needed for internalization. Especially the building of distribution network is requiring external financing. The
entrepreneurs see the availability of financing as critical for the success of the company. Without the funds, the business will stay small and be focused in Finland. The financing options are in practice business angels and both local and international venture capital funds.

The company has had adequate financing for developing the product and starting sales as planned. Public support has been in important role. However, the bureaucracy with the officials has been difficult and required a lot of effort. The entrepreneurs see the availability of both public support and external financing being essential for the company and other high tech start-ups on the region.
10 DATA ANALYSIS

10.1 Financial growth cycle and the use of debt

The theory of financing growth cycle proposes that companies use different financing options on the course of development. The order of the options are claimed to be insider finance, angel finance, venture capital, debt finance and finally public equity and debt. (Berger & Udell 1998.) Companies 1, 3, 4 and 5 follow this path, but company 2 is avoiding venture capital because of fear to lose control of the firm. Company 5 is not having angel investors yet, but public venture capital. The use of debt is different from proposed by the theory. All the other companies, but company 5, are using debt in the early development phase. The reason for this is that there are public support mechanisms build, which enable debt financing without collateral. On the other side, this is in line with the finding of De Maeseneire and Claeys (2012).

The entrepreneurs of the company 5 mention to have personal debt for the initial investment. This option is found to be feasible also by Ang (1992). None of the companies is planning to use debt financing in later phases. This is because of limited amount of collateral in use. This is typical for high technology firms (Berger & Udell 1998). Hogan's and Hutson’s (2004) finding of debt financing being too slow and insufficient for achieving highest possible valuation is especially true with the company 3. All the case companies have experienced that debt financing is inadequate already in the beginning for high R&D investments. This is in line with the earlier studies (Gabrielsson et al. 2004, Hyytinen & Pajarinen 2005).

10.2 Angel finance

Business angels are found to be important for companies with high growth potential (Berger & Udell 1998). This can be clearly seen also in case companies. All of them are using angel financing or planning to use it. However, Berger’s and Udell’s claim on one angel being often enough for small companies seem not to be true in case companies. One reason may be that the wealth of angels in Oulu region is not high. More angels are needed as Prowse (1998) notes.
Local focus of angels and participation in several financing rounds, seem to be true in case companies like found by Berger and Udell. Their finding on less control requirements and less expertise than venture capital funds is also in line with the strategy of company 2. Company is avoiding venture capital and is happy with the expertise they already have inside the company. Instead, they are issuing B series of shares without voting rights and using a private company to help in finding more investors.

All of the case companies have been reaching for business angels in practice as soon as possible. The reason has been that debt financing is insufficient and the development costs are high. This finding has been noted also by earlier studies on Finnish high tech start-ups (Alahuhta 1990, Gabrielsson et al. 2004). Especially company 4 managed to get business angel money right after the establishment of the firm. Company 3 and 4 also noticed that external investors also work as validators and enable the involvement of TEKES and other public support.

10.3 Venture capital

Venture capital was used in company 3, when the production and sales started. Companies 4 and 5 are supported by public venture capital fund. Company 1 plans to use venture capital in the coming round to finance the building of distribution network and entrance to global markets. They see that there are no wealthy enough angels to meet their coming financing needs. This is in line with the earlier findings. Venture capital firms do not usually invest in companies in the beginning, but rather later when full-scale operations in production, marketing and international sales are started. (Berger & Udell 1998.)

Company 2 has not used or planned to use venture capital financing. The reason was the desire to retain control of the firm. Venture capital firms typically want to be active investors and require large stakes and return for their investment. The cost of the financing can rise very high. (Gabrielsson et al. 2004.) These issues have driven company 2 to look other options. Company 2 has also noticed that many venture capitals firms are more interested to invest in software companies because of faster scalability opportunities.
Totally opposite example is company 3, which has been seeking venture capital investments very aggressively. They have also been successful in their efforts. They have also gone outside Finland to look for venture capital money. They see this to be very important for getting enough resources to grow to a truly global player. These ideas are similar with the findings of Gabrielsson et al. (2004), as they propose Finnish firms to consider also international venture funds. Gabrielsson et al. suggests that access to global finance resources is required for successful fast growth to global level. They also find that this is very challenging for Finnish firms, as also company 3 has found to be true. General belief within the entrepreneurs is that it is very difficult to achieve acceptable deal with international venture capital firms. More local venture capital companies would be needed as a bridge for getting access to global players.

10.4 Stock listing

High tech start-ups in Oulu region seem to set the targets high. Company 2 and company 3 are planning their financing path so that it leads to IPO. The companies however realize that because of the costs of IPO, they need use other financing options first to raise the valuation of the firm. This is also the finding of Berger and Udell (1998), when they suggest that it is not feasible for small companies to go public listing. They also remind that in practice only minority of companies achieve IPO.

