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COMPETITIVE ADVANTAGE FROM LEVERAGING EXTERNAL RESOURCES – REUSE OF OPEN SOURCE SOFTWARE COMPONENTS

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Abstract
This study is interested in how commercial firms can use open source software components and lines of open source software code as components in their own privately produced software products. International network of open source software (OSS) developers produces these reusable product components under permissive license conditions which allow firms to reuse the components and manufacture derivative works out of the reused components and then sell the derived works as a product at the market. Reusing readily developed and tested components, leveraging external resources, provides a competitive advantage for the firm using these components as resources in its software manufacturing. The competitive advantage derives from the nature of the resources in question. This study introduces that OSS components are self-renewing of their nature. The components renew regardless of the firm's actions because the international network of OSS developers develop these resources voluntarily. When these works are released to public under a permissive license such as BSD license, the firm can use these works in its products for free, and also enjoy the free maintenance and updating of the components. This phenomenon induces welfare benefits for the economy and helps reducing Dead-Weight Loss, which is a result of classical blocking IPR's. This study finds exceptional qualities in the OSS development phenomenon and therefore challenges the prerequisites of the Resource-Based View (RBV) theory once introduced by Barney (1991). The study ultimately finds that a starting software firm may enjoy competitive advantage as a result of its dynamic capabilities, as well as due to the special nature of the OSS components it uses as components in its products. The study introduces the view of Strategic Entrepreneurship and illustrates the process of developing competitive advantage and creating wealth. Key finding of the study is the special nature of open source software artifacts, which challenge the cornerstones of RBV theory. The study shows that the resource does not have to be rare, or in-imitable, or non-substitutable to produce competitive advantage for the firm.

Keywords
Open Source Software, Commercial Open Source Software, Resource-Based View, wealth creation, competitive advantage, strategic entrepreneurship, dynamic capabilities, Dead-Weight Loss, external resources, entrepreneurship financing

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1 INTRODUCTION

The objects of interest in this study are two-folded. The study is interested on the circumstances of start-up firms in the software industry and the constraints in those circumstances. This part of the study will concentrate to the financial circumstances of new ventures, because access to adequate financing has been indentified as one of the most influential obstacles for entrepreneurship, new venture creation and growth of firms and also as key issue for firm's survival (Kerr & Nanda 2009; Banerjee & Duflo 2004; OECD 2012). Parallely the study is interested in the phenomenon of open source software development. Von Krogn and Spaeth (2007) say that open source software phenomenon has a ubiquitous impact on society and the economy, and recognize its effects on a global scale. Osterloh and Rota (2007) say that open source development is an innovation model that challenges conventional economic views that innovation is best supported by strong private intellectual property rights. Välimäki (2005) says that open source has offered new firms the possibility to change existing market structure and altered the market strategies of market incumbents. According to him open source software has changed "rules of the game" in software market.

This study is especially interested in the role of such firms in software industry that make use of the development work of open source software communities to develop their own products. The study will introduce how commercial firms build commercial products based on publicly available open source software components and incorporate publicly available artifacts such as lines of open source software code into their commercial products. The study will explain a mechanism how firms making use of open source software components create wealth and are able to achieve competitive advantage. The study will handle the reusing of resources in the levels of a firm and of an economy. Latest proceeding in the Finnish economy will be presented to illustrate the need for resource mobility in an economy. It is also presented how resource mobility is not an obstacle for a firm to achieve competitive advantage. This study unravels a novel phenomenon of Commercial Open Source Software (COSS) manufacturing and points out the importance of software industry for

the Finnish economy. Kumar, Gordon and Srinivasan (2011) say that the literature considering the co-creation of products by firms and by a community of individuals contributing from outside the firm boundaries is in its infancy. This notion makes this study important and topical. Goldman and Gabriel (2005) say that a community in the context of open source software development is a group of people with a shared interest, purpose, or goal, who get to know each other better over time. According to them an understanding has been developed that that having interaction between developers on a daily basis during development is far more valuable than waiting through the typical product-revision cycles.

Hitt, Ireland, Camp and Sexton (2001) point out the important role of financial capital as a firm's resource and say that financial resources have been identified to be primary predictors for growth of the firm. The importance of attaining money as financing or investments shows clearly in the literature. For example Nesheim's book *High tech start up – The Complete Handbook for Creating Successful New High Tech Companies* (2000) concentrates almost solely into issues of attaining financing or investments, and sees money as an enabler of starting up a new venture. This study contributes to reducing obstacles of software entrepreneur's access to financing by providing its target audience insight increment for analyzing the wealth creation ability of a software firm utilizing the phenomenon of open source software development. It is in the interest of potential investor and financer, and in the interest of the entrepreneur, to recognize what characteristics indicate success in wealth creation. Information provided by this study helps financiers to recognize to which software firm they should provide financing, investors to recognize to which software firm they should invest, and lowers the access barriers of entrepreneurs, for them to receive adequate financing for their software business. The study is interdisciplinary of its nature, as a business school thesis should nowadays be, according to Teece (2011). This study directs attention to what earlier research has found out, and provides this information to those interested in becoming a successful investors, entrepreneurs or financers in the field of software manufacturing.

1.1 Motivation and backround – the exigence for entrepreneurship and new venture creation in the Finnish economy

One reason why I have started a thesis regarding software industry is that I believe that software manufacturing can be an important export branch for Finland in the future. It should be. Software can be delivered through internet globally with minimal logistic cost. This solves the problem of distant location of Finland in relation to world markets. Logistics cost of internet delivery for the delivering firm, approach zero. This economical miracle of nearly zero delivery cost is a special possibility for Finland, which should be noted with

high importance. Finland is known for high quality engineering and high education, and thousands of software engineers have recently been released from the service of Nokia's software development. Also the conditions for hardware premises needed for software distribution have been proved to be excellent in Finland (Lappalainen 2012). Our internet connections and power supply networks are reliable, our climate is cool, and our ground is steady as a rock. The opportunity window for Finland to become a leading economy in software production is here and it should not be lost. One of the reasons why I have decided to write this thesis regarding the software industry is to bring up this topical issue. Storhammar and Virkkala (2003) say that software manufacturing is considered one of the cornerstones of industrial competence of Finland. As the software industry is also integrated to many other branches of business, it will have a central role in the future development of many industries in Finnish economy.

Motivation for this study stems also from my interest towards the contemporary challenges of the Finnish economy, and towards its future and development. The future of the Finnish welfare state is facing severe contemporary challenges. (Uusi Suomi 10.2.2012; YLE 1.1.2013). The dependency ratio is weakening all the time, the economy is facing structural changes, and in addition to that, the global financial crisis is causing its contemporary challenges to financing of the firms as well to the demand of their products.

Originally my interest towards software industry has been more of a theoretical. I have wondered how open source software as a phenomenon may provide solutions to the "Dead-Weight Loss" problem introduced in the theory of Industrial Organization. This study will shortly contribute to that issue as well. An observation of how the open source software production phenomenon can solve the Dead-Weight Loss problem and will induce positive welfare effects on global scale are presented in chapter 4.1. The focus of this study however is in the firm level, and in exploring how firms can use the open source software code and other artifacts of software development, produced by open source communities, as a resource in their software manufacturing, as a resource in wealth creation, and in search for growth and competitive advantage. Therefore, this study also makes a contribution to that, how open innovation in software industry can contribute into development and future of the Finnish welfare state.

The Finnish economy is going through remarkable changes. Traditional Finnish manufacturing industries move their factories closer to global markets and customers, and in the same time, to countries where labor is cheaper. For example, many paper and pulp manufacturing factories have been closed in Finland, while new factories have been established to developing countries where raw material and labor is cheaper. (Juurus 2008; Koistinen 2011; Raeste 2007; Repo 2012; Taloussanomat 20.3.2012; Uusi Suomi 18.1.2011). It is a fact that Finland is a distant country up north, and therefore logistics cost of exporting physical goods to global destinations are relationally high. Finland has a stable political environment and Finland is a highly reliable society, but that

does not seem to be enough for globally operating firms to remain their operations here and to invest here. According to Ministry of Employment and the Economy Finnish economy needs 20-30 billion EUR more foreign direct investments (FDI) by the year 2020 to reach the arithmetic mean of EU countries in the amount of foreign investments. The Ministry suggests that Finland should take adding the amount of FDI's as its ambition (Taloussanomat 3.10.2012).

It is a tricky formula. Instead of only trying to keep the current firms in operation and their production in Finland, Finnish economy needs new entrepreneurship, new entrepreneurs and new production, new foreign direct investments, and firms that seek growth (Ihanus 2012; Maaseudun Tulevaisuus 8.10.2012; Ministry of Employment and the Economy 16.5.2012; Keinälä 2012). This makes one to think, how the turnaround can be made, and is it possible. This is a big question, at the time, when more and more unwanted economical news reach daylight. The global financial crisis caused 8% decline in the Finnish GDP in 2009 (Kiander 2010). The latest setback of the same magnitude has been experienced in the manufacturing and developing of electronic devices. Nokia has consisted about 4% of Finnish GDP in 2000 (Pohjanpalo & Ben-Aron 2012). Now Nokia has closed its factories in Finland and is also closing R&D centers and software development units in Finland.

1.2 Objectives, scope and limitations

The target audience of this study is those who are interested in new venture creation in the software industry, and those who are interested in how a software firm using open source software code as a resource of software production can achieve competitive advantage in relation to those firms producing traditional closed source proprietary software. The production of commercial, closed source proprietary software products with strict copyright terms represents the traditional business logic of the software industry. This study presents a commercial logic of commercial open source software (COSS) products which differs from the mentioned traditional business logic. The study is limited to commercial reuse of open source software code and open source software components as a firm's resource. Software components are constituted of lines of software code which means that in a broader sense this study handles the reuse of the software code which is publicly available in open source software projects and accessible through internet.

According to Sojer and Henkel (2010) the academic work regarding the code reuse in open source software phenomenon is in its beginning phase and therefore the phenomenon needs further research. This study contributes to that need of research. The study will not go into explaining or comparing different or possible business strategies that are based on ideology of open innovation or based on open source software. The study is therefore limited to only explaining basic categories of open source software products, and will not explain different strategy options or explain all the possible licensing conditions of open

source software products or open source software code. It is neither in the scope of this study to provide a full taxonomy of the categories of free open source software since this study is concentrated to commercial use of open source software code. That is, this study is interested in the reuse of software code and software components and how they can be used as resources in a firm manufacturing commercial software products.

According to University of Santa Barbara (2012) there exist over 60 different types of licenses considering open source software products alone, each with unique terms. Therefore it is impossible to cover all the possible open source software product types and their licensing conditions in the scope of this study. Therefore this study will not provide detailed list of different license terms applied in open source software products nor compare them with each other. The study is limited to presenting those prominent qualities of open source software products which enable others than authors of the software source code to reuse and modify the source code and to produce new software product on the basis of the publicly and freely available source code.

The study aims to have a say what is the role of open source software code in the competitiveness of a firm manufacturing commercial open source software. The study is limited to commercial reuse of the code and components of open source software products. The study handles the strategic meaning of reusing open source software code or software components for a firm operating in such a branch where software is a part of the end-product.

The study aims to provide information to its target audience, of how firms and entrepreneurs should manage their resources in order to create wealth, and to be competitive in relation to competition. This view of the study is not limited to the software industry and the illustration can be generalized to other branches of business too. The study also provides insight to those who are interested in the financing of start-up firms, and interested about investing into start-ups. This study introduces a dynamic capability approach which according to Teece, Pisano and Shuen (1997, 530) helps to understand how firms get to be good, how they stay that way and why and how they improve. The examinations of this study may therefore be especially interesting from the viewpoint of an investor or financer who is interested in the open source software phenomenon.

Ridder (2012) says that there is still much conceptual fuzziness regarding the concept of dynamic capabilities and the mechanisms by which they renew firm's resources. She also says that dynamic capabilities have been poorly specified. She says that most of the research conducted in the field of dynamic capabilities concern the internal sources of resource renewal and that the research on the external mode of dynamic capabilities is scarce, and that the contributions prior to her research have been made only in researching bilateral relationships such as alliances and acquisitions. She says that according to Laursen and Salter resources and operational capabilities that have been traditionally developed internally are now increasingly being accessed outside the firm's boundaries.

(Laursen and Salter 2006 in Ridder 2012). These notions of Ridder (2012) make this study very topical.

It is self-evident that the better the firm's ability to create wealth in every branch of business, the more interesting that firm is from the investor perspective, and the more reliable the firm seems from the perspective of financers. Barney (1991) provides a notion by Demsetz from 1973 saying, that a firm which exploits its resource advantages is simply behaving in an efficient and effective manner. Efficiency and effectiveness are qualities of a well-performing firm. It is clear that potential investors and financers are interested in the performance of the firm seeking investment or financing, also in a detailed level, interested in exploring the details of the performance and wealth creation ability of the firm.

From a viewpoint of a potential investor or financer, it is natural to be interested how the firm exploits its resources, and to be interested, if the resources utilized by the firm provide competitive advantage to the firm. Firm resources and their role are therefore in the core of this research. The study is interested of certain firm resources only, as a source of possible competitive advantage, and the role of those certain resources in creating wealth. It is the role of open source software code as the resource of the firm that this study will examine, and explore how it is or is not a source of competitive advantage, and may or may not provide for competitive advantage for a starting software firm. According to Wernerfelt 1984 resources have been found to be important antecedents to products and ultimately to firm performance (Saffu and Manu 2004). According to Barney (1991) not all resources are sources of competitive advantage.

Kyrgidou and Hughes (2010) refer to Foss et al. (2008) in stating that entrepreneurship scholars use the Resource-Based View (RBV) to analyze the resource characteristics, resource combinations and dynamic capabilities of firms (Foss et al. 2008 in Kyrgidou & Hughes 2010). This study falls into that specific category of research because this study examines a certain firm resource, open source software code, and unravels the mechanics, how this specific resource can form competitive advantage to the firm which uses open source software code as a resource in its production. The role of open innovation will be studied in this context. The study also provides ideas, how open innovation in software industry can contribute into the Finnish welfare state.

The report of this study will help investors to categorize and analyze the software start-up firms in order to make justified decisions. The study will also help entrepreneurs of software industry to recognize the characteristics which represent firm excellence. The study therefore also contributes into resolving challenges in access to adequate financing and helps software entrepreneurs in building up their marketing towards potential or current financers and investors.

Klein, Barney and Foss (2012) indicate that in order to achieve success and to create wealth, entrepreneurs must think like firms and firms must think like entrepreneurs. This study looks the entrepreneur and the firm from the per-

spective of Strategic Entrepreneurship and seeks to point out issues to what the entrepreneur should focus in the management of the new venture. The study is interested in software start-up firms whose software products are based in open source software code, in other words, based in to fruits of open innovation. The study also explains role of open innovation in the firm's pursuit of competitive advantage.

1.3 Research questions

The research questions are:

1. Does the reuse of open source software code, as a resource in private software manufacturing, provide competitive advantage for the software producing firm?

2. What is the mechanism of the mentioned competitive advantage, if it exists?

3. What is the significance of open source software as a resource for a software start-up?

4. How firm resources should be managed in order to create wealth, and to gain competitive advantage?

As suggested by Kyrgidou and Hughes (2010) firm's resource management and dynamic capabilities are fundamental components of Strategic Entrepreneurship. They suggest further research on these elements, and that is what this study does. The study also answers to a specific research question raised by Kyrgidou and Hughes (2010) to be one of the future research directions. Open source software code may be one answer to their question of

5. What specific firm resources facilitate or enable Strategic Entrepreneurship?

1.4 Research method and data collection

This study is concept research applying interpretative and descriptive conceptual research methodology, as described by Kansikas and Kyrö (in Fayolle, Kyrö and Uljin 2005, 125). They say that conceptual research looks for the meanings related to the concept and the interpretation is linked to the contextual factors. According to Kansikas and Kyrö (in Fayolle et al. 2005, 125) in descriptive concept research the ideas or actual writings of the authors interplay

dialectically with each other and lead to a new conceptual frame through reflective thinking.

Puusa (2008) says that using concept analysis as a research method in the field of business and economics is important, especially when researching those of abstract phenomena. She concludes that concept analysis can be seen as an independent research setting where the analysis of terms forms the core of the method. Puusa (2008) names this independent research setting as Concept Research and says that it is possible to compile methodologically qualified research without empirical part in the research, when the research is made by the method of concept analysis.

According to Kansikas and Kyrö (in Fayolle et al. 2005, 122) conceptual research consists of two branches – analytical and interpretative. According to Kansikas and Kyrö, the interpretative branch aims to find meanings included in concepts and their definitions in order to expand the understanding of that concept. They say that the interpretative research method is descriptive of its nature. The interpretative approach is also identified as one of the possible perspectives into analyzing a concept by Näsi (1980, 19). He discusses the scientific levels of concept analysis and lists 18 different perspectives of examining a definition while researching concepts, those presented by Robinson 1965. According to Kansikas and Kyrö interpretative research method emphasizes the further development of the concept and their definitions found in other writer's written texts. They say that the data in this method can be focused to the actual writing of the authors or more generally, to the ideas of the authors. (Fayolle et al. 2005). The data of this study consist of other authors' texts, added with the gathered personal information.

According to Kansikas and Kyrö (in Fayolle et al. 2005) descriptive method aims to increase the understanding of a concept by finding, describing and interpreting the entity of meanings. Takala and Lämsä (2001) say that interpretative concept research is a research which seeks meanings to terms and their definitions and interprets these meanings through a selected theoretical view. According to Lämsä and Takala (in Fayolle et al. 2005) the process is intuitional and rational. They say that this research method emphasizes more to interpretation than a strict concept analysis known from theoretical philosophy (Takala & Lämsä 2001, 4). According to Takala and Lämsä (2001) interpretative concept research seeks to expand understanding of a certain concept or term.

Puusa (2008) says, that through the knowledge attained in concept analysis, it becomes possible to understand both the meaning of a certain term, and understand the phenomenon to which the term refers to (2008, 37). Examples of those abstract phenomena which need to be analyzed through concept analysis, in the context of this study, are Open Source Software, Open Innovation and Strategic Entrepreneurship. According to Kansikas and Kyrö, contextuality and theoretical thematisation distinguish the interpretative branch from the analytical study, and justify it as a methodological alternative, and its use in human sciences. (Fayolle et al. 2005).

Näsi (1980, 8) describes a research branch of concept analysis where the reality and the process of describing the reality, become intertwined. He describes that in this view, the world of observer is what the concepts of the observer are. He says that concept analysis is forming concepts through analytical consideration, and forming synthesis through analytical consideration. He says that concept analysis can be made utilizing other, already known concepts, and creative recognition. Näsi (1980, pp. 10-12) says that the concepts produced through concept analysis can be descriptive, and also postulating. He says that when one forms consistent chains of thoughts, the result is thoughts which can be called as extrapolative. Näsi says that the results of concept analysis can be multiplicity varying and that the chains of thoughts as products of concept analysis can be recommending of their nature. Näsi (1980, 17) says that according Whewell, the ultimate criteria of the concept formation in scientific writing is the scientific fruitfulness. The analysis of concepts in this study includes both basic-level and meta-level analysis of the researched concepts, according to levels of analysis presented by Näsi (1980, 20).

1.5 Structure of the study

Teece et al. (1997, 530) say that researchers in the field of strategy need to join forces with researchers in the fields of innovation, manufacturing and organizational behavior and business history if they wish to unlock riddles that lie behind competitive advantage of firms as well as nations. This multidisciplinary study aims to response to the call of Teece et al. starting with an historical overview of Finnish economy, its special characteristics and its latest proceedings and contemporary challenges. The study therefore begins with describing the economical landscape of Finland and its special characteristics then shifting the focus towards its contemporary challenges, especially those related to entrepreneurship and the challenges of its financing. The objectives, scope and limitations of the study are then illustrated, following with the research questions and description of research methodology. The study then goes deeper to the theme of special characteristics of Finnish economy in chapter two and explains the historical pathway of those challenges the economy is facing today. The special case of Nokia and its magnitude for Finnish economy is then presented, as it illustrates the vulnerability of Finnish economy and the mechanism of resource re-allocation from the perspective of the economy. The study then goes deeper in discussing about the challenges of entrepreneurship financing and new venture creation in chapter three, introducing some Finnish special characteristics. Chapter four introduces the phenomenon of open source software and how the phenomenon is evolving. The logic of reusing software components from open source projects to create commercial products for the firm is introduced. It is also being introduced how software programs work and how they are compiled from lines of software code and from software components. It is also introduced that open source software is a special case of open innovation and explained

how the phenomenon of producing open source software results a public good and provides welfare benefits for the economy. Chapter five is devoted for describing the phenomenon of open innovation and to its special case, open source software production. In chapter six the study introduces the theme of Strategic Entrepreneurship and the resource-based theories of the firm, focusing especially to the theory about dynamic capabilities and to the process of wealth creation. At this point the theory of Resource-Based View of the firm (RBV) is challenged from the perspective of what can be said about open source software production and the dynamic capability of resource renewal. On the seventh chapter the study then will present the logic of how open source software code as a firm resource can provide competitive advantage for the firm.

As a result of the used research methodology, the analysis of the data and the constituting of a synthesis on the basis of the data become highly intertwined. This results that the findings of this study are reported directly in that original context where the data is presented and analyzed. This leads to accurate expression where the synthesis and findings are located in the original context of interpretation. Therefore the reader of this study should review especially chapters 4-7 to receive full information on the findings of this study. Chapter eight is a summarizing representation of the study's findings and answers the research questions in a concise manner also pointing out issues that a starting software firm should take into consideration when starting up its business. The ninth chapter then provides self-reflection of the study.

2 FINNISH ECONOMY – FROM CRISIS TO CRISIS

In 1980's when Nokia was starting its mobile phone manufacturing, Finland was defined to be "the Nordic Japan" or on other words "the Japan of Scandinavia". The juxtaposition was positive in nature and referred to strong economic growth compared to other industrialized countries (Kiander, 2010). As I remember it from late 1980's and early 1990's this juxtaposition also referred to Finland as a country producing products of modern technology likewise Japan was at the time known of producing the latest high-tech products in the field of home electronics. It is interesting how the paths of Finland and Japan as economies have, in a more concrete manner, traveled contiguously since 1980's. Both of the countries faced a serious economical recession in the beginning of 1990's. Many of the reasons leading to recession were same, for example serious over-appreciation in stock prices and real estate prices. In Finland the root causes were especially in the loosening of regulation policies in the field of financing, and the ending of long lasted export trade with Soviet Union, because of the collapse of Soviet Union. Since the bank crisis phase, the paths of Finland and Japan have, on the other hand, separated, and on the other hand, the two economies still share some mutual characteristics.

On the similarity side, both of the countries currently face the circumstance of declining dependency ratio in their economies, due the constant ageing of the population. That is, same challenges for same reasons. What differs in the paths of Japan and Finland is that Finnish economy recovered much more quickly from the depression, compared to Japanese economy. In Finland the branch of software manufacturing is the only product category where the amount of innovations has increased markedly since the recession period (Storhammar & Virkkala 2003). This highlights the importance of software industry for the Finnish economy. Storhammar and Virkkala (2003) note that the branch of software manufacturing is in a key role in many industry sectors, including telecommunication. They say that an increasing number of products in many industries include a software component and that software industry nowadays constitutes therefore as a success factor of many other branches.

According to Kiander Finnish economy started to recover 1993 (Kiander 2001, 67) when Japan started to recover 2004, (Kiander 2010, 6) that is, about ten years later. Some say that the emergence and growth of Nokia alone, the growth of its mobile phone manufacturing business, drew Finnish economy up from the swamp of serious economical depression. Kiander (2001, 67) verifies this at least partly, by saying that the most of the growth accumulated into Finnish economy after the recession period had its origins in the growth of Nokia and its subcontractors. According to Lehmusvirta, Nokia contributed 25% of the growth of Finnish economy during the time period between 1998 and 2007**.** Lehmusvirta (2012) also says that the significance of Nokia, of one single company, into Finnish economy, has been exceptionally high in the economical history of Finland.

The emergence and growth of Nokia might have been a pure strike of luck for Finland, but on the other hand, Finnish firms had already some track record of manufacturing those of high-tech products. The business area of mobile telephony had been developed from 1975 when Nokia established a partnership with Salora, which had experience in radio technology since 1928 and experience about manufacturing radio receivers and televisions for consumers and radio phones for military use, and for use in police and rescue purposes. (Toivonen 2012).

As recognized by Kiander (2001) a great deal of the growth accumulated into Finnish economy after the recession period it experienced in the beginning of 1990's had its origins in the Nokia cluster. Japan did not face this kind of strike of luck compared to its economy size and Japanese economy still suffers from the financial crisis encountered in the beginning of 1990's (Kiander 2010). It is not a far fetch to estimate that a major change in Nokia's strategy has some significant meaning to Finnish economy. The meaning of Nokia for Finnish economy distantly reminds us how big of a role the export to Soviet Union, was before the country collapsed. Mobile phone manufacturing and the changes in that business has also attracted a lot of media attention in Finland during the last two decades. It is natural because Nokia has been highly visible company in Finnish corporate landscape and Nokia's contributions into the Finnish economy have been enormous for more than a decade, and it has provided for many.

2.1 Resources released from Nokia's development cluster

The business of mobile phones manufacturing is known as fast moving and the industry as rivalry. February 2011 however will remain as exceptional in the industry's history. That's when Nokia's recently appointed CEO, Stephen Elop released his haunting message titled "burning platform". With that message Elop had informed Nokia staff that Nokia will abandon not only its current, but also its forthcoming software platforms under development, and adopt those provided by Microsoft. This was a strategic manoeuvre which captured media attention of the whole world's business press for several weeks.

From then on, if not earlier, the attention of every newspaper reporting about mobile phones industry, shifted into the core of the modern mobile gadget business, to the software component of mobile phones, smartphones and handheld computers. Nokia also revealed that it also was to abandon all its current software projects based on open source technology. Nokia chose closed software ecosystem over open ecosystem, and it was a shock for many.

Nokia's decision was a major change in the company's strategy and its implications have started to materialize as new products. The change has also resulted the closing of software development units in Finland (Talouselämä 18.12.2012). At the same time also Nokia's manufacturing units, assembly factories, have been closed in Finland. Thousands of people have lost their jobs, not only those in Nokia's payroll, but also amongst Nokia's subcontractor firms (Ammattiliitto PRO 27.4.2012) in Finland and elsewhere. Thousands of contemporary jobs have been lost (Michelsson 2011) but on the other hand, skillful resources have been released for new venture creation, and for other firms to use (Pietiläinen 2011). Those who have tried to see something positive in the enormous change around Nokia and look to the future have said that emphasis should be put into operationalization of those resources, to directing them for new production, instead of "crying after" what has been in the past (for example Salo 2011). At first, reactions to this kind of thinking were more or less pessimistic and attracted more of sarcastic comments than believing into bright future. However, as time has elapsed, more and more optimistic comments have been presented in public, by those looking to future and saying that the resources released from Nokia create potential to establish new innovative firms (Michelsson 2011).

Porter (1998) says that it is rational for resources to flow to where their productivity is higher. He says that freely mobile resources which move quickly and fluidly from industry to another on where their most productive use exists, are an economist's ideal. However he notes that resources usually are at their best use inside the same industry where they originate. He says (1998, 116) that innovativeness inside an industry can often boost the productivity of the resources much more than the reallocation of the resources to another industry. This refers to that for example resources released from an incumbent of software manufacturing are at their best use inside the same industry, that is, in the branch of software production.

According to Porter innovations are most necessary when current profitability is weakened for reason or another. Porter (1998, 116) has found out that nations in which resources were rapidly deployed from one industry to another when the conditions of industry became difficult, the industry receiving the resources rarely have become internationally successful. This is another reason why the resources released from Nokia's software development cluster should be reallocated inside the Finnish software manufacturing industry. Otherwise the competitiveness of Finnish economy is likely to be weakened. In the contemporary conditions of globalization another consideration is that resources of software industry may move quite fast to another countries and economies

from Finland, if the industry actors at Finland are unable to internalize and take advantage those resources at disposal, for example those skillful resources released from Nokia and its development cluster partners.

Actually, some resources "released" from Nokia have already materialized into start-up firms. It is reported that over two hundred start-up companies have to date been founded by those human resources "released" from Nokia's service (Alhonen 2012). It has been also reported that Nokia also has released some of its Immaterial Property Rights, in order to help laid-off ex-Nokians to be able to found start-up companies, based on the technology which no longer is not in the core of Nokia's strategy (IT-Viikko 27.4.2011). One of the firms exploiting these Nokia's abandoned resources has been the newly established mobile phone manufacturer Jolla (Cutler 2012). The information about the details of this Immaterial Property resource releasing however remains controversial (Roivas 2012; Souppouris 2012). It is clear, that if Nokia does not release the patents which it does not use itself, for other to exploit, this will create Dead-Weight Loss into the economy, and restrain growth.

This issue of resource-mobility between firms and industries is actually very topical in the Finnish economy, also elsewhere than around Nokia. Sitra, the Independence Fund of Finland is following an example from UK, China, Brazil and Belgium, and is starting a development program called National Industrial Symbiosis Programme in March 2013. The program aims to enhancement in the use of resources, both material and immaterial resources and will start as a regional program in the area of Jyväskylä. The basic idea of the program is that someone's waste is a valuable resource to someone else, their paths just have to meet. The amount of waste can thus be reduced and the occurring resource needs to be served better and with a lower cost. The bulletin of the programs takes some examples of the resource classes which are in the scope of the program saying that the use of for example resources as wood, plastic, know-how, food waste and waste heat could be enhanced through the program. Sitra aims to gain 40 million EUR of benefits annually through the program. In UK the benefits have reached benefits of 400 million EUR annually after 10 years of application, and over ten thousand jobs have been created or sustained there through the actions of the program. (Sitra 2013).

2.2 Latest structural changes and Nokia's significance for Finland

Nokia's case raises firm resources into spotlight. Some resources, especially those of human resources, became at disposal for others to use, as Nokia decided in February 2011 to release them from serving the old and abandoned strategy. Also the software platforms which Nokia decided to abandon in its strategy change, have to date became resources for others. The discussion of this study will link to those resources, because it is this study's focus to unravel how firms and entrepreneurs use resources to build up businesses, for wealth creation, and what is the role of firm resources in achieving growth, wealth

creation and competitive advantage. The meaning of Nokia for Finnish economy has been very significant during the last two decades. The resource aspect of Nokia's strategy change will therefore be discussed further after introducing Nokia's meaning for the Finnish economy.

The manufacturing of portable telephones under Nokia brand started 1987 in Salo, Finland (Toivonen 2012). Before that Nokia had already been manufacturing portable telephones, radiophones and car-mounted telephones under Mobira brand since 1979. Mobira was a joint venture between Nokia and TV-set manufacturer Salora, and also that manufacturing took place at Salo (YLE 2012).

It has been calculated, that Nokia contributed 25% of the growth of Finnish economy during the time period between 1998 and 2007 (Lehmusvirta 2012). Nokia created a cluster of mobile phone manufacturing to Finland which pulled Finnish economy up from the swamp of serious economic recession, which Finland faced 1990-1993. About 10 after that, Nokia's subcontractors started to move their manufacturing to countries of cheaper labor. In 15 years, from 1993 to 2008 practically all the hardware manufacturing of Nokia's subcontractors had been shifted to developing countries. (Mikkonen 2006; Korteila 2008; Ihanus 2012). Nokia itself kept some of its manufacturing in Finland, and especially, Nokia kept many R&D functions in Finland. This was however to change, too. In February 2011 Nokia had many units in Finland which were concentrating to develop the software components of its products. Software component here refers to the operating system and other non-hardware components of Nokia's mobile phone products. In addition to its own labor, Nokia also bought software development from its subcontractors. In 10 years or so, from 1993 to 2003 there had been developed a new subcontractor cluster into Finland which was seeded by Nokia's mobile phone manufacturing business. The phenomena of manufacturing hardware as a subcontractor for Nokia had been replaced by manufacturing software as a subcontractor. This cluster, too, however was to face a serious setback.

The latest changes in Nokia's strategy serve well as an example what a change of strategy means in practice. Nokia's case serves as an example of the influences which a firms strategic decision may have – not only those to competitors or products, but those to staff, to subcontractors, to political climate, or even to an entire economy, as experienced currently in Finland.

Previously not so visible part of Nokia's operations, to average citizen, became extremely visible in February 2011. That's when Nokia made a decision that it will abandon not only its current, but also its forthcoming software platforms under development. Few days later Nokia announced that it is to adopt the operating system provided by Microsoft, and use Microsoft's operating system in its future products as well (Nairaland Forum 19.2.2011). Nokia also announced that it starts to develop mobile phone software together with Microsoft, and said that this is an establishment of a strategic partnership between Nokia and Microsoft (Sorrel 2011; Nokia 2011).

In its strategy change Nokia also revealed that it also was to abandon all its current software projects based on open source technology. Nokia chose

closed software ecosystem over open ecosystem. From then on, if not earlier, the attention of every newspaper reporting about mobile phones industry, shifted into the core of the modern mobile gadget business – to the software component of mobile phones, smartphones and handheld computers.

When the news from Nokia's strategic manoeuvre spread globally, the whole Finland, if not the whole world, seemed to be talking about software platforms and about if closed vs. open software was a right strategy for a mobile phone manufacturer. The media coverage around Nokia was intensive and the news heard were interpreted as a serious setback for Finnish economy (Ammattiliitto PRO 8.2.2012; Michelsson 2011; Ovaskainen 2011). Thousands of jobs where said to be at stake (YLE 11.2.2011; Uusi Suomi 17.2.2011; Michelsson 2011) – at Nokia itself and amongst it subcontractors, especially those involved in Nokia's software development (Lukkari, 2012b).

In November 2011, less than year after the strategy change was announced, it was reported that Nokia's subcontractors in Finland had been laid off over one thousand people (Lukkari 2012a)**.** Hundreds of layoffs more have materialized after that, and also some entire development centers have been shut down, of those once supported Nokia's software development as subcontractors (Peltoniemi 2011; Talouselämä 18.12.2012). However, positive signals also begun to appear. Alhonen (2012) says that small and medium-sized (SME) firms have, in less than a year, recruited almost one thousand professionals who previously were released from the service of the electronic manufacturing industry. He says that in addition to that, many international firms operating in Finland have exploited those lately released resources of Nokia in inflating their operations in Finland. Alhonen also introduces that Nokia has a program, which has helped ex-Nokians to establish new firms, and that over 200 of those start-ups have been founded to Finland. University of Tampere (2012) has also announced a new program, to "re-establish Finnish ICT-industry" and has hired to this project professionals lately released from Nokia. Professor Raisamo, leading the project, says that the project's impact to society is high. He says that experienced ex-Nokian people establish new start-up firms through the program, and also in other ways impact to economy, for example by forming new operative procedures and providing growth potential to the whole Finnish industry, as a sector of economy. Raisamo expects the project work as a significant change agent for Finnish ICT-industry. (University of Tampere 2012). These proceedings illustrate, how resources releasing from one firm can lead to growth and positive outcomes for the economy, and for other firms.

2.3 Contemporary challenges in entrepreneurship financing

Global credit crisis has had severe impacts on the financing of firms, during the time period of 2007-2011, as observed by OECD (2012). According to OECD (2012) small and medium-sized enterprises (SME's) have suffered a double shock in the contemporary financial crisis. They have suffered from de-

creasing demand, and at the same time they have suffered from difficulties of receiving adequate financing. This according to OECD has lead to bankrupt of firms and severe employment in many OECD countries. The OECD report (2012) says that importance of SME finance has been widely recognized especially after the G20 leaders meeting held in Pittsburgh 2009, where it was acknowledged that access to finance provides growth opportunities to both firms and economies as a whole. The need to address the financing obstacles has also been underlined by G8 leaders in their Deauville summit held in 2011 where OECD among other institutions was invited to indentify obstacles of SME growth and including the financing issues.

OECD (2012) reports that the credit conditions faced by Finnish SME's were more difficult than those faced by larger Finnish firms, and lending to SME's had not returned to same level by the year 2010 that it was before the global credit crisis begun 2008. According to OECD (OECD 2012) 99,4% of all firms in Finland are SME's and they employ about 60% of the labor force. That's why the obstacles in access to adequate financing are of special importance to Finnish economy as a whole. According to OECD over 83% of Finnish SME's are micro-enterprises employing less than 10 people and having turnover under 2 million EUR. In all, OECD reports that in Finland larger firms experience less liquidity problems and solvency problems than smaller firms, and that especially firms employing 5-9 people were facing dramatically more insolvency situations in 2011 than before the crisis. (OECD 2012). This again highlights the importance on research which contributes to tackling the financing challenges of small firms. It is self-evident that start-up firms are always small firms in the beginning. Issues mentioned above confirm that it is well justified to conduct a study which aims to help financers and investors to recognize, which firms have the characteristics of a potentially successful venture.

Biggest challenges in attaining financing seem to be in providing adequate collateral for the lender, to secure the lenders funds. Credit crisis also impacted to firms as cash flow problems, problems in facing heavy competition, and the challenge of finding customers. (OECD 2012). Decline in venture and growth capital investments from 2007 to 2010 is categorized as drastic by OECD, with a notion that in 2010 the amount of total investments had not yet regained its pre-crisis level. Bankruptcy proceedings increased from 0,9% to 1,2% which according to OECD (2012) reveals the impact of global credit crisis and the lack of liquidity on the Finnish firms. (OECD 2012).

3 CIRCUMSTANCES FOR ENTREPRENEURSHIP AND NEW VENTURE CREATION IN FINLAND

It has been described in previous chapters how important entrepreneurship and economic activity are for an economy. It is in this study's scope to look at the entrepreneurs as an actor of Finnish society and economy. Berglund and Wigren (2012) consider entrepreneur as an actor in society who creates growth by introducing a new product or service on an already existing market, or by establishing a new market. This view of entrepreneur as an actor is same how Davidsson (2008) sees entrepreneurs as actors in economy. Peverelli and Song (2012) say that these actors are the ones who create, discover and exploit value-adding opportunities. Shahidi and Smagulova (2008) say that an entrepreneur is a possessor of necessary skills, qualities and knowledge who applies them in order to get the desired outcomes, particularly goals and values. Creation of wealth surely is one of the desired goals of economic activity. Wu (2007) has researched Taiwanese high-tech start-up's and says that resource accumulation is crucial in determining the success of a start-up firm. The process of wealth creation through managing resources strategically is presented in the chapter 4.

The literature highlights the importance of financial stakes in entrepreneurial activity to occur. One must have money at disposal, money in some form at hand, to be able to start a business and start as an entrepreneur. It is in scope of this study to present which kind of circumstances a starting venture should achieve in order to get started and in order to be potentially successful in wealth creation. The access to adequate financing in terms of investments, loans and other sources of financing can be seen as a very important barrier of entry to any branch of business, because access to financing is an obstacle in the pathway of starting a new venture. Mann (2006) says that availability of venture financing affects the ways open source firms enter the market. According to him the business model of the start-up has a central effect to how interested potential financers are to finance the start-up. He says that some of the most interesting startups are not making open source products, but rather are strategically capitalizing on the tension between proprietary and open source development

models, for example acting as distributors of special proprietary or quasi-proprietary versions of traditional open source products.

3.1 The issue of money

Nesheim (2000, 39) says that the founders of a new high tech venture must have a strategy for attracting investors. M. Parviainen (personal notification 20.1.2013) says that to attract investors, a firm should include such individuals in the team who can communicate to potential investors, what is the firm's strategy, and how it is to be achieved. He says that the start-up team should include an individual who can explain how the firm's strategy can be seen in the numerical information of that firm. According to Nesheim (2000, 35) the founders should write a business plan which tells how the founders plan to turn their vision into a sustainable competitive advantage. The search for sustainable competitive advantage is in the very heart of this study.

In case of start-up and its founding team Parviainen highlights the need for effective presentation skills and persuasive communication skills and highlights the need for an individual who can assure and attract investors by his marketing communications (M. Parviainen, personal notification 20.1.2013). Parviainen therefore highlights the effective and persuasive communication of the business plan. Parviainen is investment professional working in United Arab Emirates and CEO of Devenir Ltd based in Finland. Nesheim (2000, 38) says that some investors make their decisions almost solely depending on the team, on the people leading the start-up. He says this derives from a risk management perspective. According to Nesheim (2000, 38) investors see that if everything else goes wrong, a good management team can recover and make at least something useful of what otherwise would be a wipeout. Parviainen says that a professional investor is investing to both to the team and to the firm. He sees the team as an important issue, and admits that investors are usually highly interested on the team members and their reputation, and especially on their professional track-record, what they have done and achieved previously. (M. Parviainen, personal notification 20.1.2013). Wu (2007) refers to previous research and says that numerous researches indicate that the work history and experience of the entrepreneur are crucial for entrepreneurial success, but also says that numerous other resources have also to be in place in order the venture to be successful. He says that entrepreneur's relation-based networks are crucial for acquiring the requisite complementary resources and capabilities. Wu also acknowledges that the entrepreneur's partners seek economic benefits too, and therefore their willingness to co-operate with the start-up entrepreneur becomes linearly greater as the entrepreneur's own resources, such as financial and physical capital, become greater.

Mann (2006) says that some firms have obtained venture financing after their open source product was distributed, modified, and already a market success. He says that usually the innovative activity precedes the financing. He

says that this in contrast to the financing model for firms pursuing proprietary software strategies, where according to Mann little or no development or deployment is likely to occur before first financing.

3.2 Other than financing related roadblocks of new venture creation and entrepreneurship

The need for entrepreneurship and new ventures is a popular topic in contemporary Finnish politics and in the public discussion. Many Finnish Members of Parliament (MP) have over the years also recognized obstacles for new venture creation and reasons why Finnish people do not tend to start as entrepreneurs. The obstacles include but are not limited to access to adequate financing. Many MP's have recognized that the welfare benefits of an entrepreneur are much less compared to a payroll worker (Nylander 2004; Lauslahti 2007; Jaskari 2011). The difference and inequality especially materializes in case of unsuccessful entrepreneurship period, in case of failure of the business. At the moment a person who starts as entrepreneur, loses the possibility to receive many of the welfare benefits available to other members of Finnish society, such as the right for wage for in case of illness, and paid holidays. There are also several obstacles in receiving an unemployment fee after starting as an entrepreneur. (Jaskari 2011). Ramos (2009) has identified same kind of obstacles in USA and recognizes the important role of entrepreneurs for the economy of United States. He recognizes the individual's need for economical security and proposes that the unemployment benefits should be expanded in such a way that those unemployed could explore entrepreneurial options without losing the right for their unemployment benefits. He also mentions such an idea that government should consider providing similar healthcare rates and services to new entrepreneurs that it provides for government employees, to boost entrepreneurship in USA and to solve the personal economical security issue of an unemployed person. (Ramos 2009).

4 OPEN SOURCE SOFTWARE AND THE PHENOMENON SOFTWARE CODE REUSE

Kumar et al. (2011), Fitzgerald (2006), Välimäki (2005) and IDC (2013) among others have recognized that the phenomenon of open source software development has transformed the basic nature of software industry. Madey, Freeh and Tynan (2002) see the open source software phenomenon as a threat for traditional proprietary software business strategies. Schiff (2002) says that open source software (OSS) has the potential to fundamentally change the economics of software industry. Goldman and Gabriel (2005) say that the old model of closed source software manufacturing has been broken down. They say that the newer model is to look for innovations wherever they might pop up a use them carefully by layering on unique value. They say that the "game" in software market is more and more being connected rather than about domination. However many firms still trust to the old closed source system and produce fully closed proprietary software, but as it has been noted, open source software production model is challenging the old model all the time, and it has already proven to be successful. Goldman and Gabriel (2005) say that firms need to find ways to use outside innovations and to become part of a distributed fabric of innovation through a combination of licensing and well-chosen gifts. Gifts may be directed for the OSS community of user-developers as well as for non-developer users of the software.

Gartner (2013) expects open source software to continue to broaden its presence during the next three to five years and create pressure towards the leading firms of software market. Gartner says that this is happening especially because open source is becoming a key element of the software quality landscape as open source software is expanding beyond developer level, attracting corporate and consumer customers, and software manufacturing firms. Gartner is the world's leading information technology research and advisory company based in USA. In 2007 Gartner (2007) said that the phenomenon of open source software is impossible to avoid and that incumbents of IT industry should prepare that OSS products will have affect to them and to the software market. In 2007 analysts of Gartner predicted that at least 80 percent of commercial soft-

ware will contain open source code by 2011. IDC (2013) says that open source has significantly impacted to commercial firms in the software industry, and says that nearly all software markets are being impacted in some way by the open source software movement (IDC 2013). IDC (International Data Corporation) is a global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. According to Kumar et al. (2011) the direct revenue of OSS market will reach 8.1 billion dollars by 2013. They also say that open source software no longer serves only as a substitute for proprietary software, and say that open source software is increasingly being integrated into a wide range of commercial products. This study is particularly interested in the combination of open source software and commercial software. Commercial Open Source Software (COSS) is defined and explained in chapter 4.5 after first explaining the phenomenon of open source software development.

4.1 How a computer program (software) works

When speaking about software and its source code it is good to understand how a computer program, software, works. According Finnish Centre for Open Source Software the source code of a computer program includes the commands which make the computer to work in certain manner. Usually the source code has to be compiled into a performing form before the program can be used. Without the source code a human being could not notice the commands and interpret how the program works. The source code is the key to understanding how the program works. (Centre for Open Source Software 2013). Schiff (2002) provides an expert level explanation and also opens up the differentiation between open source and closed source software:

> The source code of a computer program is the instructions for the program, written in a human-readable format, usually following the syntax of a high-level programming language such as C or Perl. Instructions in source code cannot be directly executed by a computer and must first be run through a special program called a compiler which produces machine-readable binary or object code. While source code can easily be read, understood, and modified by a programmer, it is very difficult to understand binary code, and even more difficult to modify it. For this reason, a program only distributed as binary code is called a *closed source* program. A program where the source code is distributed and can be freely modified (without payment of a royalty or fee) by other programmers is, loosely speaking, called *open source* software.

4.2 Defining Open Source Software

According to Madey et al. (2002) open source software is by definition software for which users have access to the source code. This distinguishes it from the common practice of commercial software publishers who only release the bina-

ry executable version of the software product. Osterloh and Rota (2007) say that in the phenomenon of open source software, software programmers place their software at the free disposal of other users and developers. The software and its source code are published on the internet and anybody interested can download them for free. Goh (2005) differentiates open source software from commercial software, but says that the models are not mutually exclusive, and that firms are increasingly finding ways to embrace both approaches and allow them to co-exist. His definition of open source software is the following:

> "Open Source" is a software-licensing model where the source code of the software is typically made available royalty-free to the users of the software, under terms allowing redistribution, modification and addition, though often with certain restrictions.
>
> Open source programs are often, though not exclusively, developed through a collaborative effort in which a number of persons contribute elements of the final software. Software companies are also contributing paid programmer time and programs developed in-house to the open source community.

By this definition open source software products are non-commercial products, in contrast to commercial software, which Goh defines as follows:

> "Commercial Software" is the model where the software developed by a commercial entity is typically licensed for a fee to a customer (either directly or through channels) in object, binary or executable code.
>
> The source code of the software may be made available to certain users of the software through special licensing or other agreements, but is usually not distributed to the general public, and may not be copied or modified except in a manner provided for in such agreements.

Osterloh and Rota (2007) say that open source software is an information product, produced by and for users, with a highly modular design that makes parallel work of many distributed developers possible. According to Lee (1999) the software program must include the source code, and the free distribution of the code must be allowed as well as free distribution of the program in a compiled form, in order the program to be categorized as open source software. He says that *free* here means a condition of free from constraints, not necessary free of cost. Madey et al. (2002) say that most open source software is distributed at no cost with limited restrictions on how it can be used, and say that open source software is free and open. They say that *free* in many context considering open source software means 1) free of cost and 2) freedom to do what you wish with the software, and especially the freedom to read the source code of the program. Lee (1999) says that the license of open source software must allow modifications to be done and derived works to be produced, and it must allow the free distribution of these modifications and derived works. (Lee 1999, pp. 10-12). Some license conditions, such a BSD license, also provide the possibility to charge royalties of the distribution of the modified software (Välimäki 2005, Mann 2006). This makes it possible for a commercial software producing firm to use the work of originally free-of-charge software as components of their com-

mercial product. This again makes possible a royalty-free exploitation of software code as an asset for further developed software products. This is an example of sharing the fruits of innovation free-of-charge, that is, without paying royalties to the developers of the computer program. The phenomenon has been recognized for example by Harhoff, Henkel and von Hippel (2003). Kumar et al. (2011) name this phenomenon as a private features market, where a firm can freely use any open source features and include them in its software product without restriction. Some license conditions however require the firm to release feature improvements to the public, for free. Kumar et al. (2011) name this phenomenon as shared features market.