Also Papadimitriou and Mourdoukoutas (2002) talk about the difficulty of high tech start-ups to reach IPO. They state the listing requirement being too high. For this reason, company 2 targets to First North junior stock exchange before public offering. Companies 1, 4 and 5 do not yet have plans for listing.

10.5 Significance of cash flow

Cash flow is often minimal or non-existing in the early phases of new high tech firm (Berger et al. 2004). This is true also for these five case companies. The first phase has to be survived by the funds of the owners. When the first product was on the market, the companies received some cash flow from sales, but its share of all
financing was small for most of the firms. Company 2 is an exception. They managed to reach the level of 50 percent financing from income already on the second year.

The main function of cash flow, in case companies, was its importance in rising the valuation of the firm and prove the business opportunity to investors. Especially company 3 used the fast growing sales figures as a tool to persuade venture capital funds to join the next financing round. This type of practice was typical also for other case companies.

10.6 Public funding and other public support

Many earlier studies show the importance of support and financing from governments and other public sources. For example, Gabrielsson et al. (2004) propose that governments should even increase their support for small high tech start-ups. This thinking is in line with the experience in all case companies. All of them have been using public support especially from Ely Centre, TEKES and Finnvera. All case companies see this support essential especially in the beginning when the start-up is not yet capable to demonstrate its potential for external private investors. Especially Company 1 has also found it important to get financing for testing the ideas on the market. This gives good base for the next financing rounds.

Findings from case companies support fully the findings of Meuleman and Maeseneire (2012) when they highlight the role of public officials in certifying the potential firms for private investors. Also Lerner (1999) found public R&D grant having positive impact to entrepreneurs’ possibilities to attract venture capital financing. Especially companies 4 and 5 experienced however that the process of using grant money was challenging. The grant from Ely Centre for example can be drawn only afterwards. They propose changes to this process. However, company 4 mention Ely Centre grant as the enabler for early angel financing.

In Finland public funding and guarantees enable also loan from private banks. All the case companies, but company 5, used this kind of financing packages. However, it was also common that this support alone was not enough to finance the growth, but
external equity financing was needed. Company 2 mentioned also that public funding enables initial owners to keep control of the company, because it delays the need for external financing. This keeps up the motivation of the entrepreneurs.

From governments’ point of view, public interventions can be justified by many positive externalities of technology development and growth of high tech industry (Mansfield 1972, Griliches 1992, Nadiri 1993, Harrison 1994, Davidsson et al. 1995, Lerner 2002). In Finland, public support has been seen sometimes also bringing direct return for society. The latest case was just recently, when Finnish mobile game company, Supercell was sold to Japan. Supercell had received several rounds of public grants and other support and now was the payback time to Finland. Supercell is paying over 260 million in taxes to Finland in year 2013 alone.

Company 1 was also presenting ideas how public officials could do more. It is often expensive for a start-up to hire new employees. Workload is also varying a lot in early phases of the development. Public money could be used to provide services and low cost labor for the start-ups. This would be benefitting also the society especially at the times of high unemployment. This kind of situation is currently in Oulu region right in the middle of the technology sector transformation.

10.7 Other financing options

None of the companies planned to issue public debt. This is of course understandable as all the companies are still small. Public debt is even more expensive than public equity and the companies issuing public debt papers are typically very large (Carey, Browse, Rea & Udell 1994). One option might be for example First North Bond Market, but none of the companies had considered it. Maybe this is the case because it is still relatively new opportunity.

Näsi (1995) proposes funding from business partners, customers or suppliers. Case companies have no significant financing from these sources. Company 2 mentions the use of factoring, because they sell also to businesses and bigger companies are paying the bills slowly. Company 3 is using TEKES loan packages to ease the short
term liquidity problems. Berger and Udell (1998) find trade credit important for small high tech firm, but it was not used by the case companies.

10.8 Question of control and smart money

Both, business angels and venture capital funds, usually require the biggest possible stake of the company in exchange for their investments. They target often also to participate in the decision making of the firm. (Berger and Udell (1998.) This was noticed also by the case companies. However, their attitude was differing each other.

Company 1 seek to get money as money and separate it from the expertise. They were also worried about losing control of the firm. Company 2 appreciated the expertise they were receiving with new investor, but were very careful not to lose the control. They even issued B series of shares, i.e. shares without voting rights.

Company 4 was also hoping to get expertise with the money as they got with current investors. They were interested to get new investors, who would have expertise especially on their area of business. However, also they were careful not to lose control. Also company 5 was targeting to keep the control at least until the valuation has grown significantly. Company 3 on the other side is not worried about the control. Their idea is that it is better to have small share of big global successful company than majority of a few million euro company. For this target, they need to grow fast and they need help.