According to Lee (1999) the license under which the software is distributed, must explicitly permit the distribution of software built from the modified source code so that the software meets the criteria of open source software. He says that the software program must be distributed under some certain open source license in order to be defined as open source software. (Lee 1999, pp. 10-12). Mann (2006) says that to qualify as an open source license, a license must receive a certification from the Open Source Initiative (OSI). Open Source Initiative is a non-profit organization enjoying the trust of the worldwide open source software developer's community. Mann (2006) says that in order to become certified as open source license it must meet a set of minimum requirements designed to ensure that software is distributed with its source code and that it is reasonably available without constraint to developers and users who wish to use or modify it for their own purposes. OSI (Open Source Initiative 2012) says that its role is to steward and maintain the Open Source Definition, and act as a community-recognized standard body which reviews and approves open source licenses as Open Source Definition conformant. The criteria and definition of Open Source, the Open Source Definition by OSI, is attached as Appendix 1. According to Finnish Centre for Open Source Software, which says it is regarded one of the Europe's oldest and most active open source competence centers, the definition of OSI regarding OSS is the dominant definition and it is used widely in the business contexts.

According to University of Santa Barbara (2012) there exist over 60 different open source software licenses, each with unique terms. It is not in the scope of this study to explain in detail what kind of detailed terms this vast amount of licenses contains. From the perspective of this study it is enough to realize the fact that there exist such open source licenses which allow the reuse of the source code of an open source software program and allows the other than its original authors to form derivative works out of the source code, and to distribute those derivative works, and charge payment of those derivative works. Välimäki (2005, pp.151-154) provides examples of such permissive licenses. According to him BSD license achieved the status of open source license in 1999 and says that there exists also other permissive licenses such as MIT license, Apache license and Artistic license.

The findings of Haefliger, von Krogh and Spaeth (2008, 185) show that software developers predominantly reuse software components. In many cases

this reuse can be done free of charge and in conditions of minimal constraints, or in conditions where the modifier is free of any constraints. The existence of these distribution conditions of free revealing of innovation have been acknowledged by many authors, for example Allyn & Mishra (2011) and Harhoff, Henkel & von Hippel (2003).

4.3 Open Source Software as a public good

Osterloh and Rota (2007) say that the distinguishing mark of the innovation model of open source software is that economic actors, individuals and even commercial firms, invest their private resources to produce a public good. According to Osterloh and Rota (2007) open source software programs constitute a public good in its classical sense because nobody can be excluded of using the source code of the program once it is published. However, when looking this issue in detail, a certain reservation has to be made, because the detailed terms of different open source licenses differ from each other.

Osterloh and Rota (2007) describe how the traditional private investment model works. They say that private investment in innovation is furthered if inventors can appropriate the returns on their investment. Therefore, inventors will try to avoid knowledge spillovers as far as possible, and society may grant intellectual property rights to the inventors in the form of patents, copyrights, and trade secrets. These conditions create a phenomenon of Dead-Weight Loss (DWL) which represents an inefficiency of resource usage in an economy.

According to Takalo (2010a) the benefit of granting Immaterial Property Rights (IPR) in the economy is that it provides an incentive to innovate for the actors of the economy, for firms and as well as for individuals. But accordingly, the cost of applying Immaterial Property Rights, for the economy, is Dead-Weight Loss. According to Takalo (2010b) Dead-Weight Loss is a result of that the owner of Immaterial Property (IP) seeks to maximize its profits. As neoclassical economics expects perfectly functioning markets, the Dead-Weight Loss means a situation where the availability and diffusion of a certain resource, such as knowledge, is imperfect, a situation where the perfect availability of a knowledge resource is artificially limited of becoming a public good. As Osterloh and Rota (2007) also acknowledge, the collective action model on applies to the production of public goods. The collective production method provides the collectively produced goods to available of all actors of the economy and the products as well as knowledge related to the products become public goods.

Since the open source software and its source code are public goods one is able to make an implicit conclusion that the producing of open source software, instead traditional closed source software, induces welfare benefit for the society. The production of open source software therefore provides a solution to the theoretical problem of Dead-Weight Loss which occurs in the theoretical discussion of Industrial Organization. This happens due to that the sharing and

spreading of information, knowledge or resources is an opposite for restricting the sharing of them. The open source software phenomenon represents the free sharing of information, knowledge and such resources in an economy and in a society, whereas granting the ownership of information or knowledge resources through Immaterial Property Rights represents the restricting the free flowing of resources in an economy. It is therefore suggested here, that the production model of open source software might induce economical growth due the characteristics of the open source phenomenon, and help solving the Dead-Weight Loss problem. This notion is at least implicitly backed up by the findings of game-theoretical approach by Kumar et al. (2011, 1076) as they find that a licensing condition of mandatory sharing may benefit consumers and firms. Because the open source software production phenomenon is a global phenomenon of its nature its economical effects are not limited to a certain domestic economy, but provide the solution to the DWL problem in a global scale. Mustonen (2002, 116) finds out that it is the act of informing customers about a substitute open source software product that launches the increase of welfare in a society. In other words, if consumers are not aware of OSS products the welfare benefit does come into realization. The awareness of consumers regarding open source software products has developed a lot from the days of Mustonen's study. The development of recent years in mobile phone industry has raised the awareness of the open source phenomenon and open source software products among Finnish consumers. Therefore, the act of informing might not be as relevant today as it has been at the time of Mustonen's study, in 2002. This issue will be discussed further in chapter 4.8.

While open source software development benefits the society, and the economy, it also benefits software firms. Buytaert (2012) says that the collaborative philosophy of the open source model delivers significant business benefits in terms of cost savings and speed to market. He says that open source's potential for delivering significant savings to the bottom line of a firm, resulting from the lack of software license fees, has become recognized by organizations around the globe and validated by independent research. He says that open source software development also delivers faster and cheaper innovative solutions to business problems because the members of an open source community share the code and are able to create better software through collaborating. The benefits therefore realize through saving time and money.

4.4 Open Source Software development – a evolving phenomenon

Von Hippel and von Krogh (2003) say that open source software development projects are internet-based communities of software developers who voluntarily collaborate to develop software that they or their organizations need. They say that open source projects are becoming a significant economic and social phe-

nomenon. Von Hippel and von Krogh (2003) say that in the phenomenon of open source software development users of the software develop the software to solve their own technical problems as well as technical problems shared by the community, and freely reveal their innovations without appropriating private returns from selling the software.

Healy and Schussman (2003) say that the phenomenon of open source software development is partially a social movement with idealistic principles and goals, partly a formal organization with an intensive schedule and innovative products, and partly a volunteer network of developers who contribute to the development by donating their time and energy for the OSS projects. Osterloh and Rota (2007) say that Benkler (2006) indentifies commons-based peer production as mode of production, where large aggregations of individuals independently search for opportunities to be creative. (Benkler 2006 in Osterloh & Rota 2007). Dalle and David (2003) say that individuals engaging in open source software development may contribute to the OSS projects because they want to solve an instant need of certain software functionality but also for regarding themselves as belonging in to the open source movement. Osterloh and Rota (2007, 209) refer to Chesbrough and Appleyard 2007, Dahlander and Magnusson 2005, Fitzgerald 2006, O'Mahony 2003 and Ven and Verelst 2008, and note that firms collaborating in open source software projects are enabled to capture, elaborate on and capitalize value created outside the company, but may also be obliged to contribute to value creation in the projects, which means a condition that their invested resources are out of their direct control. Osterloh and Rota (2007) say that this development towards peer production opens up a new role for the firm as a peer where the resources invested by the firm will be boosted by community-related benefits in the form of economic or social value.

Open source software is mainly produced as peer production. According to St. Amant and Still (2007) peer production is a horizontal distributed method of co-operation, creative labor generally facilitated with high levels of communication, information and file sharing via the internet. Panchal (2009) says that the dynamics of co-evolution of product and community structure is not completely known despite the studies made in the field of open source software development. A proposition of the structure of developer communities is illustrated in figure 1.

Dalle and David (2003) say that in open source software production there exist co-operative communities which organize the production and regulate the quality of the outputs that will be used not only for their own internal purposes, but by also others with quite different purposes too. Kuvabara (Kuvabara 2000, in Dalle and David 2003) describes the peer production as follows:

> Anyone is welcome - the more people, the louder the clamour, the better it is. It is a community by the people and for the people, a community for all to share and nurture. It also appears chaotic and unstructured, a community where no one alone is effectively in charge of the community.

Välimäki (2005) recognizes that the worldwide community of open source software developers is a network of communities where exists different schools

of thought. Välimäki names these as camps of the OSS developer community. A modified interpretation of Välimäki´s idea is illustrated in the figure 1. In open source software development individuals gather around the software development projects. Developers gather around OSS projects to solve technical problems and develop better software for themselves, and to establish connections to other developers. The projects can thus be thought as camps in a community. The project is the core of the camp, like a fireplace of the camp, around which the developers gather. Camps form the community of the open source movement which is a network of open source software developers. The network can be multilayered and individual developers can have participation in several sub-communities and several camps at the same time. The structure of sub-communities and their camps can follow the OSS project structure.

In figure 1, A and B represent two different communities of developers. Members of community A may for example work around development of Linux and community B may for example work around development of Apache. These communities are sub-communities of the worldwide open source software developer network. C and D represent groups of individual developers (camps) within developer communities. The camps may work around a certain sub-component, of Linux and Apache software products. Lines (E) between triangles in the figure represents the connections between individual developers to each other, and connection lines outside the sub-community (F) represent the linkage of a sub-community to the worldwide developer's community, the network of OSS developers.

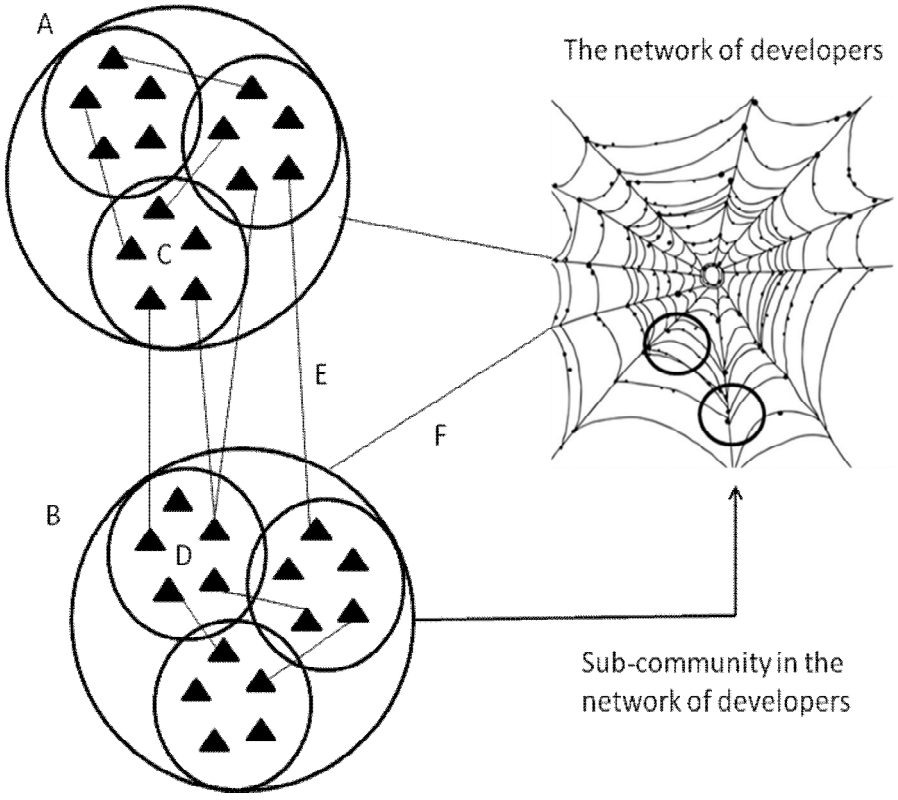

Figure 1. Structure of the network of open source software developers

Schiff (2002, 72) says that some advocates of open source movement such as Eric Steven Raymond (2000) argue that open source development is a superior model of software development in terms of the speed of development and the fixing of bugs of the program, due to the large number and high motivation of open source programmers. Particularly the speed of development is an interesting quality of open source software development from the perspective of this study. Also Madey et al. (2002) report that open source development has been recognized by many authors (Jorgensen, 2001; Koch, 2002; O'Reilly, 1999; Raymond, 1999; Sharma, 2002; Stamelos, 2002; Wang, 2001; Wu, 2001) to produce more bug-free code, faster than closed proprietary developed code is produced.

From the point-of-view of traditional business logic the phenomenon of open source software development by networked enthusiasts without getting paid what they do, seems very odd. The note of Storhammar and Virkkala (2003) makes it even more amazing. They say that in Finland there have been many starts of networking and inter-firm collaboration in the software industry, but according to them nothing special has evolved from these proceedings. The result has been that the firms have not started to interconnect enough and the result of aspiring networking between the firms of software industry has been a shortfall. Especially, there has not evolved actual strategic collaboration what would be needed in product development. (Storhammar & Virkkala 2003, 76). This speaks for the strength of closed and proprietary software development as a business model. At the same time however tens of thousands software developers network globally and get interconnected to each other, and not even geographical distance has not been an obstacle to that. This makes the phenomenon of open source software development well worth of investigating.

The notion of Kogut and Metiu (2008) reminds the importance of internet for the open source software phenomenon. They say that open source software development is a production model that exploits the distributed intelligence of participants in internet communities. Goldman and Gabriel (2005) say that typical open-source project uses a web or other internet site as the repository for the source code, documentation, discussions, design documents, bug and issue lists, and other artifacts associated with the project. They say that often a project will be broken into modules, which can be thought of as logical or conceptual wholes, and a module owner is assigned to each. The module owner is in charge of inspecting proposed source changes and deciding whether to accept them or not. In many open-source projects, the overall owner and the module owners are the primary contributors while others contribute a small percentage of the work. In general, debugging through use is the significant source of contributions from the larger community. (Goldman and Gabriel 2005). The module structure recognized by Goldman and Gabriel (2005) is in line with the illustration attempt presented in figure 1.

According to Open Source Resource Center of Black Duck Software based in United States, there are hundreds of thousands of open source projects and billions (thousands of millions) of lines of source code available on the internet (Open Source Resource Center 2013). The listing provided by Ohloh

(www.ohloh.net) says that there exist currently 582.627 open source projects in the world (Ohloh 2013). Ohloh is an internet site collecting data of open source software projects and their developers, maintained by Black Duck Software. According to Saastamoinen who represents Finnish Centre for Open Source Software, many of the projects may however not be active and many of the projects may also be hobby projects of one person (M. Saastamoinen, personal notification 4.3.2013). According to Schiff (2002) there are tens of thousands of open source developers worldwide contributing to open source software development. The listings of Sourceforge and Ohloh provide such information that the total amount of OSS developers in the world ranges from a little over 2 million (Ohloh 2013) to 3,4 million (Sourgeforge 2013) developers. Saastamoinen (2013) says that it is difficult to provide a definition for an "active developer" and therefore it is difficult to estimate the amount of active OSS developers. Saastamoinen estimates that the numbers that Sourgeforge and Ohloh provide do overlap at least partially, regarding the presented number of projects and number of developers. He also thinks that many of the users mentioned in the numbers of Ohloh and Sourceforge might be users which haven't made any contributions, and users which haven't been confirmed, identified to certain person. (M. Saastamoinen, personal notification 4.3.2013). Most popular and active OSS projects, and most active contributors according to database of Ohloh (2013) are presented in appendix 2.

According to von Hippel and von Krogh (2003) the number of users of the software produced by open source software development projects range from only few users to many millions of users per project. Buytaert (2012) takes Drupal, an open source web content management platform as an example of large open source software project and reports that it is supported by a collaborative, international community of 16.000 active developers and hundreds of thousands of users. As seen in appendix 2 and reported by Buytaert (2012) it becomes evident that some popular OSS projects attract the attention and contribution of thousands of developers and some most popular over ten thousand developers, and the total amount of developers may be counted at least in hundreds of thousands, if not in millions. The recent numbers provided by Sourceforge (2013) and Ohloh (2013) and the quantitative estimate presented by Schiff (2002) some ten years ago, show explicitly that the practicing of open source software development has expanded greatly in a decade as the total number of developers involved has grown from tens of thousands to at least hundreds of thousands. The phenomenon has also evolved over time, for example firms have found new ways to interact with and integrate to the developer communities. Kumar et al. (2011) say that the growth of open source software has been, and is, rapid. According to them the direct revenue of OSS market will reach 8.1 billion dollars by 2013, growing 22 percent annually.

Fitzgerald (2006, 595) says that early developers of open source software were often users of the software themselves. Fitzgerald says this has changed as the phenomenon has developed further, in addition to users also commercial firms take part to the development of OSS. Fitzgerald (2006, 593) says that as

the open source software (OSS) phenomenon has developed further, the development phase of OSS has become more structured, less bazaar-like, and product delivery and support for the software developed has become less structured, more bazaar-like. He says that many software firms now have employees who's job is to develop OSS further together with the rest of the developer community. Fitzgerald (2006, 594) says that strategic planning becomes more important as the phenomenon develops further, and the design of products more structured. He says that the claim by large closed source proprietary software manufacturers, that open source software development phenomenon would kill small local software firms, has proved to be false. He sees lots of opportunities especially for small service-centric firms which offer training, technical support and consultation for local customers who deploy open source software products.

4.5 Rising awareness towards Open Source Software

Consumers are nowadays better informed about OSS products and the open source production made by the network of OSS developers, even without active informing of such product option. At least in Finland the newspaper and TV coverage was very intensive during 2011 and 2012 after Nokia chose to abandon its open source projects and turn to a closed source software platform in its mobile phone products. In my opinion this news coverage has significantly raised the awareness of Finnish consumers about the open source software products as an option to closed source software products. Another issue regarding open source software which has been discussed actively in Finnish media is the high cost of IT systems in the area of public healthcare. In this discussion has been made a comparison to costs of Estonian healthcare IT systems and it has been found out that Estonia has managed to produce its healthcare IT renewal at a fraction of that cost what has been used in Finland to the same purpose. (Nissinen 2012). This has risen awareness of alternatives to costly IT system renewals and the theme of open source based solutions has came up in the public discussion. It has also been stated that resources released from Nokia's software development cluster should be targeted into manufacturing OSS based information systems to the field of public healthcare. (Pirkanmaan Vasemmistoliitto 21.2.2011). This idea represents the idea of resource mobility inside the economy.

The risen awareness of OSS products has created a situation of where a great number of consumers, institutions and decision makers already know about the presence of open source software products without active promoting by the developers of their open source software projects or about the phenomenon in general. This has created a situation where Finnish consumers and decision makers can already search for alternatives for proprietary software products because they are aware of the alternative products are being developed in OSS communities, in their OSS projects. Therefore it might be that the act of

informing consumers about the OSS product option might not be as relevant today as it has been at the time of Mustonen's (2002) study.

4.6 The phenomenon of software code reuse

Haeglifer et al. (2008, 191) say that open source software projects offer a vast repository of readily usable software for almost all purposes, and this software can be used, reused and built upon freely. Haefliger et al. (2008) recognize that software code reuse is a form of knowledge reuse in software development. They say that knowledge reuse and code reuse are fundamental to the economics of innovation and central to software development. Sojer and Henkel (2010) also say that that code reuse is of major importance for open source software development. They say that software reuse is a software-specific form of knowledge reuse and define that it is the process of creating software systems from existing software rather than building software systems from scratch. Figure 2 below (Välimäki 2005) illustrates this knowledge reuse phenomenon and the leveraging of knowledge resources external to the firm.

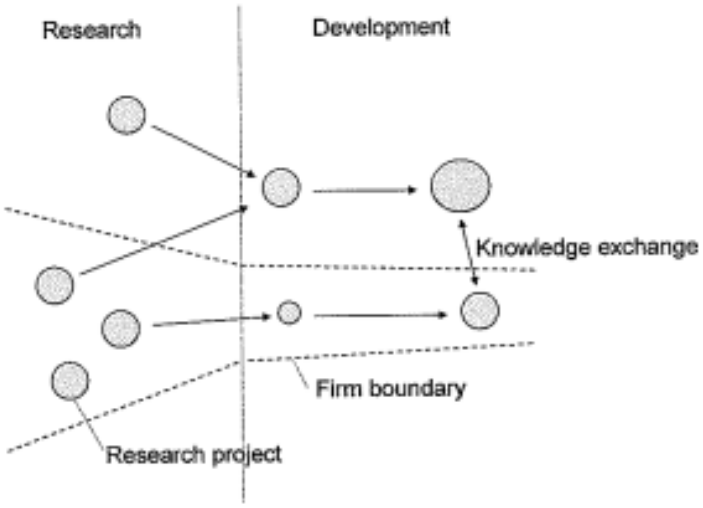

Figure 2. Open innovation model and the phenomenon of knowledge reuse (Välimäki 2005)

Haeglifer et al. (2008) say that software developers make use of the modular design options of software development by adding reused components to software they develop. According to their research many developers perceive the reuse as an opportunity get rid of mundane, time-consuming, or difficult coding tasks and therefore the reuse helps them to work on the tasks which they prefer to be more interesting or important.

The research of Sojer and Henkel (2010) shows that 30 percent of the functionality of open source software developers programming has been based on reused code. They also find that developers with larger personal networks within the OSS developer's community who are involved in many OSS projects reuse code more often, presumably because their networks and experience provide access to larger number of reusable artifacts, and that a developer's commitment to the OSS community leads to increased reuse behavior. Sojer and Henkel (2010) say that the artifacts most commonly reused in software development are *components*, pieces of software that encapsulate software functionality and have been developed specifically for the purpose of being reused. According to Haeglifer et al. (2008, 191) the reuse can be regarded as outsourcing part of the development work, and as an enlargement to the project and firm resources.

According Sojer and Henkel (2010) the mentioned kind of knowledge reuse is also an important factor in lowering the cost of innovation. They see that the code reuse phenomenon within the OSS community provides motivation to firms to also leverage existing OSS code in their software development. They say that by reusing the code available from OSS communities the firm receiving the code might lower its development costs. Sojer and Henkel (2010) report that according to Frakes and Kang (2005) the software reuse provides development efficiency and reduced development times, and also improved software quality and provides better maintainability of the software because the developers do not have to develop everything from scratch, and they rather can rely on existing, proven, and thoroughly tested artifacts instead (Frakes and Kang 2005, in Sojer & Henkel 2010).

The typically high upfront investment costs of building an internal reuse library can be avoided at least partly by exploiting free OSS repositories such as Sourceforge (www.sourceforge.net) which offers vast amount of reusable software. Sojer and Henkel (2010) say that OSS developers have broad options to reuse existing code if they wish because there is lots of reusable OSS code available under licenses that generally permit the reuse of code in other OSS projects. Sojer and Henkel (2010) suggest that commercial firms should encourage and support their employees to enhance their access to local search for suitable OSS code for reuse by building personal networks, connections to other OSS developers, and by becoming involved in various OSS projects.

Sojer and Henkel (2010) report the findings of Haeglifer et al. (2008) regarding the OSS communities, stating that software code is reused in cases when the developers want to make their development work more efficient, they lack the skills to implement certain functionality by themselves, they prefer some specific development work over other tasks, or they want to deliver a credible promise for their project (Haeglifer et al. 2008 in Sojer & Henkel 2010). A credible promise is needed to attract the other developers to contribute to a certain OSS project. According to Sojer and Henkel (2010) developers see code reuse as a means to kick-start new projects, as it helps them deliver a credible promise of their project and close the gap to existing and competing projects

more quickly. Haefliger et al. (2008) say that the credible promise enables sufficient functionality of the software to catch the attention of potential developers and users, and say that the reuse of software components seems rational at any time, not only in the beginning of the project. Lerner and Tirole (2002, 220) define the credible promise as a critical mass of code to which the programming community can react. They say that enough work must be done to show that the project is doable and has merit, that is, to deliver a credible promise of the project.

Haeglifer et al. (2008, 189) have found out that one additional incentive to reusing software components is that the reusing projects can benefit of free maintenance by other projects. This means that the reused component is maintained in its original context, within the software project where it appears originally. In their study of Haeglifer et al. (2008) found out that in the case of 53 reused component out of total amount of 55 components, at least one new release became available after the first date of reuse. A *release* here means a new updated version of that piece of software, a component of software product. Haeglifer et al. (2008, 189) report that developers in their study considered external maintenance as an incentive to reuse components because it lowered the long-term cost of producing a component. The developers in their study therefore systematically reused software components because, first, they saved effort by not having to write the component themselves, and second, by not having to maintain it in the future. This, according to Haeglifer et al. (2008) reveals that a pattern of an economical logic influences reuse behavior. The developers benefit from free maintenance and improvements made to components external to the project. This economical reuse behavior is in the very core of this study.

The previous finding regarding "outsourced maintenance" of a software component by Haeglifer et al. (2008, 189) adduces the logic and mechanism of the self-renewal of a software component which is being reused. Let us then create an analogy for the behavior of the re-user, and let us assume that this actor reusing the component is not an individual, but a firm. This adduces the central finding of this study. From the re-user's point of view the software component, the resource which is being reused, renews itself timely, and this happens autonomously and regardless of the firm. According to findings of Haeglifer et al. (2008) this resource renewal happens 53 times out of 55, which means that the renewal of reused component may happen in over 96 percent of the cases, if a generalization can be made from the findings of Haeglifer et al. (2008). The self-renewal which happens in the form of a software release update represents a development step which makes the product better, because enhancement to a component of a product represents an enhancement to the entire product. This phenomenon of software component's self-renewal represents a condition where the resource of the firm, the reused software component, generates competitive advantage for the firm through the process of autonomous self-renewal.

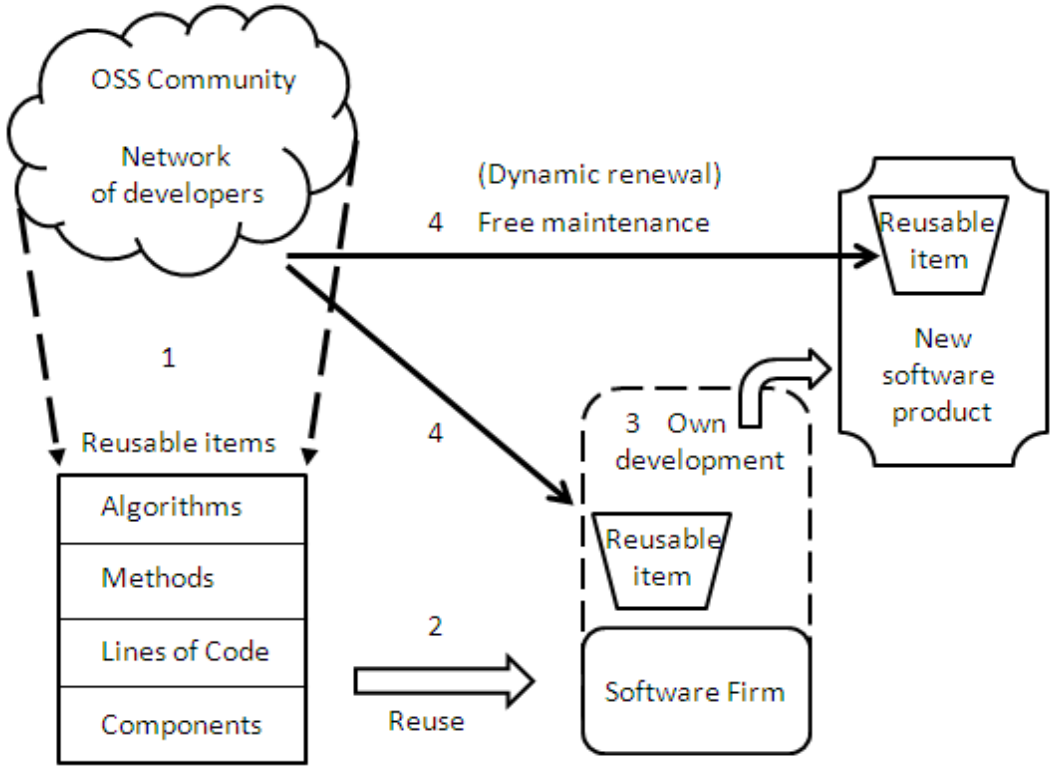

FIGURE 3. The phenomenon of reuse of external resources and the phenomenon of dynamic renewal of resources

Figure 3 illustrates how software firms can reuse (2) the existing free resource components made available by OSS developers (1) and how the firm can, by adding their own development efforts, create (3) new products which are based on reused software components or lines of code, more generally, on reused resources. Figure 3 also shows the mechanism how the network of OSS developers provides (4) new releases and updates for the reusable item which is now also is a component in the commercial firm's product. This (4) is the phenomenon of dynamic renewal. The updates and releases to the reusable item also update the software firm's product. Therefore the updating provided by the network of OSS developers provides an autonomous dynamic renewal of the software firm's resources. This phenomenon creates competitive advantage for the firm, as explained in chapter 6.

4.7 What is being reused: the domains of reusable artifacts

Haefliger et al. (2008) identify several types of resources which can be reused in the process of software development. They include but are not limited to the following: problem description, artifacts, project proposals, feasibility reports, enterprize models, data dictionaries, prototypes, decision tables, pseudocode,

source code, databases, tacit knowledge of developers, network's of developers (Haefliger et al. 2008, 181). As a result of their study they identify three broad forms of knowledge reuse and code reuse: algorithms and methods, single lines of code, and components.

According to Knight and Dunn (1998) reusing the code and components from software libraries enhances the quality of the new manufactured software products, they become fully tested and debugged products (Knight & Dunn 1998, in Haefliger et al 2008, 181). Their research reveals that the primary driver of reusing is making the projects the best it can be, and it also done because it saves time and makes the development faster. Haefliger et al. (2008, 185) report that nearly all developers they interviewed for their study, mentioned the reuse of algorithms and methods in their open source software development. They define algorithms and methods as follows:

> An algorithm is a finite set of well-defined instructions for accomplishing some task or solving some problem that, given an initial state, will result in a corresponding recognizable end state. Methods contain several alternative algorithms and other scripts for solving a problem, and rules from choosing between them, and they can be expanded to cover large problem area. The use of algorithms and methods includes the examination of source code or other information, but also the interpretation and adaptation of cues about technical problems and their solutions, abstraction, and implementation in a local context.

The research of Haefliger et al. (2008) where they analyzed six different open source development projects provides a result saying that knowledge use in the form of algorithms and methods is frequent among the software developers and is a part of the learning of these developer individuals.

Haeflier et al (2008, 187) say that copying several lines of code from external projects is a systematic and direct form of code reuse. They report that this type of reuse was relatively rare among the open source software developers, but also difficult to quantify. At the same time they find that open source developers routinely and widely reuse software components, which again, consist of lines of code. According to their findings, reusing of software components happened in all six analyzed projects. According to them

> A software component is a software technology for encapsulating software functionality, often in the form of objects, adhering to some interface description and providing an API (application programming interface), so that the components may exist autonomously from other components on a computer. Technically, this allows the developer to treat the component as a "black box".

The term "black box" refers to that the software component provides a certan functionality to the software, and the code of that reused component remains untouchable, as it was at the time of lending it. In the "black box" thinking the attention of the developer focuses only to the functionality what the component provides, not to the lines of code how this functionality has been built. In the findings of Haefliger et al. (2008) the components were either integrated into the code of the project or linked to it. They say that linking a component to the software can happen either at the time of compilation, which rep-

resents static linking, or at run time of compilation, which represent dynamic linking. Chesbrough (2005, pp. 60-61) introduces two different software architectures, an interdependent architecture where the components of the software are interdependent of each other, and a modular architecture where the components are connected to each other but they function in autonomous manner. In a modular architecture a component of a system may be replaced in a manner that the replacement does not require modification in the other components. Deriving from Chesbrough's introduction to basics of software architecture, it can be recognized that the modular architecture is simpler and allows the firm to easily make software products out of reused components. Therefore it is recommendable that a firm exploiting OSS components should use the modular software architecture in its products if possible. Figure 4 illustrates how software products can be produced from software components (Välimäki 2005).

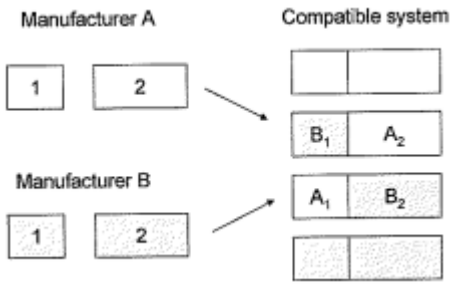

Figure 4. Components approach to software production (Välimäki 2005)

In the findings of Haefliger et al. (2008) all the components reused were maintained as external projects, meaning that they are available through a dedicated project website providing code releases or reusable components. Their closer analysis of code reuse revealed two distinct type of reuse, architectural and functional reuse. They find that the developer makes the functionality of the component available to the program through architectural reuse of the component. They say that the decision to reuse a component establishes a need to an architectural change to be made to the software because the reusing changes the overall structure of the software. To make the code reuse the developers usually need to study the software code and also the documentation following the code, and other available information such as web-based information resources, before deciding to reuse a component.

4.8 Commercial Open Source Software

Commercial open source software products represent a hybrid of open source software and proprietary software. Kumar et al. (2011) recognize that commer-

cial open source software (COSS) firms build commercial products based on adding features and enhancing the usability of publicly available open source software. According to them COSS firms add value to open source by increasing the functionality and usability, which according to them are two distinct dimensions of software. They say that the combination of public and private good is a unique aspect of COSS. (Kumar et al. 2011, pp. 1066-1068). According to Remneland-Wikhamn, Ljungberg, Berqvist and Kuschel (2011) the production of open source software has been increasingly intertwined with the commercial software market, leading to new business models. They say that firms engaged in open source are to be driven by economical and technical motivations, whereas the individual contributors are not. Riehle (2007) defines a model of commercial open source and say that it is software that a for-profit entity owns and develops. In this model the software firm maintains the copyright of the software and determines what is accepted into the software code base and what features are implemented. Google's Android, a software platform for mobile phones and especially smartphones is an example of this kind of commercial open source software. Riehle (2007) uses a term community open source of the open source software development which generally is named only as open source software. He says that the source code of commercial open source software is available in source code form just as in community open source. However in commercial open source one firm controls the software. He says that by controlling the source code of the software the commercial firm can gather some of the benefits of community open source, for example faster adoption of the product, free and speedy user feedback and possibly also development contribution of volunteer coders. (Riehle 2007).

Riehle (2007) introduces another business model where a firm makes money by selling proprietary software enhancements to open source software products. This is the business model especially interesting from this study's point of view. The defined business model thereby is that a commercial software firm uses the open source software developed by a worldwide community of developers, the source code which at their disposal, as an ingredient in the manufacturing of an enhanced product which is based on the original open source code, and then sells the manufactured software product at the market.

4.9 Open Source Software – a special case of Open Innovation

Open source software development is a special case of Open Innovation. Dahlander and Magnusson (2008) say that in the phenomenon of open source software development a distributed innovation process allows the software code to be continuously improved, modified and diffused. According to them many studies have shown how firms pursue to make profits out of the fruits of open source software through re-packaging as well as embedding proprietary software in hardware products. They however say that previous research has poorly understood how firms make use of the open source communities. They

say that firms benefit from the creative ideas of individuals outside the company but the inflow of the ideas does not happen spontaneously, the firm has to be active in pursuing to benefit from the development made in open source communities. They say that a number of firms have demonstrated that it is possible to rely on communities to provide a fundamental input into firms product development over a prolonged period of time but the question of how to make the relationship work in practice is according to them not obvious. West and Gallagher (2006) say that open source provides a powerful example how firms can manage a complex ecosystem where external and internal innovations are combined, creating such architecture for the whole product solution that both creates and captures value. They say (2006, 28) that open source is open innovation only if it has a business model. Chesborough and Appleyard (2007, 57) say that open innovation has created a new empirical phenomenon which exist uneasily with well-established theories of business strategy. According to them this is because traditional business strategy has guided firms to develop defensible positions against the competitive forces and power position in the value chain, and encouraged firms to construct barriers to competition instead of promoting openness. The previously established conception that a successful business looks the world from behind closed doors has came across with an opposite view, which suggests that a successful strategy is based to openness and collective innovation. West and Gallagher (2006) say that in the paradigm of open innovation firms exploit both internal and external sources of innovation and maximize the return accruing from both sources. They also define that exploiting knowledge spillovers is a defining aspect of open innovation.

According to Remneland-Wikhamn et al. (2011) the typical open source project is a loosely coupled community where work is totally delegated, relying on a high amount of voluntary contributions and coordinated by one or a few developers. For example in case of Linux the anyone can download the source code, contribute to it and send it back, and if the contribution is considered good enough by the reviewers the new strings of code will be included in the product, the next release of the software. West and Gallagher (2006) report the findings of Mockus et al. (2002) and state that in open source software the development is controlled by a small group of developers who receive occasional contribution, for example error correction, from a much larger group of developer-users (Mockus et al. 2002 in West & Gallagher 2006). The developers therefore form a network of developers contributing to the development of the software. West and Gallagher (2006) say that open source development is an innovation strategy which has two distinct key elements: shared rights to use technology, and collective development of that technology.

5 THE MARKET SETTING FOR A SOFTWARE START-UP

When starting up a firm and planning to enter a certain branch of business it is recommendable for the new firm to analyze the market conditions of the business where it is about to enter, and to recognize the structure and characteristics of competition in the industry it is about to enter. Porter (1980) describes that an entry to the industry may occur through firm's internal development which involves the creation of a new business entity including new production capability and distribution relationships. This refers to heterogeneity of the firm compared to other incumbents of the industry. In his analysis, Porter focuses to possible reaction of other incumbents of the industry, which may follow the entry of the new firm to the industry. According to Porter (1980) a firm planning to enter to an industry through internal development should direct its emphasis directly to the two sources of entry barriers of an industry: structural entry barriers and the expected reaction of incumbent firms of the industry. Porter (1980) also recognizes that industry evolution is strategically important because evolution brings changes to structural sources of competition.

McKelvie and Davidsson (2009) say that barriers to entry in the case of new firms in general are not as strong an inhibitor as theory would propose. They say that firms usually start with very limited resources and that new firms sometimes actually succeed because they are not constrained by their existing resource endowments. Barney (1991) says that barriers of entry, into a certain industry of business, exist only when competing firms are heterogenous in terms of strategically relevant resources which they control, when these resources are not perfectly mobile.

Firms in software industry apply quite much same resources when their software production is based on open source software code. The start-up firms entering the open source software industry therefore meet low barriers of entry. This is derived from the fact that open source software code as a resource of software production is at everyone's disposal at all times. Therefore there are and will be many small and medium-sized companies at the market using open source software code as their resource in developing software products. So

competition exists, which also is a result of low barriers of entry. It is of course an entrepreneurial challenge to create unique products and offering despite that open source software code is at everyone's disposal. According to Mustonen (2002) the presence of open source software development actually creates a barrier to the market entry of the monopolist. According to him the monopolist is not be able to exercise full monopoly power in the market if a OSS product exists in the same market. If the market is small the monopolist may decide not to enter the market at all. The open source product is then the only available product at the market. He says that this result coincides with some real-world phenomena. Therefore OSS products may dominate some markets. (Mustonen 2002, pp. 118-119).

Goldman and Gabriel (2005) say that open source based software projects enjoy a time-to-market advantage. They say that a firm can avoid reinventing something that already exists, by using available open source code in its software project. This can according to them speed up getting to market, but the more important effect, they say, is that a company can achieve a very good product quickly, especially one with a greater number of already proven features and better quality. They say that the right product is therefore achieved faster and if existing open source code is available, this could also mean getting a product into the new market space ahead of the competition. Goldman and Gabriel (2005) say that the 1.0 release of an open source project usually compares to the 2.0 or 3.0 release of a proprietary product, and therefore, building on open source creates products faster and with better quality, as many bugs have been fixed already in the first version of the product.

Mann (2006) says that one option for a software start-up is to start with open source code as the platform on which to a proprietary product is then built. Kumar et al. (2011, 1069) say that it has been clearly recognized by industry professionals that building proprietary products on top of open source software is an important business strategy. According to Mann (2006) several venture capitalists say that this type of startup is increasingly common. He says that the basic expectation in this business model is that the start-ups build proprietary products on open source platforms, and that the open source nature of the platform will make it easier for the start-up to integrate its products with the platform. This business model described by Mann has lately become increasingly popular in the branch of mobile phones applications, as operating systems based on open source software such as Android have become increasingly popular. It is worth notifying that by September 2012 Android had reached a 75 percent market share in the market of mobile phone operating systems. (Taloussanomat 3.11.2012). As time goes on, it may well be that building products on an open source platform will become an increasingly common method for the development of proprietary software.

What it comes to general conditions of the market, according to Salmela (2013) internet lowers the barrier of starting the first firm as an independent entrepreneur. She writes that internet-based entrepreneurship also requires less capital than opening a traditional physical store. The chairman of Finnish e-

commerce society compares current popularity of internet-based entrepreneurship to the gold rush. (Salmela 2013). In the case of open source software production internet truly is the vehicle of development which enhances and speeds up the open innovation phenomena, and also speeds up the cycles of competition.

5.1 The need for strategic architecture

The low barriers of entry in the world of start-ups of the open source software industry call the need for a strategic architecture. Prahalad and Hamel (1990) say that firms need a strategic architecture for the acquisition of new competencies or the development of existing competencies. They say (1990, 208) that core competencies are a source of competitive advantage. Barney (1991, 1995) sees that certain resources the firm possesses can form a competitive advantage for the firm. Deriving form the core competencies view (Prahalad & Hamel 1990) the competencies the firm possesses can be regarded as firm resources and knowing that resources can be sources of competitive advantage, the idea of the need for a strategic architecture by Prahalad and Hamel can be extended to consider the resource base of the firm. Firms must manage their resources strategically in order to create wealth (as illustrated in figure 7). The firm should have a strategic architecture in place, so that it can manage its resources strategically. According to Prahalad and Hamel (1990) strategic architecture identifies the major capabilities to be built, but does not specify exactly how they are built. It identifies what the firm must be doing now in order to achieve its future targets. It is about strategic direction. (Prahalad and Hamel 1990, pp. 107-111). Interpreting Prahalad and Hamel (1990) a strategic architecture is about what resources and competencies a firm must start acquiring and developing to meet its future objectives, including targets regarding its competitive position and the wealth creation. Teece et al. (1997, 528) note that capabilities cannot generally be acquired, they must be built. This is an issue the managers and founders of a new venture face when starting up a business.

5.2 Start-ups and the leveraging of external resources

New ventures often start with very limited resources, in the software industry as in other branches of business. Founders of a software start-up however presumably have previous experience in software manufacturing and their employees in software coding. Employees of the software start-up might also have previous experience in open source software programming and they might have several connections to the worldwide open source software development network, to the open source software development community.

As new software firms start with scarce resources the reuse of open source software code and software components is arguably an option worth investigating from their point-of-view. Dahlander and Magnussen (2005, 646) say that using communities is a way for firms to increase the total amount of resources they can draw upon in their innovation processes. As Sojer and Henkel (2010) point out reuse of software code is an important factor in lowering the cost of innovation. Haefliger et al. (2008) say that open source software developers and software developers in firms apply tools that lower their search cost for reusable software code and asses the quality of software components, and have incentives to reuse software code. They say that open source software developers reuse code because they want to integrate functionality quickly, because therefore they can operate under limited resources, and because they can thus lower the cost of software development. There is no reason why these attributes and incentives would not work for commercial firms, contrariwise. Leveraging firm's external resources, reusing previously written software code and the development efforts of an international network of open source programmers, is a feasible option for a software start-up and forms a base of certain business strategy.

According to Dahlander and Magnussen (2005) the firm must develop in-house expertise and absorptive capacity to be able to screen and assimilate the developments derived from the OSS community. They say that absorptive capacity is needed for identifying, assimilating and applying useful external knowledge. Dahlander and Magnussen recognize three themes that seem to be important in how firms can make use of OSS communities: accessing communities to extend the firm's resource base, aligning firm's strategy with the community, and assimilating communities in order to integrate and share contributions. They recognize the identifying and using existing communities to be one of the firm's strategy options, and establishing a new community to be another. Dahlander and Magnussen (2005, 644) have found out that some firms use an adaptive approach in relation to the communities they interact. In the adaptive approach the firm does not try to change the direction of the development in the communities in any substantial way. Instead of that the firm focuses on using what is developed in the communities and put their effort into integrating the work of the communities into their internally developed components. This is the particular phenomenon which is in the core of this study. An adaptive strategy might be a natural way for a start-up to start making use of the OSS communities in the beginning of the firm's operations. The challenges of attracting developers with a new project and keeping the project vital identified by Dahlander and Magnussen (2005, 646) also defend the adaptive strategy option.

Suoranta and Jones (2012) have studied small software firms in UK and USA, and found out that start-up firms in both countries consider networks and relationships vital for the firm. They name innovation networks to be one network category. Von Hippel and von Krogh (2003) say that open source software production is an example of private-collective innovation network where innovations are shared without expectation of direct monetary compensation.

Suoranta and Jones (2012) find out that in the software industry networks are vital in the process of leveraging resources. Also Ridder (2012) has studied how firms create competitive advantage in innovation through leveraging their external resources. Fitzgerald (2006, 592) says that leveraging the talents of open source community allows firms to increase development productivity with the added benefit that much of the work is received for free. Dahlander and Magnussen (2005, 646) however remind that the firm needs to have competencies and selection mechanisms to decide which developments are critical, when having a high reliance on external actors and their development contribution.

Table 1 is a modified presentation of West and Gallagher's (2006) table. It summarizes the important actions of a firm wishing to exploit external resources from repositories of open source software development community. The five arrows in the table illustrate which actions are most crucial for the software manufacturing firm wishing to gain benefit from the contributions of OSS community. The arrows show what are the core tasks and managerial challenges in a software firm utilizing external resources as ingredients in the firm's own, internal software manufacturing. From the perspective of open source software community these products are derivative software products.

Innovation Model	Management Challenges	Resulting Management Techniques
Proprietary (or internal or "closed")	1. Attracting "best & brightest" 2. Moving research results to development	1. Provide excellent compensation, resources, and freedom. 2. Provide dedicated development functions to exploit research and link it to market knowledge.
External → →	1. Exploring a wide range of sources for innovation. 2. Integrate external knowledge with firm resources & capabilities	1. Careful environmental scanning 2. Developing absorptive capacity, and/or using alliances, networks, and related consortia.
Open → → →	1. **Motivating** the generation & contribution of external knowledge 2. **Incorporating** external sources with firm resources & capabilities 3. **Maximizing** the exploitation of diverse IP resources	1. Provide intrinsic rewards (e.g. recognition) and structure (instrumentality) for contributions. 2. As above. 3. Share or give away IP to maximize returns from entire innovation portfolio.

TABLE 1. The core tasks of exploiting external resources in software product development (modified representation of West and Gallagher 2006)

The firm has to search suitable artifacts (exploring) and internalize them, and integrate them into the firm's own resources, and try to maximize the benefit of these external resources. West and Gallagher (2006) say that the existence of external knowledge does not provide benefits to the firm if the firm cannot identify the relevant knowledge and incorporate it into its innovation activities faster than its rivals and new entrants. This according to them requires the capabilities of scanning, recognition and absorption and also willingness to incorporate external innovation. They also say that it is beneficial for the firm to mo-

tivate the external contribution, in this case, to motivate the community of open source software developers to contribute to the software also after the firm has internalized some open source software artifacts of that open source software project and started to exploit them in firm's product development. The motivation of developers to contribute should stay up so that the firm's derivative product keeps developing further, by the external contributors. If the stream of external innovation continues, the firm's derivative product will enjoy a phenomenon of self-renewal and this will provide competitive advantage to the firm. (West & Callagher 2006). The phenomenon of a product's self-renewal due to external contribution is in the core of this study. This phenomenon is reality for example in the development of Android platform, which is currently the most popular operating system in smartphones and also very popular in handheld computers. The external contributors contribute to the development of the product because they like the product, and Google which controls the development, includes external contributors code to the product releases which it controls. The analysis of motivation factors of developers to contribute in such development is not in the core of this study, and therefore the notions of the phenomenon are limited to recognizing only the existence of the phenomenon by taking a short and simple example of such phenomenon. Google's Android is an example of open source software platform which fits to definition of Chesbrough (2003) stating that firms both use a broad range of external sources of innovation, and seek a broad range of commercialization alternatives to their internal innovation.

McKelvie and Davidsson (2009) say that resource endowments are critically important for new firms and that the development of dynamic capabilities is a likely mechanism for their performance effect. They also state that understanding how and where specific resources affect the value-creating ability of a new firm is a necessary condition for managers to make effective decisions concerning their resource investments. McKelvie and Davidsson (2009) recognize that knowledge resources are important for the firm's development and that they are sometimes provided by members of the firm's network or social capital, and individuals who are neither founders nor employees of the firm. This notion fits to the definition of worldwide network of open source software developers. McKelvie and Davidsson (2009) report that access to employee human capital and access to technological knowledge resources are ascribed important positive effects regarding to firm's performance. Their research shows that improvements to resource base of the firm had highly significant effects on dynamic capabilities of the firm, and that improvement in reputational resources and in technological resources were statistically significant for new product development capability and new process development capability. This says that the better the firm's reputation and the better the firm's technological resources, the better the firm's product development capability and new process development capability, which refers to the firm's dynamic capability in general.

Wu (2007, 553) says that start-up resources influence to the firm's performance through dynamic capabilities. In his research of Taiwanese high-tech

start-ups he has found out that the more the start-up has resources the more the start-up will attract external partners to co-operate with the start-up and to finance it. According to his survey results both the increased external party involvement and greater amount of resources result in greater dynamic capabilities. He also has found out that the greater the start-up's dynamic capabilities are, the better will be its performance.