10.9 Impact of financing success

What does a successful financing round mean for a company? For most of the case companies, new money has enabled to develop the next versions of the products. Another important result has been the ability to build new sales and distribution networks. This has been especially important for company 2.

New products and additional sales have then been used to justify higher valuation of the company and attract new investors. This is how they have created tools for the next financing round. This kind of line of dependences can be seen in all case
companies. In addition, the share of investments to marketing seems to be growing when the companies are moving to third or fourth financing rounds. Company 4 was an exception. They started marketing right from the beginning, parallel with product development. Their finding is that the investment in marketing also helps in getting the financing. Visibility creates interest within the investors.

New investors often bring also competences and new networks to the company (Berger and Udell 1998). Especially company 3 has utilized the expertise and networks of the investors. The impact has not been so significant on business development side, but on financing side. The help of the investors has enabled company 3 to attract international venture funds.

The development and growth of the companies happens in steps in the case companies. All of the steps in the first years seem to require successful financing round. The comment from entrepreneurs of the case companies is that if financing does not work, the company will remain as a small player. Entrepreneur of company 1 describes this dilemma so that the time to the sustainable level is depending from the financing. If this time is stretched too much, sustainable level will be never achieved.

10.10 The gap and possible solutions

Earlier studies show that small high tech companies are experiencing financing gap. The companies do not get enough financing. This gap is constraining the growth and internationalization of the companies. (Berger & Udell 1998, Carpenter & Petersen 2002, Luostarinen & Gabrielsson 2004.) The case companies have similar experiences. The companies’ common experience also was that, financing requires a lot of work and effort from the management.

Company 1 claims that the financing defines the time to global company. More and wealthier local business angels and local venture capital firms would help the situation. Company 2 is quite satisfied with the financing they have been able to get. However, they see that the growth rate is defined by the availability of funds. Company 3 is worried on the supply of local venture capital. They see that missing
local funds are causing the benefits of innovations and competences to flow outside of the region and outside of Finland. Also companies 4 and 5 are relatively happy with the financing they have managed to get, but they have experienced that internationalization is not possible without significant external financing.

On the other side, case companies admit that the scarcity of funds can have also positive effects. Companies 1 and 2 see that the limited financing forces to keep the focus in the essential things. Company 3 claims that easy financing situation would lead to work too long also with bad ideas. They feel that the scarcity in the first years was good for the development of the company.

Luostarinen and Gabrielsson (2004) have studied so called born global firms, which are not starting with only domestic operations, but are simultaneously going to global markets. This is typical especially to high tech companies. All the case companies fall to this category. They are not happy with the sales in Finland, but have started international sales already with the first product version. This kind of growth strategy requires clearly more financing that traditional slow growth. Company 2, 3 and 4 for example had analyzed different options, but decided to set targets high. They however realize that this strategy is constrained by financing. On the other side, high growth targets are required by investors. Especially venture capital firms are only financing the companies with high growth potential (Gabrielsson et al. 2004).
11 CONCLUSIONS

11.1 The background and research questions

This master’s thesis is focusing to the questions around small and medium size high tech firm financing. High technology sector is going through a rapid transformation in Finland. Nokia centric industry is changing to a wider field of smaller new technology companies. This change has an impact to many professionals in high tech area, but also to the local and state economy in Finland. Successful transformation requires that new growth is supported by financing sector.

The study searches reasons to financing gap of SMEs. The focus is in the finance obstacles of high tech firms. The study seeks answers to the question if availability of financing is constraining the growth and internationalization of small and medium-sized high tech companies. Interesting is also to find possible solutions to lower the financing barriers of growth targeting high tech firm. Empirical part of the study focuses to high tech start-ups in Oulu region, in Finland. The city of Oulu and neighboring towns is in the center of the industrial transformation. Oulu has been one of the main Nokia cities and this is why the change has been dramatic. The case study looks deeper to the high tech companies and their financing challenges in Oulu. These companies have almost impossible task, to replace the former success of Nokia with new technology business in global markets. The location of Oulu far from the world financing centers brings additional challenges to start-up financing.

11.2 The results

11.2.1 The findings from earlier theoretical and empirical studies

High tech SMEs are found to contribute positively to economic growth, employment and well-being at local and state level (Mansfield 1972, Nadiri 1993, Harrison 1994, Davidsson et al. 1995). Information opacity limits the financing options of SMEs and increase the cost of finance. SMEs typically seek to obtain debt financing instead of external equity in order to retain control of the firm. Debt financing is however limited by collateral requirements. (Berger & Udell 1998, Manove et al.
2001.) Small high tech companies need finance often more and faster than other companies. Higher finance requirements and intangibility of assets lead high tech SMEs to prefer equity to debt. Business angels and venture capital firms have crucial role in high tech financing. (Berger & Udell 1998, Alahuhta 1990, Luostarinen & Gabrielsson 2004.)