Duarte and Sarkar (2011) recognize two ways of how small firms can profit from open innovation and say that these options are related to the direction of knowledge flows. The other of the options is that the firm uses the knowledge of users and customers to commercialize new products. This option is in line with the reuse phenomenon. The other option according to them is to collaborate with a larger firm which has access to economics of scale and strive for a wide diffusion for the product the smaller firm has developed. For example Android Market serves as a pathway for software applications and helps the producers of applications to access a large global market. Small software firms as well as individuals may develop software applications for mobile devices and by getting them available through Android Market, the diffusion of the applications get a wide audience and the odds of receiving users and customers increase greatly. In Android Market the application can be shared for free or sold at a price. Therefore Android Market offers a vast amount of free-of-cost applications as well as chargeable applications. Wikipedia (2013) says that Android Market is a digital application distribution platform for Android, developed and maintained by Google. The service allows users to browse and download music, books, magazines, movies, television programs, and applications from Google Play. The Android Market was rebranded as the Play Store on March 6th 2012. (Wikipedia 2013).

5.3 Markets for Commercial Open Source Software

Kumar et al. (2011) analyze the strategic options of COSS firms. They see that there exists a market for private features and for shared features. They say that in case of a software product the features define the set of tasks the product can help accomplish, and that the usability of the software refers to the ease with which a consumer can make use of the product's features. According to them consumers value both more features and greater usability. According to them the decision which markets to access depends on the firm's resources, experience and capabilities.

Whether to access the market of private features or shared features depends of the license conditions by which the firm has access to those OSS components it wishes to exploit. Kumar et al. (2011) take example of Red Hat Linux which is under conditions of GNU license, implying that Red Hat must make any feature contributions publicly available, but can keep any usability enhancement private. As said earlier, if the firm gains access to such OSS compo-

nents which are released under BSD license, the firm has more freedom in keeping the developments made to the product as private.

Figure 5 illustrates these market options of COSS firm, a market of private features and a market of shared features. In both markets there exist their own conditions which have affect to what kind of business logic is possible. To be able to access the private features market the firm must obtain the OSS components under such license which permits to keep the derived works private. This means a condition where the enhancements made to the software features or features built upon the exploited OSS components, are not donated back to the OSS community nor revealed to the firm's competitors because the license conditions allow the derived works to be kept private. This makes possible of direct collection of rents from the derived works.

Kumar et al. (2011) say that the key difference between shared features market and the private features market seen in figure 5 is the formulation of product quality. They say that firms in private features market incorporate open source features and their own privately developed features, the derived works, into their end-products. In shared features market firms must contribute all the derived works back to open source community, which makes them also available to the competitors of the firm. The derived works developed by the firm might thus also end up into its competitor's end-products. Therefore, firms in the shared features market differentiate more on usability because that is the only means of differentiation (Kumar et al. 2011, 1076).

Kumar et al. (2011) compare two types of strategies for a firm exploiting OSS components: a low-quality firm which is purely free-riding on others development efforts, and a high-quality firm which develops new features to the end-product. According to their game-theoretic approach the low-quality firm's quality is always higher in the shared features market because the firm is able to free-ride on the features which the high-quality firm provides. On the other hand they find that the high-quality firm may make a higher profit because a larger external demand induces a broad base of developers to contribute into the original OSS components, which increases the developer-firm spillover and reduces the firm-firm spillover, which is the free-riding phenomenon. They say that under these conditions, a high-quality firm can do better in shared features market. As the high-quality firm is the only one of these two incumbents who exists on the private features market, the implication of a game-theoretic analysis is that a start-up firm should choose a high-quality strategy. That is, to reuse OSS components, to manufacture derivative works from OSS developers contribution, and to position itself into private features market when the licensing conditions make it possible. Von Krogh and Spaeth (2007, 242) refer to Bonaccorsi et al. (2006) and say research to have shown that open source software may be the preferred license form of new entrants into the software industry.

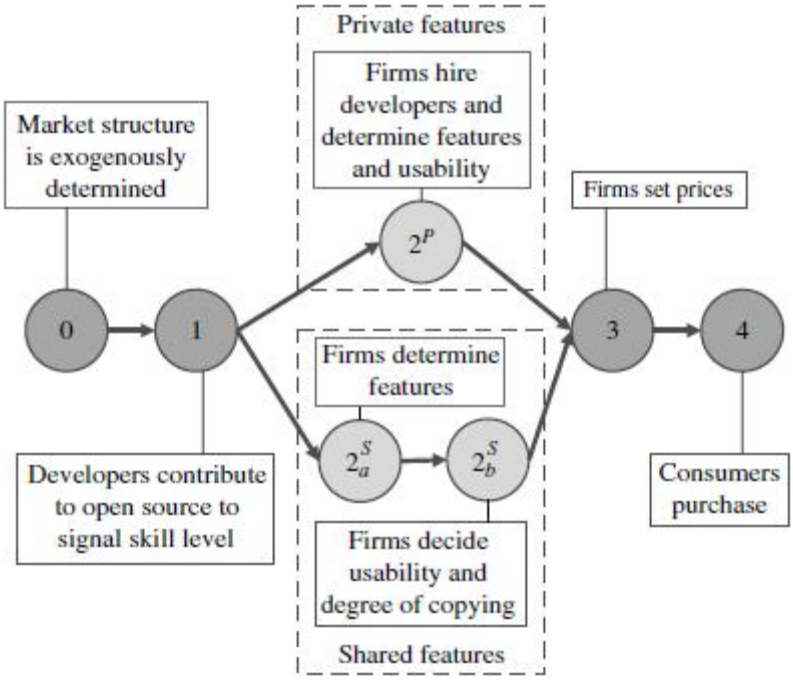

Figure 5: Market options for a COSS firm (Kumar et al. 2011)

Goldman and Gabriel (2005) ponder reasons why a firm should get involved with the phenomenon of open source software. They find that when a company has a proprietary product built on top of open-source software, the freely available open source version of the product will bring in customers and by that, increase the company's market share. Users of the free version may be persuaded to upgrade to the sold-for-money version of the software to get access to new features, better support, training, or consulting services. Chesbrough (2005, 57) also notes that open innovation firms use licensing extensively to create and extend markets for their technology. Goldman and Gabriel (2009 say that providing a lower level version available for free also makes it more difficult for competitors to enter the market because they will need to compete with a free product. Therefore, building products on top of OSS products as well reusing the components or source code of OSS programs is an interesting strategy option from for a software start-up, from several points of views. Goldman and Gabriel (2005) also see that one reason to build a product on top of available OSS is that the firm may not have time or other resources to do all the work on its own. They say that the firm might find a good fit in relation to the OSS project. If the contributions of the firm adds value to the work already done by the OSS project and fits in with its vision, then the community might be very welcoming to the firm's contribution. If the project's license is suitable the firm might be able to create a commercial product. This is the basic strategy which this study is handling. A wise firm of course checks the compatibility of the OSS project's licensing conditions as a first priority before going in to the project or reusing components or code from that project.

Mann (2006) says that collaborative development of firms and individual OSS developers has its highest potential in the area of platform products, where firms specializing in different parts of a value chain have joint incentives to participate in the development of a high quality product that is broadly accessible. It has already been noticed how open source based software platform products as Linux, Apache and Android have challenged and even outcompeted their commercial rivals made by large multinational corporations producing traditional closed source proprietary software, such as Microsoft for example. The operating system battle in the branch of mobile phones manufacturing is one of the branches where the success of an OSS platform is noticeable. By September 2012 Google's Android operating system had reached a 75 percent market share in the market of mobile phone operating systems, meaning that every third mobile phone sold carried Android as its operating system (Taloussanomat 3.11.2012). According the internet site developer.android.com, Android is used in hundreds of millions mobile devices in more than 190 countries and it's the most installed of mobile phones platforms. Android provides a platform for creating applications and games, as well as an open marketplace for distributing them. (developer.android.com 2013)

6 STRATEGIC ENTREPRENEURSHIP

Klein, Foss and Barney (2012) say that Strategic Entrepreneurship is a newly recognized field that stems from the fields of Strategic Management and Entrepreneurship. They also state, that the field of Strategic Entrepreneurship (SE) is very young, that it has existed for only about decade or so, and that SE is "still mainly rather loose amalgam of a number of insights from Strategy and Entrepreneurship" (Klein et al. 2012, 10). Hitt, Ireland, Camp and Sexton (2001) say that wealth creation is at the heart of both, entrepreneurship and strategic management and that strategic entrepreneurship is entrepreneurial action with a strategic perspective. Ireland, Hitt and Sirmon (2003, 963) as well as Hitt et al. (2001) note that both of the research schools, Strategic Management and Entrepreneurship, are interested in the themes of growth and wealth creation. Kyrgidou and Hughes (2010) say that the relationship between strategic management and entrepreneurial activity has emerged in an interrelated way over time but has only lately been crystallized into a construct of practice, that of Strategic Entrepreneurship. This is in contradiction with Hitt et al. (2001) who say that the fields of entrepreneurship and strategic management have developed mainly independently of each other, but both of the fields are interested in how firms adapt to environmental change and exploit opportunities. The difference in statements of Hitt et al. (2001) and Kyrgidou and Hughes (2010) indicate the development what has happened from 2001 to 2010 in the field of Strategic Entrepreneurship.

Kyrgidou and Hughes (2010) introduce the origins of SE and refer especially to the works of Schumpeter 1934 and 1942, and work of Penrose 1959. They introduce Schumpeter's view on entrepreneurship as a "disequilibrating" phenomenon, where industrial and market dynamics over time destroy inefficient business models and new more effective ones emerge from the activities of innovating entrepreneurs and their firms, a phenomenon where less-innovative actors of economy are replaced with better performing actors, leading to higher degree of economic growth. This study is one of those studies, where the Schumpeterian tradition is present, because this study focuses to describing and characterizing firm's actions, as mentioned by Kyrdigou and Hughes (2010).

Kyrgidou (2006) says that Strategic Entrepreneurship can be defined as a process that guides decision-making and managerial efforts for identifying the best opportunities with the highest potential returns, and then for exploiting them through strategic actions. Hitt et al. (2001) say that entrepreneurship is about creation and strategic management is about establishing and maintaining an advantage. Hitt et al. (2001) say that growth and wealth creation are Entrepreneurship's defining objectives, and that Strategic Management is concerned with understanding the reasons why firms differ in their capability to create wealth (Hitt et al. 2001). Barney (1991) says that implementation of strategy requires the application of firm resources. Barney (1991) says that the Resource-Based View of the firm pushes further the value chain logic represented by Porter 1985, by examining the attributes that resources must possess in order to be sources of competitive advantage.

Hitt et al. (2001) say that strategic management provides the context for entrepreneurial actions. They say that entrepreneurial action can be considered to be strategic action with entrepreneurial mindset. According to them entrepreneurial actions are about creating new resources or combining existing resources in new ways to develop and commercialize new products. According to Kyrgidou (2006) Strategic Entrepreneurship suggests entrepreneurial actions to be taken within a strategic framework. She says that the key concepts of SE are entrepreneurial actions, strategic actions, entrepreneurial orientation and strategic renewal. She says that these four should be seen as driving forces leading to strategically aligned and strategically grounded entrepreneurial orientation. From the viewpoint of a potential investor or financer, this set of viewpoints mentioned by Kyrgidou (2006) provides opportunity for analyzing if the firm in question knows what it is doing and is the orientation of the firm favorable for wealth creation. It can be analyzed if the firm is acting entrepreneurially, if its actions are strategic, if there exists entrepreneurial orientation, and if the firm has a process of strategic renewal. Kyrgidou and Hughes (2010) say that growth is presented as a direct outcome of Ireland at al.'s (2003) SE model (figure 6). They say that firms which follow this linear sequence of activities presented in the model of Ireland et. al. (2003) are strategically entrepreneurial and should achieve wealth creation as the result of the process. Therefore, the framework presented by Ireland et al. (2003) also provides a useful framework for potential investors and financers to analyze the firm, if the firm possesses such qualities which are needed for wealth creation, and predict wealth creation.

Kyrdigou and Hughes (2010) say that despite the mentioned interrelation between Strategic management and Entrepreneurship the construct of Strategic Entrepreneurship presented originally by Ireland, Hitt and Sirmon (2003) has for long been the only study presenting a conceptual model of SE. The mentioned model by Ireland et al. (2003) has thus not been challenged before Kyrdigou and Hughes (2010) presented their extension to the model. That makes the model presented by Ireland et al. (2003) well established in its own field. Kyrgidou and Hughes (2010) however find some weaknesses in the model. One is that the concept of dynamic capabilities is not sufficiently explained. The

construct of Ireland et al. (2003) will be developed further, the mechanism of dynamic capabilities explained, and their model used as the theoretical framework of this study. Its use as a theoretical framework is also strengthened, not weakened, by some remarks of Kyrdigou and Hughes (2010).

Ireland et al. (2003, 964) as presented in their figure 6, define that Strategic Entrepreneurship has four distinctive dimensions, those of 1. Entrepreneurial mindset, 2. Entrepreneurial culture, 3. Strategic management of resources, and 4. Applying creativity and developing innovation. In this research we are interested especially about the described dimension number three, about the firm resources and their strategic management.

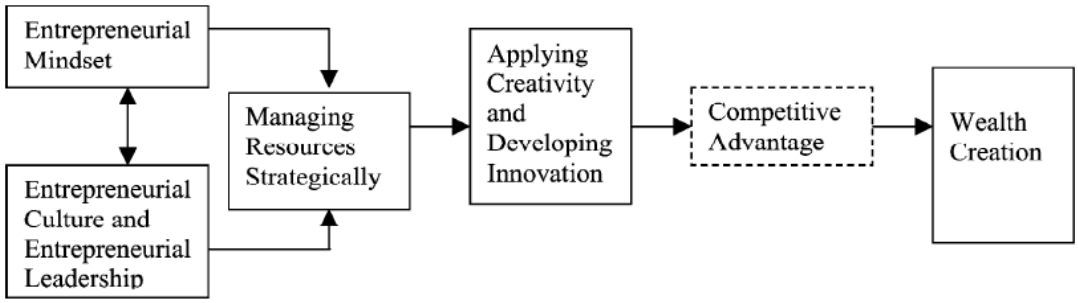

FIGURE 6. A model for Strategic Entrepreneuship (Ireland et al. 2003)

Kyrdigou and Hughes (2010) say that the field of Strategic Entrepreneurship has emerged as a new concept to examine the convergence of the opportunity-seeking behavior of Entrepreneurship and the advantage-seeking behavior of Strategic Management. They verify that innovation is the act which generates the creation of new productive resource combinations, which, again is said to be an essential source of wealth creation, as seen in the framework of Ireland et al. (2003). Ireland et al. (2003, 964) report that Meyer and Heppard (2000) have observed the Entrepreneurship and Strategic Management disciplines to be inseparable. (Meyer & Heppard in Ireland et al. 2003). This notion is backed up by Hitt et al. (2001). Ireland et al. (2003) say that both the viewpoints are needed for explaining each other's research findings for better understanding of the findings. This is in line with the convergence notion of Kyrgidou and Hughes. Kyrgidou and Hughes (2010) say that a firm's ability to continually renew current resources and build new capabilities is central in achieving competitive advantage, and for the long-term success of the firm, attained through acting entrepreneurially.

The firm which operates by the model presented by Ireland et al. (2003) is acting both strategically and entrepreneurially (Kyrgidou & Hughes 2010). As an extension to the model by Ireland et al. (2003) Kyrgidou and Hughes (2010) found out that the implementation of those components presented by Ireland et al. need not to be linear for a firm to be strategically entrepreneurial. Kyrdigou

and Hughes (2010) say that therefore, there might be different pathways to the implementation of the components of SE, and to SE based on “configurational” approach. They say it is necessary to consider both the integration and interdependency of these components to synthesize SE. They say that SE can be perceived as a form of strategic architecture, listing those elements that should be in place in the development of strategy and entrepreneurship. Strategic Entrepreneurship therefore fulfills the need for strategic architecture, which has been mentioned by Prahalad and Hamel (1990) as mentioned in chapter 5.1.

In figure 7 is presented a model which at first describes how origins of Strategic Entrepreneurship are in Entrepreneurship and in Strategic Management. Secondly it illustrates the process of Wealth Creation and the process of developing Competitive Advantage. Competitive Advantage is, according to Ireland et al. (2003) developed through managing resources strategically. As verified by Kyrgidou and Hughes (2010) and originally presented by Ireland et al. (2003) applying creativity and developing innovation together with managing resources strategically, will develop competitive advantage for the firm, which then, will lead to wealth creation. This presented model is the main theoretical framework used in this study. It is a modified representation of the model presented by Ireland et al. (2003) seen in figure 6. This modified framework can be used to analyze how firms can create competitive advantage and wealth through managing resources strategically.

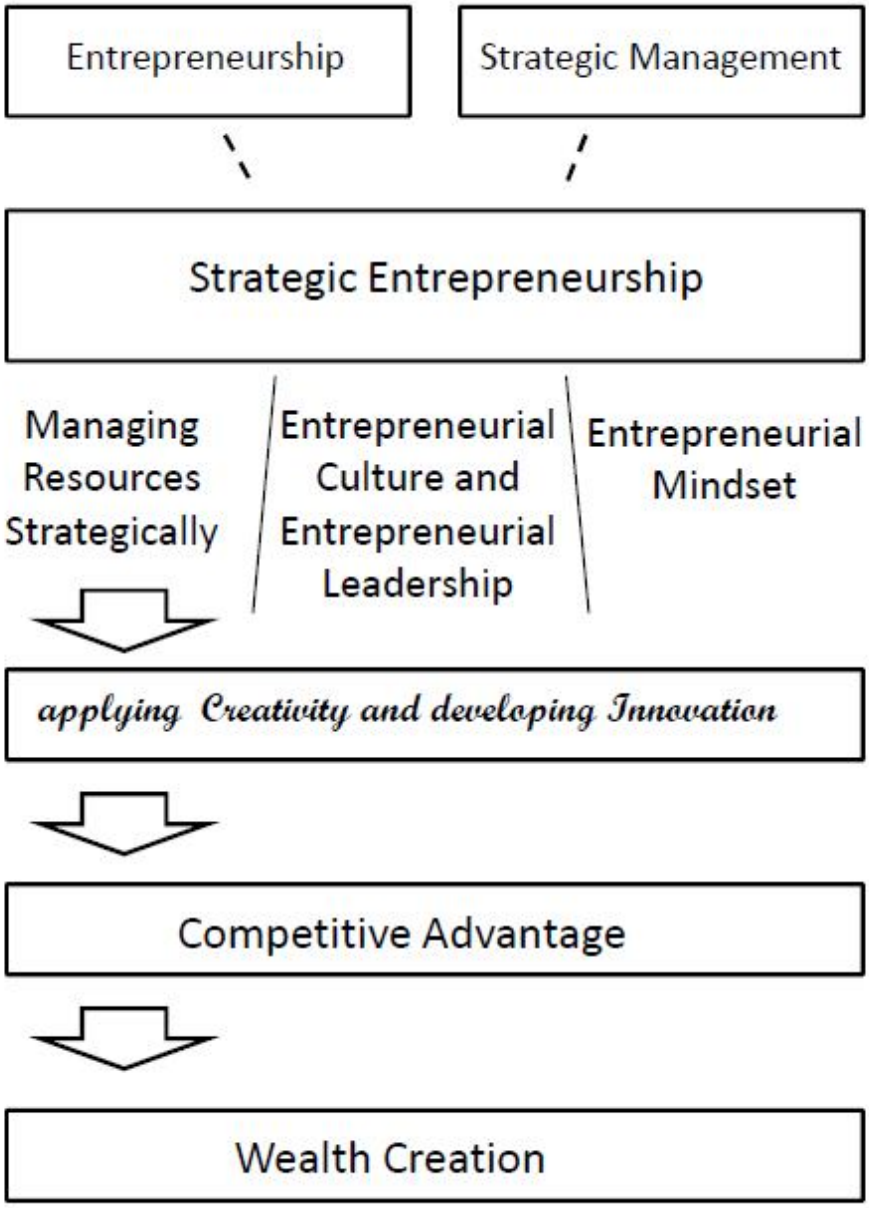

FIGURE 7. A model for achieving competitive advantage and creating wealth

Kyrgidou and Hughes (2010) say that any of the processes of SE will not continuously renew itself without the existence of a number of firm specific resources and especially dynamic capabilities. This is partially true and partially not, what it comes to open source software code as a resource of software producing firm. The constant renewal of open source software code does not need any firm specific resources because of the mechanism how the open source software code is produced. The open source software code itself includes a dynamic nature. It is continuously developed further, in peer-to-peer networks outside the firm boundaries. The firm does not take any action in this constant renewing of resources, the renewing happens autonomously and despite the firm and its actions. By having open source software code as a firm resource,

the firm's resource base will be autonomously renewed and developed further, because the open source software code renews itself all the time, outside the firm boundaries, and is at all times in the disposal of the firm. Kyrgidou and Hughes (2010) did not find this out because they limited their study in such a manner that they did not analyze how external factors influence and shape the process of SE, albeit they assumed that environmental context might be notable on the SE process. Hitt et al. (2001) have analyzed the role of external networks in their work. The role of external resources and external networks will be discussed in chapter 7 together with the dynamic capabilities perspective.

6.1 The Resource-Based View

The Resource-Based View (RBV) is a concept of Strategic Management (Fahy & Smithee 1999) and it has become one of the standard theories in that field (Hoopes, Madsen and Walker 2003). RBV examines the link between firm's internal characteristics and its performance (Barney 1991). It has said to be one of the most fruitful and popular areas of research in the field of Strategic Management (Hoopes et al. 2003). It has evolved from early economic models of imperfect competition, through the work of evolutionary economists, to the contributions of scholar from strategy and marketing, and its popularity in the strategy literature has been growing since the mid-1980's. The principal contribution of RBV has been its application as a theory of competitive advantage. (Fahy & Smithee 1999). Barney in 1991 as Conner and Prahalad in 1996 have discussed about a resource-based view in which the sustainable competitive advantage is formed from unique set of resources in the core of the firm (Saffu and Manu 2004). Dolinger has stated 1991 that a resource-based view describes how the owners of the firm build their business from those resources which they at the time possess and which they can acquire (Saffu and Manu 2004). Chesborough and Appleyard (2007, 59) say that in the resource-based view ownership of certain resources is seen as the core of competitive advantage. Saffu and Manu (2004) say that central to the theory of RBV is a statement that a firm can achieve superior performance in relation to its rival at the same market by acquiring and exploiting unique resources of the firm.

According Fahy and Smithee (1999) the concept of RBV was first coined by Wernerfelt 1984. According to Kyrgidou and Hughes (2010) Penrose contributed to the emergence of RBV presenting the resource heterogeneity to be the primary source of competitive advantage. The initial idea of Penrose 1959 then later formulated into the theory known as RBV, through the work of Wernerfelt 1984 and Barney 1991. The concept of RBV remained dormant for much of the 1980s, but then, dissatisfaction towards Porterian focus on industry structure eventually ignited the development of the RBV concept. (Fahy & Smithee 1999). According to Barney (1991) strategic research did not place much of attention to firm specific resources because it was assumed that firms within an industry, and firms within a strategic group, where identical in terms of strategically rel-

evant resources they control and in strategies they pursue. According to Porter (1980, 129) a strategic group is the group of firms in an industry following the same or similar strategy regarding the strategic dimensions of that strategy. As RBV was able to show differences among the firms in the same industry and differences among the firms of same strategic group, this increased interest in firm-specific variables took a stance substituting the Porterian focus on industry structure. Teece et al. (1997, 513-514) report that one of the key elements of the Resource-Based View is how it acknowledges firms with superior systems because of their have higher product performance, that is, acknowledge firm-specific factors in explaining firm performance. According to them RBV sees the rents accruing of scarce firm-specific resources rather than from product market positioning suggested by the competitive forces approach made familiar by Porter (1980).

In 1994 the article Wernerfelt published 1984 was awarder as a paper being truly seminal and being an early statement of an important trend in the field of Strategic Management. (Fahy & Smithee 1999). Barney (1991) says that the model of RBV assumes that firms within a same strategic group may have different strategically relevant resources, and that they may not be perfectly mobile across firms. Therefore, heterogeneity between firms and their resources can be long lasting and a sustaining competitive advantage can thus be achieved.

Kyrgidou (2006) says that the Resource-Based View of the firm (RBV) is aligned with the main dimensions of Strategic Entrepreneurship – with value creation in the marketplace through opportunity exploration and exploitation, and with sustainable competitive advantage. Kyrgidou (2006) says that RBV provides a useful framework for focusing on the development of the resources and capabilities which the firm need to perform efficiently. According to Saffu and Manu (2004) the firm's capabilities are in a central role in how the Resource-Based View explains firm performance. Kyrgidou (2006) says that resources and capabilities can be seen as performance enabling mechanisms in the context of SE, that is, in the context of entrepreneurial actions, strategic actions, entrepreneurial orientation and strategic renewal. Kyrgidou and Hughes (2010) say that strategic management theory is epitomized by the Resource-Based View of the firm (RBV) and that strategic management theory "highlights the creation of a unique resource position for the firm to create advantages that allow it to compete effectively into the long term" (2010, 46). This is a denotation to the concept of sustainable competitive advantage.

Kyrgidou and Hughes (2010) say that resources and dynamic capabilities are two critical components in the study of Strategic Entrepreneurship. They say that resources are perceived as value creation drivers via the development of competitive advantage. This suggests that possessing valuable and rare resources, as suggested by RBV, provides the basis for value creation. According to Barney (1991, 2001) a firm's sustained competitive advantage derives from the resources and capabilities a firm controls, and that these resources must be 1. Valuable 2. Rare. 3. In-imitable and 4. Non-substitutable in order to provide

sustainable competitive advantage to the firm. The assumptions 2-4, the need for rarity, in-imitability and non-substitutability will however be challenged in this study.

Barney (1991) says that those resources of a firm's physical, human, and organizational resources that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness are such resources, that Wernerfelt has originally defined as firm resources when introducing the definition of RBV in 1984. Barney (1991, 101) suggests that a company's resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness. He says that firm resources may include such resources as the technology used in the firm, the firm's access to raw materials, relationships and informal relations between the firm and its environment. He also notes that not all firm's resources are strategically relevant.

Amit and Shoemaker (1993, 35) divide the term of resources, to two categories which are 1. Resources and 2. Capabilities and say that these two categories of firm characteristics form Strategic Assets of the firm. They say that capabilities are firm-specific in contrast to resources which are not. Capabilities in their definition refers to a firm's capacity to deploy resources. They say that capabilities are tangible and intangible processes that can be abstractly thought as of as intermediate goods generated by the firm to provide enhanced productivity of its resources. They also say that capabilities are based on developing, carrying and exchanging information, and that capabilities are often developed by combining physical, human and technological resources at the firm level. They take short product development cycles as one example of firm capabilities. The product development capability of a firm and the pace of product development are in the core of this study.

Amit and Shoemaker (1993) describe how resources, information and people are combined sequenced over time in order to evolve firm capabilities. They say that material aspects of resources and capabilities are not that important, form the point of value creation, but the transformational characteristics are especially important, and that's what they are from the perspective of this study too. It is the transformational nature of the specific resource in question (open source software) and the dynamic renewal process of that resource which provides an explanation, why open source software can provide competitive advantage to a software producing firm.

6.2 The Dynamic Capabilities View

Teece et al. (1997) say that the dynamic capabilities approach builds upon the theoretical foundation presented by Schumpeter 1934 and Penrose 1959 among others. This is a clear indication that the concept of dynamic capabilities has very much to do with the discipline of Entrepreneurship. Möller, Svahn, Rajala

and Tuominen (2002, 10) say that dynamic capabilities view is an extension to RBV which explores how valuable resources are created and acquired over time in order to achieve or maintain competitive advantage. Teece et al. (1997, 516) define dynamic capabilities as the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments. Möller et al. (2002, 10) say that dynamic capabilities are rooted in firm's managerial and organizational processes aimed at the creation, coordination, integration, reconfiguration or transformation of its resource position. Thinking of open source software code as a firm resource, it is integrating, building and reconfiguring what a software manufacturing firm does when it is manufacturing software products from open source software code, transforming a resource to create new products.

Ridder (2012) refers to earlier literature and says that the role of dynamic capabilities has been highlighted in the creation of new technologies and products, more generally, in the creation of innovations. Wu (2007, 550) says that dynamic capabilities are of particular importance for technology-based ventures because the speed of development is high at high-tech industries, and therefore the dynamic capabilities affect greatly to survival of high-tech start-ups. Kyrgidou and Hughes (2010) define that dynamic capabilities of the firm are the firm's capacity to renew physical resources and skills at a high pace. According to them the firm's ability to continually improve current resources and build new resources is the most important thing in maintaining competitive advantage over time. They say that this dynamic renewal of resources, and the firm's dynamic capability to renew its resources, are central elements of the wealth creation process. They also say that the chances for a successful wealth-creating process become that higher, the faster the pace of resource renewal through the dynamic capabilities is. The framework described by Kyrgidou in writing (2006) is illustrated in figure 8. The attributes of Entrepreneurial Orientation in the figure 8 are those presented by Schillo (2011). The frames drawn in to the figure describe the focus of this study, which is, the relation of the Resource-Based View and Dynamic Capabilities to Strategic Entrepreneurship.

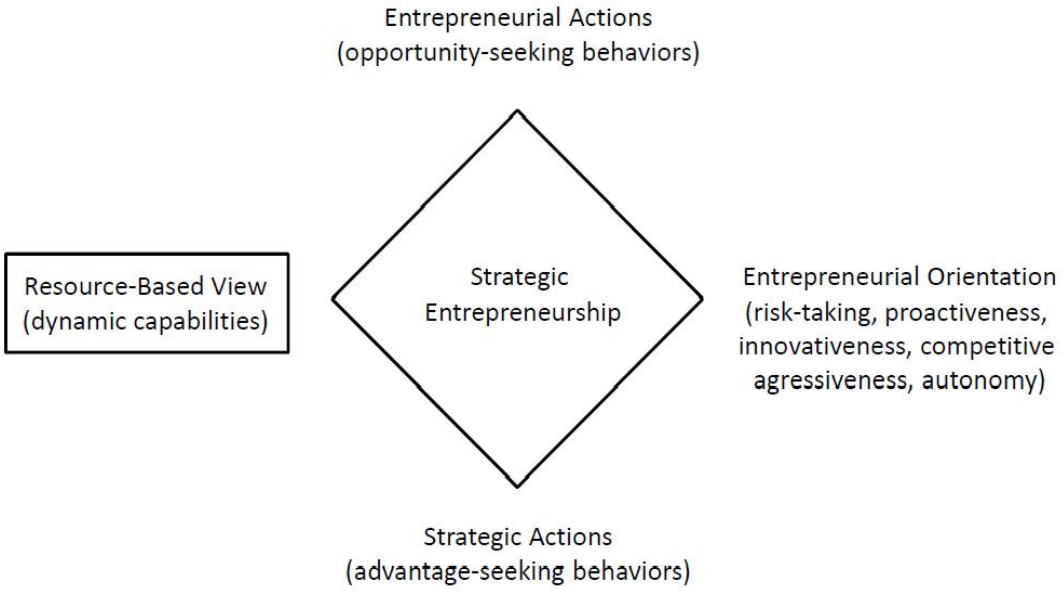

FIGURE 8 Strategic Entrepreneurship, Resource Based-View and Dynamic Capabilities

According to Teece et al. (1997) the dynamic capabilities framework analyzes the sources and mechanisms of wealth creation in environments of rapid technological change. The development of open source software represents an area of rapid technological change and therefore the framework of dynamic capabilities suits very well into analyzing the renewal process of open source software, and to analyzing the wealth creation process of the firm using open source software code as a resource of software manufacturing, and is a suitable framework to analyze whether the use of open source software code as a firm resource provides a source of competitive advantage to the firm. Kyrgidou and Hughes (2010) say that the dynamic capability perspective is of particular importance for entrepreneurial processes, and that dynamic capabilities are essential drivers behind the recombination of existing resources into new sources of firm value. (2010, 47.) According to Teece et al. (1997) firms can achieve competitive advantage through dynamic capabilities, which as view, according to Kyrgidou and Hughes (2010), has emerged from the RBV. Kyrgidou and Hughes (2010) say that the dynamic capability approach overcomes the static limitations of the RBV, and that the dynamic capability approach considers the internal functions of the firm as key to achieving firm success. This is in line what Barney (1995) says regarding resources as the source for competitive advantage. Barney (1995) says, that in search for competitive advantage one should look the sources of competitive advantage from inside the firm, not outside, as proposed by the well-known market forces approach of Porter (1980). Also Teece et al. (1997) stresses out the importance of firm's internal technological, organizational and managerial processes (the dynamic capabilities) over so called strategizing, which concentrates to keeping competitors off balance and to safeguarding the current competitive advantage, instead of concentrating to

how the firm should build competitive advantage in the environment of fast change. Teece et al. (1997, 528) say that focusing too much to strategizing can lead the firm to invest too little into development of core competencies and thus harm its long-term competitiveness.

Kyrgidou (2006) says that dynamic capabilities form the core of Schumpeterian search for new resource combinations from inside and outside of the firm, and that this mechanism is the driver of entrepreneurial activity. Kyrdigou (2006) says that Strategic Entrepreneurship will materialize through integrating a third fundamental perspective to opportunity-seeking behavior and advantage-seeking behavior, by adding the resource based view. She says that Strategic Entrepreneurship will materialize especially through the development and management of specific dynamic capabilities. Dynamic capabilities and the renewal of essential resources of the firm, then becomes the key feature of wealth creation. Kyrgidou and Hughes say that dynamic capabilities are critical to balance advantage-seeking and opportunity-seeking behaviors (2010, 44).

Figure 9 illustrates the role of resource management and dynamic capability of the firm, in relation to Strategic Entrepreneurship. Kyrgidou and Hughes (2010) present here six components which they have observed to be consistently highlighted to contribute to the fundamentals principles of Strategic Entrepreneurship, and say that each of these six components is set against the common value of resource management and against the dynamic capability generation. Kyrgidou and Hughes (2010) say that resource management and dynamic capability are two critical components in the study of Strategic Entrepreneurship. Resource management and dynamic capability of the firm according to Kyrgidou and Hughes then become the seventh and eight component relevant to the study and analysis of SE. Kyrgidou and Hughes (2010) say the essence of SE to be, that the components of SE presented in Figure 9, work together in a common direction. They say that it is not necessary that each component would weigh equally, but together, they form an integrated system creating SE.

Kyrgidou and Hughes (2010) say that resources are value creation drivers. They align with RBV and say that possessing valuable and rare resources provides the basis for value creation. This however might not be true in case of open source software code as a firm resource. Open source software code is not a rare resource because it is freely at anybody's disposal, but it is a resource which is constantly renewed and developed, and therefore, open source software code itself has very strong dynamic nature and contains a capability of constant renewal. This makes it such a firm resource which may develop competitive advantage for the firm, in relation to those firms which are not using open source software components as a resource in their software production.

According to Hitt and Reed (2000) if a firm fails to renew its resources or key strengts, its future strategic options will be eliminated (Kyrgidou & Hughes 2010). Therefore renewing the resources is essential for the firm to remain competitive. This suggests, that a constant resource renewal is vital for any firm looking forward to remain competitive.

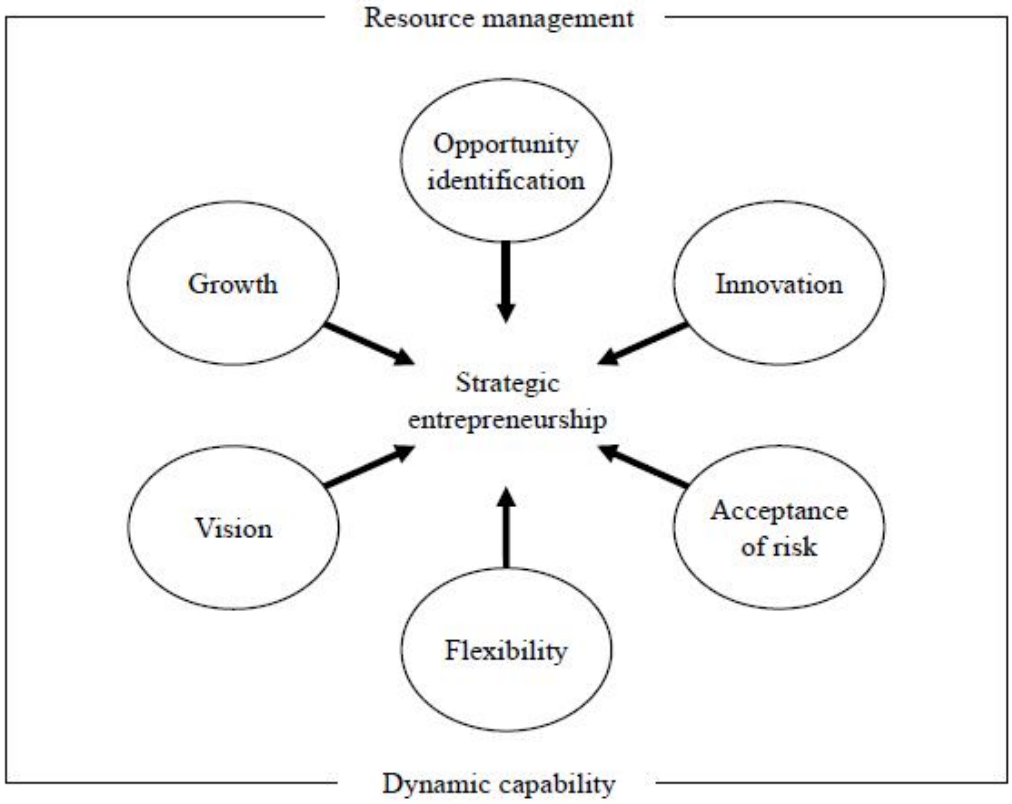

FIGURE 9. Components of Strategic Entrepreneurship (Kyrgidou & Hughes 2010).

6.3 Strategic Management of Resources

Ireland et al. (2003) say that the Resource-Based View (RBV) of firm provides the theoretical underpinnings how resources can be managed strategically. The framework of Ireland et al. (2003) presented in figure 6 and the theoretical framework of this study presented in Figure 7, modified from the previous, include the component of strategic management of resources. It has therefore been well justified to take the RBV into close analysis in this study. Klein et al. say that RBV is critical to specification of what is Strategic Entrepreneurship (2003, 972). They say that research has shown differences in resources to be the basis of difference in performance, among firms (2003, 973). Klein et al. (2012) say that the view of Dynamic Capabilities once introduced by Teece (et al.) 1997 is perhaps most direct precursor for the domain of Strategic Entrepreneurship. The view of dynamic capabilities introduced by Teece et al. (1997) argues that "superior performance comes from a firm's ability to change its resource base in the face of Schumpeterian competition and environmental change." (Klein et al 2012, 6).

Ireland et al. (2003) say that tacit knowledge is increasingly defined as a resource explaining firm performance, which suggests, that tacit knowledge shall be managed strategically. They also say that tacit knowledge is embedded in firm routines including collaborative working routines and its social context. (2003, 974.) Hitt and Ireland (2002) and Ireland et al. (2003, pp.974-975) say that tacit knowledge is commonly known as a source of competitive advantage. Ireland et al. (2003, 975) write that

> Managerial tacit knowledge is necessary to bundle most appropriate resources to create capabilities and to design effective leveraging strategies that produce a competitive advantage and exploit identified opportunities.

Jarillo (1989) has said that using external resources which provide access to external resources provides competitive advantage to the firm, and that the use of these external resources is in the essence of entrepreneurship. Jarillo also says that that utilizing these external resources becomes a distinguishing factor between fast and slowly growing firms (Jarillo 1989 in Suoranta and Jones 2012). Therefore, it becomes topical to ask, how a firm should manage its external resources, in order to manage them strategically.

6.4 Seeking Competitive Advantage

Klein et al. (2012) say that future competitive advantages are highly uncertain, and that the field of Strategic Management has until recently been surprisingly silent about where competitive advantage has its origins. This calls for the need to investigate how competitive advantage is attained, and makes this study very topical. The pursuit of sustainable competitive advantage is an idea which is in the heart of Strategic Management and Marketing (Fahy & Smithee 1999). Fahy and Smithee (1999) say that it is the Resource-Based View of the firm which has made the principal contribution to date as a theory of competitive advantage. Another view which has achieved a solid position in the discussion about competitive advantage is the work of Porter. He published his work *How Competitive Forces Shape Strategy* in 1979 and his view of Five Competitive Forces has for long been quite dominant in the field of Strategic Management, whenever there is discussion about how firms can achieve competitive advantage in the marketplace. The theory of Five Competitive Forces is however delineated outside the scope of this study, due to several reasons.

Chesborough and Appleyard (2007) say that there has emerged new and anomalous development in the field of strategy which calls the need for examining critically the works of Porter and his followers. They say the Resource-Based View has its origins in the research of Richard Rumelt who turned the focus from analyzing industry characteristics into analyzing characteristics of individual firms. Rumelt was a former student of Porter. Chesborough and Appleyard (2007) appreciate Porter's pioneering works but also describe how

his theories analyzing the origins of competitive advantage fail to explain why firms and whole industries, especially the industry of software manufacturing, use business models that are based on open innovation and collective creativity. According to Chesborough and Appleyard (2007) there are such business models among the business models based on open innovation which challenge the traditional views of how a firm can be successful. They say that the concept of open source development and similarly inspired ideas of such as open innovation and peer production represent a phenomena that require a rethinking of strategy.

Chesborough (2003) and Chesborough and Appleyard (2007, 60) say that in case of the open innovation phenomenon the Porterian view of firms position in its market cannot adequately answer to the question how the firm remains competitive or achieves competitive advantage, because the Five Forces model does not notice the potential value of the external resources that are not owned by the firm in question. Chesborough (2003, 60) says that these external resources represent growing sources of value creation. Homa (2012) says that Porter's model of Five Competitive Forces was developed at a time when cyclical growth characterized the global economy, at a time when primary corporate objectives consisted of profitability and survival, and that a major prerequisite for achieving these objectives was optimization of strategy in relation to the external environment. Homa (2012) says that conditions in today's market are much more dynamic and therefore Porter's Five Forces model is not so valid today as it used to be. According to Jones (2011) Porter's model of Five Competitive Forces created 1979 and his Value Chain model created 1985 represent are very basic of their nature and represent the old-school of strategy tools. He says that they are no longer very useful in making strategic analysis because the usage of those models does not provide such insight which the competitors of the firm could not easily find out too, by making the same textbook level calculations. Therefore he sees that the mentioned models of Porter can at most be suitable purposes of tactical planning instead of strategic planning.

Homa (2012) says that Porter's model assumes relatively static market structures. According to him Porter's view of Five Competitive Forces is not able to take into account new business models and the dynamics of the markets. As described by Homa (2012) and Barney (1991) Porter's (1980, 1985) analysis of competitive position of the firm concentrates to conditions outside the firm and makes an assumption that firms and their strategic groups do not usually differ from each other. That is, usually, because even Porter (1980, 129) says that at the extreme, each firm can be regarded as its own strategic group. This however is not the general view of the theory of strategic groups. This comes evident since Porter (1980) sees that mobility barriers are generally high in industries which are not new. Thus, the mobility barriers between strategic groups become defining factors of the groups.

Teece et al. (1997, 514) report Cool and Schendel (1988) to have shown that there are systematic and significant performance differences among firms which belong to the same strategic group and say Rumelt (1991) to have shown

that intra-industry differences in profits are greater than inter-industry differences in profits. Teece at al. (1997) say that these finding strongly suggest the importance of firm-specific factors. Teece et al. (1997, 528) criticize the model of Porterian competitive forces by noting that the competitive forces approach is not particularly firm specific, as it is industry and group specific. They say that there is no algorithm for creating wealth for the whole industry, and say, that prescriptions applied to industries or groups of firms can at best suggest overall direction and may indicate some errors to be avoided. Barney (1995) has also noticed that firms differ from each other and says that one should look the source of competitive advantage from inside the firm, look the resources possessed by the firm, not the market conditions outside the firm to which Porter's model concentrates. By this notion Barney wishes to differentiate the firm-specific Resource-Based View from the once dominant Porter's theory of competitive forces of an industry, as does Teece et al. differentiate their firm-specific dynamic capabilities view of the Porterian static competitive forces view.

Chesborough (2003) brings up discussion about a new paradigm, the study of Open Innovation, and directs attention to those resources which are not fully owned or controlled by the firm, those resources that exist outside the firm boundaries. If we think about Open Source Software and its production mechanism, this is where the magic happens, the source of competitive advantage lies in the resources external to the firm. It is then only question how the firm can internalize the fruits of Open Innovation. As Teece et al. (1997, 528) say the competitive advantage stems out of high-performing routines inside the firm, which then are shaped by firm's processes and position. By position Teece et al. mean the specific assets of the firm.

Ireland et al. (2003) say that firms should produce disruptive innovations and say that disruptive innovation provides the firm the possibility to control its competitive destiny. They say that disruptive innovation, when successful, can result creation of new markets and business models. (2003, pp. 981-982.) Being in control of its competitive destiny, means that the firm becomes competition setter instead of being competition taker. Ireland et al. (2003) present that disruptive innovation can happen through creativity, and the process of bisociation, where a person combines previously unrelated things with each other. They say that the firm should seek for balance between exploration, in tampering disruptive innovations, and exploitation of current innovations, to fully materialize their value. (2003, pp. 981-983).

Dahlander and Magnussen (2005, 646) say that when the role of the firm shifts from internal development and manufacturing to assembling reused knowledge and components, certain capabilities of the firm become fundamental in developing and sustaining competitive advantage. According to them, in making use of the development contribution of OSS communities these capabilities are the efficient and effective scanning of the environment, evaluation of developments outside the core areas of activities, and a rapid and seamless integration of the external knowledge and components. They say that when firms rely heavily on the development made in the communities, the capability to

manage relationships in a way that makes it possible to access, coordinate and use the knowledge produced outside the firm's boundaries becomes critical for competitiveness. Duarte and Sarkar (2011) find that open innovation strategies intend to increase the competitiveness of firms, in particular regarding the speed of introducing innovations in the market.

6.5 Major shifts of thoughts

Authors once introduced ideas how sustained competitive advantage can be achieved (ie. Barney 1991) now say, some opposite comments, that the nature of competitive advantage to be achieved, is temporarily of its nature, not sustained. (Klein, Barney & Foss 2012). Kyrgidou and Hughes (2010) say as well, that advantage is at best temporary and that firms must explore new opportunities rather than only exploiting its current resource advantages over other firms. They say that this feature explains why small firms and new entrants can outmanoeuvre their larger and well-established competitors.

7 COMPETITIVE ADVANTAGE THROUGH DYNAMIC CAPABILITIES

Teece et al. (1997, 515) say that competitive advantage requires both exploitation of internal and external firm-specific capabilities and developing new capabilities. According to them it is the core of the dynamic capabilities view how firms first develop firm-specific capabilities and then renew their competences to respond changes in their business environment. Ridder (2012, 19) says that according to the literature regarding dynamic capabilities, dynamic capabilities do not directly lead to competitive advantage, but dynamic capabilities changes the resource base of the firm, which then affects firm's performance. She says that the effect of dynamic capabilities to firm performance is therefore indirect. Chesbrough (2003, 57) says that open innovation firms cannot treat their knowledge as static, they must treat it as fundamentally dynamic.

7.1 Challenging the Resource-Based View

Chesborough and Appleyard (2007) report about their findings that they have recognized several exceptional developments related to open innovation phenomenon which call the need for reassessment of the Resource-Based View of the firm. Wu (2007) says that application of the Resource-Based View is too simplistic in rapidly evolving market and can produce misleading conclusions of firm performance. He says that high-tech firms face unstable and dynamic market conditions and short product lifecycles. According to Wu this calls the need for examining the dynamic capabilities of the firm as explainer of firm performance. He says that without dynamic capabilities the entrepreneurial resources of the firm do not transform into performance. Ridder (2012) says that resources are essentially static in their nature and are not capable of explaining competitive advantage in changing environments. She says that dynamic capabilities fill this gap by emphasizing the firm's pursuit of renewing these resources, in adapting to firm's volatile environment.

Klein et al. (2012, 5) refer to empirical findings which support such understanding, that competitive advantages are temporary of their nature. This challenges the views which say, that sustainable competitive advantages could and can be achieved (ie. Barney 1991). Whether or not competitive advantages that can be achieved, are sustained or temporarily of their nature, this study is interested in, what is the mechanism how competitive advantage comes into existence. The Resource-Based View (RBV) says that competitive advantage can be formed on the resources that the firm possesses, and builds into four assumptions regarding those resources. As Barney (1991) describes it, firm's resources should always be 1. Valuable, 2. Rare, 3. In-imitable, and 4. Non-substitutable in order to be able to create competitive advantage to the firm. The phenomenon of Open Source Software forms an interesting exception to this rule.

Chesborough and Appleyard (2007, 58) call the need for a new approach to strategy which the name as open strategy. They say that the viewpoint of open strategy is needed in finding out what kind of effect innovation communities and innovation ecosystems have to the forming of competitive advantage. According to them an open strategy combines the traditional views of strategy to a promise of open innovation by adopting the benefits of openness in creating value.