Financing constraints are found to limit establishment, investments, growth and internationalization of high tech SMEs. The companies with less financing constraints are growing faster. Projects with positive net profit value are cancelled because of missing funding. (Berger & Udell 1998, Becchetti and Provato 2000, Klapper et al. 2006.) Government institutions and development of financial markets are proposed as tools to lower the financing constraints. Lowering the financing barriers have been found to have significant effect to growth of small companies. Support from government institutions has been found important especially for funding R&D in early phase of firms. (Beck et al. 2004, Gabrielsson et al. 2004.) All opinions on government interventions are however not unanimous. There are views that financial markets should let solve which firms are financed and which are not. (Cressy 2002, De Meza 2002.)

11.2.2 The view of local financing support

Before the research, the relevance of the research subject tested in discussion with local financing experts in Oulu. When comparing the findings in literature to the learnings of BusinessOulu financing experts, the findings were surprisingly similar. Fast access to global markets was found important for many high tech firms. This kind of development is requiring external financing already in the early phases of company. Equity finance was found to be more important than debt finance. Collateral requirements and sensitivity of bank finance for global economic cycles were found limiting debt financing. Importance of private equity, business angels and venture capital, was highlighted. Actually, more venture capital money is hoped. Public financing support is also seen important for the growth of high tech firms. On the other side, the general understanding is that getting financing is very much dependent on skills and competences of high tech companies. The best firms will get the financing.
11.2.3 Results of the empirical research

The empirical research on five fast growing high tech start-ups shows the importance of public interventions in early phases of high tech start-up development. This research finds public support to be essential for the establishment and the first development phase. There is however room for development in different public support programs.

The financing needs and options are different in high tech start-ups than in other more traditional SMEs. This study finds business angel and venture capital financing having key role in later financing rounds as also shown by earlier theoretical and empirical studies. Debt financing is not fulfilling the financing needs of the companies.

However, there are clear gaps in financing options. The amount of business angel and venture capital financing is found to be insufficient in Oulu. International financing is found to be often unavoidable and this is challenging for the entrepreneurs. This study finds need for more local funds. Local investors would help in financing, but also in providing expertise and networks to reach international investors.

The availability of financing seems to define the time to global company. The growth rate is defined by the availability of funds. The finding is that internationalization is not possible without significant external financing. This research also finds that the desire to retain control of the start-up may exclude venture capital and limit the growth of the company. These results can be generalized to the other technology concentrations far from the world financing centers. The results can be also used to enhance financing environment and services in those areas.
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TEEMAHAASTATTELUN RUNKO / INTERVIEW PLAN

Tutkimusaihe: "Financing gap as constraint for growth of high tech SMEs" – “PK-sektorin teknologiayrityksen rahoitushasteet kasvun esteenä”

1. Haastateltavan yrityksen kuvaus lyhyesti.
   a. Toimiala ja tuote/tuote yleisellä tasolla.
   b. Yrityksen kehityksen ja kasvun vaihe. Mitä on tapahtunut? Mitkä ovat seuraavat päättavoitteet?
   c. Minkälaisia kasvu- ja kansainvälistymistavoitteita yrityksellä on?

2. Rahoitus yrityksen eri vaiheissa
   a. Miten yritys on hoitanut liiketoiminnan ja kasvun rahoituksen? Lainarahoitus, pääomasijoittajat, tulosrahoitus, ...
   b. Syitä valittuun rahoitukseen.
   c. Erilaiset rahoitustarpeet yrityksen eri vaiheissa.
   d. Miten rahoituksen järjestelyminen on vaikuttanut yrityksen toimintaan?

   a. Minkälaisia haasteita yrityksellä on ollut rahoituksen alueella?
   c. Yhteiskunnan tuen merkitys?

4. Yrityksen tulevat rahoitushaasteet
   a. Mihin rahoitusta tullaan tarvitsemaan? Kansainvälistymisen merkitys yritykselle?
   b. Mitä vaihtoehtoja harkitaan? Miksi?
   d. Toiveita rahoitushaihtoja suhteen?

5. Ongelmat, haasteet ja kehitystarpeet teknologiayritysten rahoitussa.
   a. Onko teknologiayrityksillä riittävästi rahoitusta?
   b. Muutostarpeita?
   c. Julkisen rahoituksen merkitys.
   d. Mitä vaikutuksia rahoituksen kehittämisellä voisi olla teknologiayritysten menestymiselle?