7.2 The superfluity of Rarity, In-imitativeness and Non-substitutability

It is agreed here that a firm resource should be Valuable in order to be a source of competitive advantage. But it is disagreed that the firm resource should also be Rare of its nature, In-imitable of its nature, and Non-substitutable of its nature. It is argued here that the logic of Resource-Based View of the firm (RBV) does not hold in the case of open source software code as a firm resource. It is argued that open source software code does provide a source of competitive advantage to the firm, without being Rare, In-imitable or Non-substitutable. This is because the dynamic nature of that specific resource.

Open source software constantly renews as a resource and therefore this resource in question holds inside a dynamic renewal paradigm. This phenomenon happens as follows: Numerous software developers around the world voluntarily review and develop the freely available source code and therefore develop the foundations of the software program, and develop the software product and its components to be better and better. This development happens independently and irrespective of the firm which uses or can use the source code and components developed by the worldwide collective developer community as a component its own private software product and or as an ingredient of its private production. The development of open source software is autonomous. The notion of Teece et al. (1997) regarding virtual structures suits well to this condition of autonomous innovation. Teece et al. (1997) say that

firm's external linkages have an important meaning on the rate and direction of innovation. In the phenomenon of open source software development firm's external linkages to the OSS developer network provide direction and content for the firm's own product development.

It is a new finding that a firm can enjoy a competitive advantage that stems from a resource which is homogenously, not heterogeneously distributed as the RBV insists, from the perspective of the firm. Firms belonging to same strategic group, those firms using open source software code as a resource for their software manufacturing, can enjoy competitive advantage, at least in relation to firms manufacturing traditional proprietary software even if the resource in question (open source software code) is homogenously distributed among the firms in the strategic group, not heterogeneously that the RBV insists as a precondition to the competitive advantage.

It is argued here that the belonging to the same strategic group as explained above is not prerequisite for enjoying the competitive advantage created by the open source software code. This view is based to the dynamic nature of OSS code and OSS components as a firm resource. The constant renewal process of open source software code which happens autonomously, irrespective of the firm, is the reason. Open source software code as a firm resource is constantly renewed and developed further irrespective of the firm which uses it as a resource, as an ingredient in its software manufacturing, and therefore also the firms end-product develops further, to be better, all the time, irrespective of the firm's own actions. This finding, that a certain homogenously distributed resource, open source software, can be a source of competitive advantage challenges the prerequisites defined by the RBV.

Barney (1991) says that a competitive advantage may exist when it will not be competed away through the duplication efforts of other firms. This condition exists in regarding OSS code and OSS components. A possible competitive advantage provided by the use of OSS code as a resource for software manufacturing cannot be competed away because according the open source principle the OSS code is at everybody's disposal at all times. Using the same resource as a component of software products therefore does not take away the possible competitive advantage. The firms here enjoy the competitive advantage because they enjoy the positive effects of the works of open source development community.

According to Barney a firm may enjoy competitive advantage if it is implementing a value creating strategy which is not simultaneously being implemented by any of its current or potential competitors. There exist several different possible strategy options and business models for a firm exploiting open source software phenomenon. One of these is the reuse of software code and readily working software program components as an ingredient of the firm's software product manufacturing. Another, for example is the dual licensing model where the firm is licensing a certain software product in both license types, under the open source license and commercial license.

If a firm using OSS code as its resource is compared to a firm producing proprietary software, a software product with a closed source code, these two are clearly different strategies and therefore the firms can be defined as competitors for each other. They are using different resources and producing different kind of products. If comparing two firms producing commercial open source software (COSS) in which they use publicly available open source software code or components as ingredients in their manufacturing process, these may also be considered as competitors. These two firms cannot compete away each other on basis of the reused source code because all the open source software source codes are at all times available to both of them. Barney (1991) says that "whether or not a competitive advantage is sustained depends upon the possibility of competitive duplication". Duplication in the case of open source software code is irrelevant, because both of the incumbents have the same resource availability, and practically the same access to OSS code and OSS components. Because these resources are at their disposal at all times, both of the incumbents gain the competitive advantages of open source software development.

The reason why both of them gain the competitive advantage and why not neither of them, derives from the dynamic nature of the resources in question. OSS code and OSS components are dynamic of their nature *per se*. This is a central finding of this study. Because open source software code constantly renews itself through the development efforts of the worldwide developer community this forms a situation where the software code the firm uses as an ingredient in its software manufacturing, is always up to date and always renewed according to the latest proceeding of development. Therefore using open source software code provides at least theoretically a constant and sustained competitive advantage for the firm who is using the open source software components as an ingredient in its software products. This "always-updated" condition exists without and regardless of the firm's own contribution. If two firms exploiting the results of the work of the worldwide open source developer's network, develop their products without revealing their own contribution, it is unlikely that they end up with exactly same product features. These firms thereby hold the competitive advantage of open source software development towards each other, too. The resources they receive from OSS communities do not define the result of their competitive struggle *ex ante*. Despite that they have access to same resources it is unlikely that they end up in exactly same end-products and their features. If they compete straight against each other, the result of their competition is finally solved at the market after they have released their derivative products to public, to the market.

Barney (1991) says that the inability of current and potential competitors to duplicate firm's strategy makes the competitive advantage sustained. Barney (1991) says that in general, firms cannot expect to obtain sustained competitive advantage if strategic resources are evenly distributed across all competing firms and highly mobile. According to this notion, firms using open source software code in their software production could not gain sustained competitive advantage over each other. But at least, what is comes to the firms which

produce proprietary software using closed source structure in their production, firms reusing OSS code and OSS components may achieve sustained competitive advantage against proprietary software manufacturers, especially when the dynamic nature of the mentioned OSS resources is taken into account.

It is however argued here that also firms which base their strategy to reusing the OSS code provided by the open source development communities, enjoy a competitive advantage in the market because of the very special nature of open source software development. Especially the special quality that the source code develops further and better all the time by the worldwide developer's community, despite the actions of the firms in question, makes this possible.

According to Jones (2011) the teachings of traditional business strategy, derived largely from the field of economics, tend to call anything that does not fall into categories of traditional market-factors or market-actors, as exogenous factors and delineate them out in the performed analysis. He says that exogenous factors are such which have traditionally considered as such factors that are out of the reach of a firm, such which the firm cannot straightly influence and therefore they are taken as given circumstances in the traditional views. The open source development community is a non-market actor, as introduced below by Jones (2011). This non-market actor however provides competitive advantage to the software firms exploiting its works. One possible way of exploiting the works of the developer community is the reuse of the source code and readily working software components, as it has been explained above.

Jones (2011) says the limited view of the firm's actual circumstances where exogenous factors are excluded from the analysis is a weakness of a traditional static business strategy. He says that in the real life these "exogenous" factors however influence to the firm's ability to create and sustain value. Jones (2011) therefore presents a model of an integrated strategy which takes the non-market actors into consideration. From the viewpoint of a software manufacturing firm the network of open software developers can be thought as an exogenous factor, but it should not be left out in the analysis of software industry and its phenomena. A good example of how these factors can be taken into account in practice is that some software manufacturing firms ask their employees to use part of their time as contributors in networks external to the firm, developing the open source software further as a member of the worldwide informal network of developers.

7.3 External resources and Networks

Möller et al. (2002, 14) say that strategic networks can create and master capabilities that are beyond the capacity of any single actor, and that the networks in which the firm operates condition firm's internal resources and capabilities, and their development potential. They say that both the firm and the network should be regarded as agents that are engaged in a simultaneous structurization process where the firm influences the structure and processes of the network, but the network also

influences the resources, behavior and options of the firm. In this study we are interested how the network of open source software developers affects to the firm's resources and behavior.

Möller et al. (2002) present as set of capabilities which the firm needs when it is involved with a business network. These capabilities include incremental innovation capability and deep partnering ability which have been highlighted in figure 10. It is suggested here that a firm in interaction with the worldwide open source developer network needs these capabilities to take advantage of the network and therefore create value for the firm. In addition to these, according to Teece et al. (1997, 521) the firm also has may have different kind of assets that enable the firm to achieve various goals. Such assets may include reputational assets which may help to catch the attention of potential future employees or development partners from the network of open source software developers. Or structural assets, like formal and informal external cooperation linkages to product development partners. Also the degree of integration, be it vertical, lateral or horizontal, is quite some significance, according to Teece et al. (1997). They say that organizational boundaries represent an important dimension of firms' positioning. Defining firm's boundaries is interesting in the context of open source software development, since some software manufacturing firms ask their employees to use part of their time as contributors in networks external to the firm, developing the open source software further as a member of the worldwide informal network of developers. This phenomenon has been acknowledged by several authors such as Fitzgerald (2006). Teece et al. (1997, 524) say that in their conceptualization the firm is much more than the sum of its parts or a team tied together by contracts. This is true especially regarding a firm involved in external networks, such as the worldwide community of open source software developers, and highlights the network relationships of a certain software developer on the payroll of a software manufacturing firm.

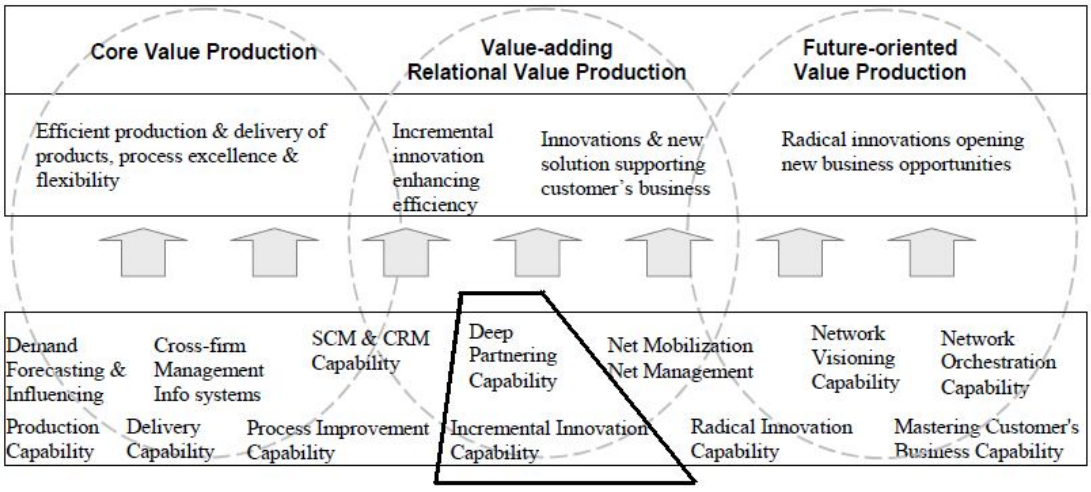

FIGURE 10. Essential capabilities, in illustration of value production and network capability base (modified from Möller et al. (2002)

7.4 The dynamic capabilities of sensing, seizing and reconfiguring new technological knowledge

Ridder (2012, 3) introduces work of Teece and explains how Teece (2007) categorizes dynamic capabilities into acts of *sensing*, *seizing* and *reconfiguring*. Ridder (2012, 7) says that firms require the dynamic capability of external *sensing* for recognizing valuable sources of external resource renewal. She says that according to Teece the *sensing* refers to the recognition of technological opportunities and the mobilization of requisite resources (Teece 2007 in Ridder 2012). Ridder says that once the knowledge sources have been recognized as valuable opportunities, these opportunities need to be seized in order to optimize their outcomes. *Seizing* refers to the organizational strategy and infrastructure for integrating resources to create and capture value from opportunities (Ridder 2012, 7). According to her, firms need to be able to absorb the knowledge contained in the external sources and to be able to integrate it into their internal innovative processes. She says that the dynamic capability of external *seizing* refers to the capacity to address opportunities for external renewal and implement external resources within the firm. Ridder introduces the prevailing discussions of existing resources and says that resources can be leveraged by putting them into new use. She refers to Eisenhardt and Martin who say that new products can be created by brokering knowledge from previous projects (Eisenhardt and Martin 2000 in Ridder 2012). Ridder says that such leveraging may also exist in the context of externally generated resources. Ridder (2012, 8) says that the dynamic capability of external reconfiguring can also be described as a combinative capability that refers to a novel synthesis of external and internal resources into new innovations. She says that as such the dynamic capability of external reconfiguration refers to the capacity to recombine external resources internally in order to achieve novel configurations that serve new purposes. This is exactly what happens when a software firm reuses software components or lines of code, or other artifacts from open source software projects which can be projects in the past or projects which are developed simultaneously with the firm's software development.

In her study Ridder (2012) specifies the processes underlying the dynamic capabilities (DC) of sensing, seizing and reconfiguring which put dynamic capabilities into use and make the external resource renewal happening, through firms knowledge management (KM) processes. According to Ridder (2012, 13)

> External sensing DC refers to the capability to scan the external environment and strategically select resource renewal paths. External seizing DC refers to the capability to coordinate resource transfer, integrate external resources within the organization and apply systematic KM processes. And finally, external reconfiguring DC refers to the capability to develop resource cognition and recombine internal and external resources in order to achieve novel configurations.

Ridder (2012, 14) says that the dynamic capability of external sensing can help the firm to obtain privileged access to external technological resources.

According to her external *sensing* consists of systematic processes of external scanning and strategic selection which enhance the identification of emerging technologies that fit to the firm's strategy. She says that if the firm has strong capabilities in sensing the opportunities of external technological renewal it is more likely that the firm obtains access to relevant technological resource outside the firm boundaries. Discussing the *seizing* of external technological resources, Ridder says that firms need to be able to effectively incorporate external technological resources into their own innovation processes in order to generate superior technological capabilities. Strong capabilities in technological operations that outperform those of competitors lead to the development of superior products. Therefore, according to Ridder, superior technological capabilities are associated with competitive advantage in innovation. (Ridder 2012, pp.16-17). Ridder then moves to analyze the dynamic capability of reconfiguration and says that reconfiguring is particularly relevant in innovation where most new products are inventive combinations of existing technological resources and capabilities. She says that the dynamic capability of reconfiguring is driven by resource cognition and recombination processes and that these processes together enable the firm to leverage external technological capabilities and put them into new uses. Ridder also argues (2012, pp.17-18) that the dynamic capability of external *reconfiguring* can contribute to forming of competitive advantage in innovation by drawing on external technological capabilities and applying them to new uses. The key elements of the dynamic capability of external reconfiguring are: Monitoring the external resource base, recombining external and internal elements, and creating novel combinations of them. Ridder (2012) says that the mentioned reconfiguring helps to achieve inimitability because novel combinations that combine both externally and internally created technological capabilities are complex and ambiguous and therefore they are more difficult to imitate. Ridder (2012, 18) anticipates that the dynamic capability of external reconfiguring determines the degree to which the firm's technological capabilities lead to competitive advantage regarding the innovativeness of the firm.

In her study Ridder (2012) found out that access to external technological resources has a negative effect to the firm's performance if the firm does not have strong dynamic capability of external seizing. She says that if the firm does not have systematic knowledge management and coordination and integration processes in place, accessing external technological resources will have a harmful effect on its technology-related operational capabilities. But if the firm possesses strong dynamic capabilities of external seizing, its access to external technological resources has a strong and significant positive effects on the firm's technological capabilities. Ridder (2012, 30) thus emphasizes the importance of developing a systematic coordination, integration and knowledge management processes for the firm to be able to seize external technological resource access into superioir technological capabilities. Her study therefore differentiates between the resource access and the firm's operational capabilities. Her empirical findings support the differentiation of technological resource

base into technological resource access and technological capabilities. Her findings also state that the dynamic capability of external reconfiguring has a direct positive impact on competitive advantage in innovation. This means that the influence of reconfiguring is independent of previously configured resources and capabilities.

Ridder (2012, 32) says that most previous research has emphasized that effects of dynamic capabilities are always and entirely mediated by the firm's resource base, but she has found out that one specific class of dynamic capabilities, that of dynamic capability of reconfiguring, directly contributes to competitive advantage in innovation. Ridder's work also reveals, why dynamic capabilities are difficult to imitate. According to her view (2012, 33) the dynamic capabilities of a firm are difficult to imitate because they consist of lower level processes, of firm's internal sub-processes. According to Ridder (2012, 12) dynamic capabilities reside at a higher level of abstraction than their underlying processes. These sub-processes, as well as their higher level processes, the classification of different dynamic capabilities the firm should possess, are represented in figure 11. Table 2 translates the classes of dynamic capabilities introduced by Ridder (2012) to firm activities, to activities which the firm should pursue in order to be able to effectively leverage its external resources.

Dynamic Capabilities	Firm Activites
External Sensing	External Scanning Strategic Selection Process
External Seizing	Coordination of Resource Transfer Integration of Resources into Firm's Culture Systematic Knowledge Management
External Reconfiguring	Monitoring the Resource Base Recombining External and Internal Elements Creating Novel Combinations

Table 2: Ridder's classes of dynamic capabilities and their derived firm activities

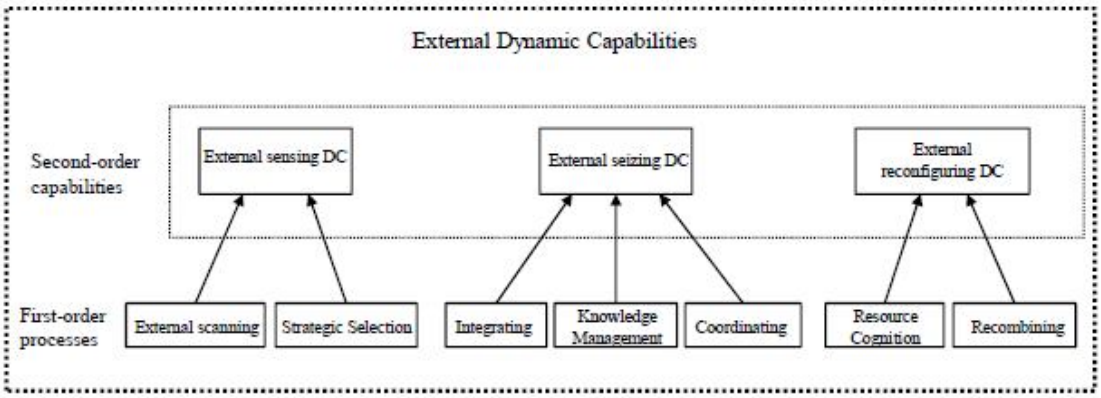

FIGURE 11. Sub-processes of External Dynamic Capabilities (Ridder 2012)

Ridder (2012, 33) says that external dynamic capabilities help to explain why some firms are better than others in creating value from external sources and how firms can create competitive advantage in innovation on the basis of external resources, and states that

> It is not external resources per se, but it is the firm-internal DCs and their underlying processes that are a key to competitive advantage in innovation. The more and the better the firm senses opportunities for external renewal, seizes these opportunities by transforming resources into operational capabilities, and boosts the value potential of external resources by reconfiguring them internally, the more effective and efficient will be its innovation process.

Even though I agree with the vast majority of Ridder's contribution, in the case of reusing open source software artifacts, lines of code or entire components, I disagree regarding to her notion that external resources *per se* could not be a key factor of producing competitive advantage. The reason for this is the self-renewal nature of open source software components and self-renewing processes that produce open source software artifacts. This idea finds support in West and Gallagher (2006, 5) who say that in the phenomenon of open innovation a continuing stream of external innovation is assumed.

8 SUMMARY OF FINDINGS AND CONCLUSIONS

The reporting of findings of this study is highly determined by the research methodology that has been used in this study. Kansikas and Kyrö (in Fayolle et al. 2005) say that in descriptive concept research the ideas and actual writings of the authors, which constitute the research data, interplay dialectically with each other and lead to a new conceptual frame through reflective thinking. Näsi (1980) points out, that in the research branch of concept analysis the reality and the process of describing the reality, become intertwined. Takala and Lämsä (2001) say that in interpretative concept research the observations of the researcher and the theory are in constant interaction.

As a result of the used research methodology, the analysis of the data and the constituting of a synthesis on the basis of the data become highly intertwined. This results that the findings of this study are reported directly in that original context where the data is presented and analyzed. This leads to accurate expression where the synthesis and findings are located in the original context of interpretation. Therefore this chapter of the study is limited to answering to the research questions in a summarizing manner, without repeating all the singular findings, which have already been presented in their original contexts. Therefore the reader of this study should review especially chapters 4-7 to receive full information on the findings of this study.

8.1 Answering the research questions 1 and 2

Open source software code and open source software components, as a resource in private software production, provide a competitive advantage for the software producing firm. This is due to the nature of the specific resources in question. Online communities of open source software development contain reusable lines of software code and also reusable software components which have been produced by groups of individual programmers and handed availa-

ble for free under a certain license. There exists such licenses which permit the source code and developed software components to be used in commercial purposes. These licensing conditions permit the firm to make derivative works out of freely available OSS artifacts and sell these derivative works for money. Examples of these permissive licenses are BSD license, MIT license and Artistic license. A commercial firm may reuse lines of OSS code and OSS components in their commercial products, that is, in private software manufacturing, when the OSS artifacts have been released under these permissive licensing conditions. The reuse of OSS artifacts such as source code of a software program and readily working software components provides competitive advantage for the firm because the international OSS developer's network develops these artifacts all the time them to be better, autonomously, irrespective of the firm's actions. Figure 3 illustrates how software firms can reuse the existing free resource components made available by OSS developers and how the firm can, by adding their own development efforts, create new products which are based on reused software components or lines of code, more generally, on reused resources. Figure 3 also shows the mechanism how the network of OSS developers provides new releases and updates for the reusable item which is now also a component in the commercial firm's product. This is the phenomenon of dynamic renewal of the firm's resource base. The updates and releases to the reusable item also update the software firm's product. Therefore the updating provided by the network of OSS developers provides an autonomous dynamic renewal of the software firm's resources. This is a mechanism that creates competitive advantage for the firm. Reusing OSS components provides a competitive advantage to the firm. This is due to the specific nature of those components themselves. OSS code and OSS components are external firm resources which are dynamic of their nature *per se*. This is a central finding of this study. Because open source software code constantly renews itself through the development efforts of the worldwide developer community this forms a situation where the software code the firm uses as an ingredient in its software manufacturing, is always up to date and always renewed according to the latest proceeding of development. Therefore using open source software code provides at least theoretically a constant and sustained competitive advantage for the firm who is using the open source software components as an ingredient in its software products. If two firms are exploiting the results of the work of the worldwide open source developer's network, and develop their products without revealing their own contribution, it is unlikely that they end up with exactly same product features. These firms thereby hold the competitive advantage of open source software development towards each other, too.

The mechanism of how a firm gains competitive advantage of OSS artifacts is also to do with the firm's dynamic capability of external reconfiguring. The dynamic capability of external reconfiguring is a combinative capability that refers to a novel synthesis of external and internal resources to become new innovations. The dynamic capability of external reconfiguration refers to the capacity to recombine external resources internally in order to achieve novel

configurations that serve new purposes. This is exactly what happens when a software firm reuses software components or lines of code, or other artifacts from open source software projects which can be projects in the past or projects which are developed simultaneously with the firm's software development. The dynamic capability of external *reconfiguring* can contribute to forming of competitive advantage in innovation by drawing on external technological capabilities and applying them to new uses. The key elements of the dynamic capability of external reconfiguring are: Monitoring the external resource base, recombining external and internal elements, and creating novel combinations of them. Ridder (2012) says that the mentioned reconfiguring helps to achieve inimitability because novel combinations that combine both externally and internally created technological capabilities are complex and ambiguous and therefore they are more difficult to imitate. Ridder also anticipates that the dynamic capability of external reconfiguring determines the degree to which the firm's technological capabilities lead to competitive advantage regarding the innovativeness of the firm.

8.2 Answering the research question 3

New ventures often start with scarce resources. Leveraging external resources provides an opportunity to overcome certain challenges incurred by scarce resources. Leveraging firm's external resources, reusing previously written software code and exploiting the development efforts of the international network of open source programmers, is a feasible option for a software start-up and forms a base for certain business strategy. Exploiting the resources provided by OSS communities is a way for start-ups to increase the total amount of resources they are able to use in their innovation processes. The reusing of OSS artifacts is a mode of leveraging external resources. Reusing OSS artifacts saves time and therefore makes the development faster and helps the firm to produce its derived works faster. As leveraging external resources in product development saves time, it also saves money and thus lowers the cost of the firm's software manufacturing. The start-up can also save in investment cost because it does not have to build its own repository of reusable artifacts. Instead, it can use the publicly available repositories which contain reusable lines of code, reusable components and other artifacts. The start-up can thus save those upfront investment costs which typically are high in the software industry. Therefore the start-up is able to start its operations with a smaller amount of capital and needs less external financing compared to a software start-up which produces traditional proprietary software.

In case of open source software development leveraging external resources also enhances the quality of the product, as the product becomes tested and debugged through the contributions of external network of OSS developers. A start-up may look for external sources of innovation in the open source communities and they can also commercialize their products through the OSS

communities. One possibility is to build software products on top of an open source software platform and then release these products available through a suitable channel, at a selected price and with selected features which depend on the firm's product launching strategy. An example of such a pathway is Google's Android Market, nowadays branded as Google Play. Small software firms as well as individuals may develop software applications for mobile devices and by getting them available through Android Market. Through this channel the applications get a wide audience and the odds of receiving users and customers increase greatly.

8.3 Answering the research question 4

In order to create wealth and to gain competitive advantage, firm resources should be managed strategically. The firm should have a strategic architecture in place, so that it can manage its resources strategically. In addition to managing resources strategically the firm also has to apply creativity and develop innovations, to achieve competitive advantage and create wealth for the firm owners. The process of Strategic Entrepreneurship illustrated in figure 7 fulfills the requirement of strategic architecture and describes how strategic management of resources is linked to adding creativity and developing innovations, and how this process leads to competitive advantage and creation of wealth.

Firm's capabilities are in a central role of firm performance. Capabilities refer to firm's ability to deploy resources, which are the other central source of wealth creation and competitive advantage. Especially the transformational characteristics of resources and capabilities are central in wealth creation and achieving competitive advantage. Firm's resource base is renewed through dynamic capabilities of the firm. Dynamic capabilities are the firm's capacity to renew its resources and skills. Dynamic capabilities are rooted in firm's managerial and organizational processes. Therefore, the internal functions of the firm are in a key role of achieving success in wealth creation. Without dynamic capabilities the entrepreneurial resources of the firm do not transform into performance.

Dynamic capabilities are of special importance for technology-based ventures because of the high speed of development at high-tech industries. Therefore the dynamic capabilities of the firm also affect greatly to survival of high-tech firms. Strong dynamic capabilities support the survival of start-ups which face the challenge of survival higher compared to well-established firms of the industry.

Firm's ability to continually improve its current resources and build new resources is the most important factor for the firm to maintain competitive. Dynamic renewal of resources and the firm's capability to renew its resource base are central elements of the wealth creation process, as is the need for innovation. Innovations have to be made and resources combined in new ways to produce value for the firm's customers, and create wealth for the owners of the

firm. Dynamic capabilities are drivers behind the recombining of existing and new resources in new ways. The dynamic capability of external reconfiguring is a combinative capability that refers to a novel synthesis of external and internal resources into new innovations. That is a capacity to recombine external resources internally in order to achieve novel configurations that serve new purposes. This is what happens when a software firm reuses artifacts that are made available by the international OSS developer network.

8.4 Answering the research question 5

When considering what specific resources facilitate or enable Strategic Entrepreneurship the term Resource has to be broken down to subcategories. Amit and Shoemaker (1993) divide Resources of the firm to Resources and Capabilities. Capabilities refer to firm's capacity to deploy its resources. It is especially dynamic capabilities of the firm which facilitate and enable Strategic Entrepreneurship. Firm's ability to recombine and transform resources to new innovative combinations completes the objective of Strategic Entrepreneurship, which is to create wealth for the owners of the firm and to achieve advantageous competitive position for the firm at the market. Dynamic capabilities can be broken down to capabilities of sensing, seizing and reconfiguring new technological knowledge. Ridder (2012) emphasizes the importance of developing a systematic coordination, integration and knowledge management processes for the firm so that the firm is able to seize external technological resource access into superior technological capabilities and transform the knowledge to new products. According to Ridder the dynamic capability of external reconfiguring has a direct positive impact on competitive advantage in innovation. Innovation again is a source of competitive advantage and innovation is needed to create wealth, as the theoretical framework of this study, seen in figure 7, shows.

Prahalad and Hamel (1990) say that firms need a strategic architecture for the acquisition of new competencies or the development of existing competencies. The firm should also have a strategic architecture in place, so that it can manage its resources strategically. Competencies the firm possesses can be regarded as firm resources and knowing that resources can be sources of competitive advantage, the idea of the need for a strategic architecture by Prahalad and Hamel can be extended to consider the resource base of the firm. A strategic architecture is about what resources and competencies a firm must start acquiring and developing to meet its future objectives, including targets regarding its competitive position and the wealth creation. Strategic architecture of the firm therefore facilitates and enables Strategic Entrepreneurship.

8.5 Suggestions for start-ups

According to Goldman and Gabriel (2005) it is essential for firms to find new ways to use innovations outside the firm boundaries. Suoranta and Jones (2011) say networks are vital in the process of leveraging resources for firms in software industry. Wu (2007) says that especially relation-based networks are crucial in acquiring complementary resources and capabilities. It is therefore suggested that a start-up in software industry should focus on building network relationships. When the firm's business logic is based on exploiting external resources provided by the OSS developer community, the firm should include a networking strategy into its business strategy.

When hiring programmers to develop firm's software products, it is recommendable for the firm to hire such programmers which are already familiar with the open source software phenomenon and have some previous experience in developing open source software as a member of OSS developer's community. If possible, the firm should hire such programmers which have a good reputation in the OSS developer community. By hiring such programmers the firm can benefit from the relationships of the recruit and be faster in developing such beneficial network relationships which enable the maximized exploitation of external resources from OSS developer communities. Fast and efficient start in exploitation of firm's external resources speeds up the firm's software production and improves the use of firm's financial resources. This increases the odds of firm's survival and reduces the time-to-market lead time of firm's software products. With a shorter lead time the firm is also able to produce a credible promise of its software products faster, to support obtaining of financial resources for its operations. This all enhances the firm's position in the market and improves the firm's survival and improves the odds of firm's business to become successful in wealth creation.

According to West and Callagher (2006), as illustrated in table 1, the start-up should explore a wide range of external sources of innovation and integrate external knowledge with internal firm resources and capabilities. The start-up should develop its adsorptive capacity from the very start of its operations, to be able to exploit the available external resources it encounters in its search of suitable external resources. The absorptive capacity, the firm's ability to leverage external resources, is ultimately a capability which highly determines the wealth creation ability of a COSS software company.

8.6 Suggestions for research

A natural extension for this interpretative concept research is conducting an empirical study examining a set of start-up firms which are reusing OSS components in their software manufacturing. It would be thus possible to collect empirical evidence of how the reusing of external resources affect to the wealth

creation ability and competitive position of software firms, and to compare firms reusing OSS artifacts to those which are not reusing these external resources. This kind of research might reveal also some other explanations of why some firms have a higher competitive advantage and higher ability to create wealth than other firms of the research. It would also be interesting to see an empirical research which unwraps how the reusing of OSS artifacts affects to Dead-Weight Loss phenomenon in the Finnish economy. Another interesting area would be researching how the resources released from Nokia's software manufacturing cluster have been diffused after Nokia's strategy change. It would be interesting to know the rate by which the resources have been remained in the field of software manufacturing and to follow how the software start-ups founded by ex-Nokians perform in the software market, and do these firms remain their operations in Finland or do they decide to relocate their operations to some other country, and why, if such phenomenon would take place. Researching the start-ups of ex-Nokians would also form an interesting set of firms to find out reasons why some of them may attract more investments and financing than others, as well why some of them might be more successful in creating wealth and than others.

9 SELF-REFLECTION OF THE STUDY

According to Kasanen, Lukka and Siitonen (1991) the evaluation of a scientific research can be made according to four characteristics of scientific research provided by Niinluoto (1984). These characteristics are:

Objectivity, which means that the proceedings of the research have been reported in such detailed level that the stages of the research can be checked, and even to be repeated if needed. Criticality, which means that it becomes possible to justify how the findings have been constructed, through checking the stages of the research. Autonomy, which means that the research has been autonomously conducted, and that the selection of the topic and its coverage have been independent. Progress, which means that the research brings forward new problems that can be solved through scientific research.

The objectivity of this research can be checked from the list of references. This study includes many references from online sources. The bibliography of this research shows the sequence of how the research has been conducted because all the online sources include a mentioning when the online source has been accessed. Also other references have been marked with great detail. Many references have been marked with page numbers. It is therefore possible to repeat the research if someone wants to do that. Objectivity of this research is therefore high.

The criticality of this study is high because the research goes on explaining the researched phenomenon step by step in each section of the study, before going into the final conclusions. The study brings forward several and different points of views to provide justified and well established conclusions. The research consists of a very wide dataset which increases the criticality of the study.

The study has a very high level of autonomy. The study has been conducted free of constraints because there is no external client for this study. This has enabled very independent decisions and independent conduction of the study. The study has served personal interests of the researcher which also makes the research very autonomous of its nature.

The progress level of this study is very high because this study challenges some prevailing economic theories and provides new information of the researched phenomenon. The study also manages to present a theoretical logic of how a firm leveraging open source software code and components as its resource can achieve competitive advantage. This presented finding is something that has not been previously presented in the research. Therefore the progress level of this study is very high and the conducted research is very valuable of its nature.

According to Huuskonen (1992) conceptual research has three possible sources for error, these are: the level of gathering data, the level of thinking, including the interpretation of the data, and the level of expression. In this study the research data is very wide. This reduces the possibility for error. Also the expression in this study is clear and informative, which reduces the possibility for error. This study is interdisciplinary of its nature which increases the possibility for error regarding the interpretation of the data. However, the research has been made by thoroughly investigating those phenomena which this study is researching. This should reduce the possibility for error. However, the possibility for misinterpretation is always present in human action and the possibility for error in thinking cannot be totally excluded in any study.

REFERENCES

Alhonen, M. 2012. Luova tuho – uuden alku. Available in: http://www.teknologiateollisuus.fi/fi/uutishuone/blog/2012-12/luova-tuho-uuden-alku. Accessed: 11.3.2013.

Allyn, M. R. & Misra, R. B. 2011. Motivation of Open Source Developers: Do License Type and Status Hierarchy Matter? In Multi-Disciplinary Advancement in Open Source Software and Processes. IGI Global, 233-249.

Amit, R. & Schoemaker, P. J. H. 1993. Strategic assets and organizational rent. Strategic Management Journal 14 (1), 33-46.

Ammattiliitto PRO 2012. 14.6.2012. Pron Rinne Nokiasta: "Valitettavasti jollakin tavalla tämä on ollut nähtävissä". Available in: http://www.proliitto.fi/fi/media/uutiset/pron-rinne-nokiasta-valitettavasti-jollakin-tavalla-tama-on-ollut-nahtavissa.html. Accessed: 18.12.2012.

Ammattiliitto PRO 2012. 27.4.2011. Pro: Myös Nokian alihankkijoilla työnsä menettävät tarvitsevat tukea. Available in: http://www.proliitto.fi/fi/media/uutiset/pro-myos-nokian-alihankkijoilla-tyonsa-menettavat-tarvitsevat-tukea.html. Accessed: 18.12.2012.

Ammattiliitto PRO 2012. 8.2.2012. Rinne: Nokialta tyrmäysisku Suomen työllisyysnäkymille. Available in: http://www.proliitto.fi/fi/media/uutiset/rinne-nokialta-tyrmaysisku-suomen-tyollisyysnakymille.html. Accessed: 18.12.2012.

Banerjee, A. V. & Duflo, E. 2004. Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program. MIT White Paper , 1-55.

Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. Journal of Management 17 (1), 99-120.

Barney, J. B. 1995. Looking inside for competitive advantage. The Academy of Management Executive 9 (4), 49-61.

Berglung, K. & Wigren, C. 2012. Soci(et)al Entrepreneurship:The Shaping of a Different Story of Entrepreneurship. Tamara Journal for Critical Organization Inquiry 10 (1-2), 9-22.

Buytaert, D. 2012. Why companies must adopt the open source way. Available in: http://www.bbc.co.uk/news/business-18466270. Accessed: 11.3.2013.

Centre for Open Source Software 2013. Avoin lähdekoodi. Available in: http://coss.fi/avoimuus/avoin-lahdekoodi/. Accessed: 22.2.2013.

Chesbrough, H. W. & Appleyard, M. M. 2007. Open innovation and strategy. California management review 50 (1), 57.

Chesbrough, H. W. cop. 2003. Open innovation : the new imperative for creating and profiting from technology. Boston (MA): Harvard Business School Press.

Cutler, K. 2012. Jolla's Sailfish Rises From MeeGo's Ashes As Company Signs First Carrier Deal With DNA. Available in: http://techcrunch.com/2012/11/21/jolla-meego-sailfish/. Accessed: 2.2.2013.

Dahlander, L. & Magnusson, M. 2008. How do Firms Make Use of Open Source Communities? Long range planning 41 (6), 629-649.

Dalle, J. & David, P. A. 2003. The allocation of software development resources in 'open source'production mode. SIEPR-Project NOSTRA Working Paper,(15th February)[Accepted for publication in Joe Feller, Brian Fitzgerald, Scott Hissam, Karim Lakhani, eds., Making Sense of the Bazaar, MIT Press in 2004] .

Davidsson, P. cop. 2008. The entrepreneurship research challenge. Cheltenham, UK: Edward Elgar.

Developer.android.com 2013. Android, the world's most popular mobile platform. Available in: http://developer.android.com/about/index.html. Accessed: 10.3.2013.

Duarte, V. & Sarkar, S. 2011. Separating the wheat from the chaff - a taxonomy of open innovation. European Journal of Innovation Management 14 (4), 435-459.

Fahy, J. & Smithee, A. 1999. Strategic marketing and the resource based view of the firm. Academy of Marketing Science Review 10 (1), 1-21.

Fayolle, A., Kyrö, P. & Ulijn, J. 2005. Entrepreneurship research in Europe : outcomes and perspectives. Cheltenham: Elgar.

Fitzgerald, B. 2006. The Transformation of Open Source Software. MIS Quarterly 30 (3), 587-598.

Gartner 2012. Gartner Says Cloud, Mobility and Open Source Will Drive Application Development Market to Exceed $9 Billion in 2012. Available in: https://www.gartner.com/it/page.jsp?id=2131115. Accessed: 10.3.2013.

Goh, S.H. 2005. Open source and commercial software, an in-depth analysis of the issues. Available in: http://www.bsa.org/country/Public%20Policy/innovation/~/media/Files/Policy/IntellectualProperty/OpenSourceCommercialSoftware.ashx. Accessed: 21.2.2013.

Goldman, R., & Gabriel, R. P. cop. 2005. Innovation happens elsewhere: open source as business strategy. Amsterdam: Morgan Kaufmann.

Haefliger, S., von Krogh, G. & Spaeth, S. 2008. Code Reuse in Open Source Software. Management Science, 2008, Vol.54(1), p.180-193 54 (1), 180-193.

Harhoff, D., Henkel, J. & von Hippel, E. 2003. Profiting from voluntary information spillovers: how users benefit by freely revealing their innovations. Research Policy 32 (10), 1753-1769.

Healy, K. & Schussman, A. 2003. The ecology of open-source software development. Unpublished manuscript, January 29, 2003.

Hitt, M. A. & Ireland, R. D. 2000. A Model of Strategic Entrepreneurship: The Construct and its Dimensions. In D. L. Sexton & Landstrom H. (Eds.) The intersection of entrepreneurship and strategic management research. Oxford: Blackwell Publishers, 45-63.

Hitt, M. A., Ireland, R. D., Camp, S. M. & Sexton, D. L. 2001. Guest Editors' Introduction to the Special Issue. Strategic Entrepreneurship: Entrepreneurial Strategies for Wealth Creation. Strategic Management Journal 22 (6), 479-491.

Hitt, M. A. & Reed, T. S. 2000. Entrepreneurship in the New Competitive Landscape. In D. G. Meyer & K. A. Heppard (Eds.) Entrepreneurship as Strategy. Sage Publications, 23-47.

Homa, K. 2012. Five Forces - Critique. Available in: http://faculty.msb.edu/homak/homahelpsite/webhelp/HomaHelp.htm#Five_Forces_-_Porter_-_Critique.htm. Accessed: 20.2.2013.

Hoopes, D. G., Madsen, T. L. & Walker, G. 2003. Guest editors' introduction to the special issue: why is there a resource-based view? Toward a theory of competitive heterogeneity. Strategic Management Journal 24 (10), 889-902.

Huuskonen, V. 1992. Yrittäjäksi ryhtyminen: teoreettinen viitekehys ja sen koettelu. Turun kauppakorkeakoulu.

IDC 2013. Ongoing Analysis. Available in: http://www.idc.com/prodserv/maps/opensource.jsp#.UTnfcDd-J0x. Accessed: 10.3.2013.

Ihanus, J. 2012. Suomi tarvitsee lisää investointeja. Available in: http://www.sttk.fi/blogi/suomi-tarvitsee-lisaa-investointeja-3. Accessed: 8.2.2013.

Ireland, R. D., Hitt, M. A. & Sirmon, D. G. 2003. A model of strategic entrepreneurship: The construct and its dimensions. Journal of management 29 (6), 963-989.

Ireland, R. D., Hitt, M. A. & Sirmon, D. G. 2003. A Model of Strategic Entrepreneurship: The Construct and its Dimensions. Journal of Management 29 (6), 963-989.

IT-Viikko 2011. 27.4.2011 MTV3: Nokia jakaa patentteja lähtijöille. Available in: http://www.itviikko.fi/uutiset/2011/04/27/mtv3-nokia-jakaa-patentteja-lahtijoille/20115894/7. Accessed: 19.12.2012.

Jaskari, H. 2011. Yrittäjän sosiaaliturva paremmaksi. Available in: http://www.harrijaskari.fi/kirjoituksia/yrittajan-sosiaaliturva-paremmaksi-mielipide-al-4-2-2011/. Accessed: 8.2.2013.

Jones, M. 2011. Start with Geostrategy, or call it Tactics . Available in: http://silberzahnjones.com/2011/12/10/start-with-geostrategy-or-call-it-tactics/. Accessed: 11.3.2013.

Juurus, K. 2012. Sellu tulee Brasiliasta. Available in: http://blogit.yle.fi/mot/sellu-tulee-brasiliasta. Accessed: 28.12.2012.

Kasanen, E., Lukka, K. & Siitonen, A. 1991. Konstruktiivinen tutkimusote liiketaloustieteessä. Liiketaloudellinen aikakauskirja 40 (3), 301-329.

Keinälä, S. 2012. Severi Keinälä: Suomi tarvitsee ulkomaisia investointeja ja pääomia . Available in: http://www.tem.fi/?104488_m=109019&s=4712. Accessed: 29.12.2012.

Kerr, W. R. & Nanda, R. 2009. Financing Constraints and Entrepreneurship. HBS Working Paper 10-013. Harvard Business School.

Kiander, J. 2010. Voiko Japanin pitkä taantuma toistua Suomessa? Sitran selvityksiä 43. Helsinki.

Kiander, J. 2001. Laman opetukset : Suomen 1990-luvun kriisin syyt ja seuraukset. Helsinki: Valtion taloudellinen tutkimuskeskus.

Klein, P. G., Barney, J. B. & Foss, N. J. 2012. Strategic Entrepreneurship. SMG Working Paper No. 3 /2012 .

Kogut, B. & Metiu, A. 2001. Open-Source Software Development and Distributed Innovation. Oxford Review of Economic Policy 17 (2), 248-264.

Koistinen, O. 2011. UPM sulkee Myllykosken tehtaan ja vähentää Suomessa 645 ihmistä. Available in: http://www.hs.fi/talous/artikkeli/UPM+sulkee+Myllykosken+tehtaan+ja+v%C3%A4hent%C3%A4%C3%A4+Suomessa+645+ihmist%C3%A4/1135268983708. Accessed: 28.12.2012.

Korteila, M. 2008. Elcoteq lopettaa tuotannon Salossa. Available in: http://www.arvopaperi.fi/uutisarkisto/elcoteq+lopettaa+tuotannon+salossa/a189797?page=35. Accessed: 27.12.2012.

Kumar, V., Gordon, B. R. & Srinivasan, K. 2011. Competitive Strategy for Open Source Software. Marketing Science 30 (6), 1066-1078.

Kyrgidou, L. 2006. Strategic Entrepreneurship: A Novel Approach to Corporate Rejuvenation. Available in: http://www.innovationimpact.org/index.php?option=com_content&task=view&id=22&Itemid=2. Accessed: 4.2.2013.

Kyrgidou, L. & Hughes, M. 2010. Strategic entrepreneurship: origins, core elements and research directions. European Business Review 22 (1), 43-63.

Lappalainen, E. 2012. Suomi yllätti Googlen niin hyvässä kuin pahassa. Available in: http://www.tietoviikko.fi/kaikki_uutiset/suomi+yllatti+googlen+niin+hyvassa+kuin+pahassa/a826190. Accessed: 28.12.2012.

Lauslahti, S. 2007. Yrittäjäksi ryhtymisen esteet. Available in: http://puheenvuorot.kansanmuisti.fi/istunnot/81-2007/7089-yrittajaksi-ryhtymisen-esteet. Accessed: 8.2.2013.

Lee, S.H. 1999. Open source software licensing. Available in: http://cyber.law.harvard.edu/openlaw/gpl.pdf. Accessed: 21.2.2013.

Lehmusvirta, A. 2012. OP: Nokian leikkaukset tuntuvat BKT:ssa. Kauppalehti , 16.12.2012.

Lerner, J. & Tirole, J. 2002. Some Simple Economics of Open Source. The Journal of Industrial Economics 50 (2), 197-234.

Lukkari, J. 2012a. Nokian alihankkijat vähentäneet jo yli tuhat työntekijää. Available in: http://www.tekniikkatalous.fi/ict/nokian+alihankkijat+vahentaneet+jo+yli+tuhat+tyontekijaa/a852184. Accessed: 19.12.2012.

Lukkari, J. 2012b. "Olihan se kova tärsky" - Nokian alihankkijat etsivät paluuta normaalitilaan. Available in: http://www.tekniikkatalous.fi/ict/quotolihan+se+kova+tarskyquot++nokian+alihankkijat+etsivat+paluuta+normaalitilaan/a792536. Accessed: 19.12.2012.

Maaseudun Tulevaisuus 2012. 8.10.2012. Suomi tarvitsee lisää yrittäjiä. Available in: http://www.maaseuduntulevaisuus.fi/mielipiteet/p%C3%A4%C3%A4kirjoitukset/suomi-tarvitsee-lis%C3%A4%C3%A4-yritt%C3%A4ji%C3%A4-1.25482. Accessed: 29.12.2012.

Madey, G., Freeh, V. & Tynan, R. 2002. The open source software development phenomenon: An analysis based on social network theory. Americas Conference on Information Systems (AMCIS) 8, 1806-1813.

Mann, R. J. 2006. The Commercialization of Open Source Software: Do Property Rights Still Matter?. Harvard Journal of Law & Technology 20 (1).

Manuel Sojer & Joachim Henkel 2010. Code Reuse in Open Source Software Development: Quantitative Evidence, Drivers, and Impediments. Journal of the Association for Information Systems 11 (12), 868-901.

McKelvie, A. & Davidsson, P. 2009. From Resource Base to Dynamic Capabilities: an Investigation of New Firms. British Journal of Management 20, 63-80.

Michelsson, J. 2011. Uusia Nokioita vai Valtion Ohjelmisto Oy?. Available in: http://mises.fi/blog/uusia-nokioita-vai-valtion-ohjelmisto-oy/. Accessed: 19.12.2012.

Mikkonen, A. 2006. Kännykkäklusterin huima nousu ja pako Aasiaan. Available in: http://www.talouselama.fi/liitetyt/kannykkaklusterin+huima+nousu+ja+pako+aasiaan/a2044293. Accessed: 27.12.2012.

Möller, K., Svahn, S., Rajala, A. & Tuominen, M. 2002. Network Management as a Set of Dynamic Capabilities. 18th Annual IMP Conference.

Mustonen, M. 2003. Copyleft—the economics of Linux and other open source software. Information Economics and Policy 15 (1), 99-121.

Nairaland Forum 2011. Nokia To Abandon Symbian And Ally With Microsoft. Available in: http://www.nairaland.com/607960/nokia-abandon-symbian-ally-microsoft. Accessed: 19.12.2012.

Näsi, J. 1980. Ajatuksia käsiteanalyysista ja sen käytöstä yrityksen taloustieteessä. Tampere: Tampereen yliopisto.

Nesheim, J. L. 2000. High tech start up : the complete handbook for creating successful new high tech companies. (Rev. and updated ed. edition) New York: Free Press.

Nissinen, P. 2012. Lääkärilehti: Viro teki vuodessa sen, mihin Suomessa on hukattu jo 10 vuotta. Available in: http://www.taloussanomat.fi/ulkomaat/2012/08/14/laakarilehti-viro-teki-vuodessa-sen-mihin-suomessa-on-hukattu-jo-10-vuotta/201235617/12. Accessed: 10.3.2013.

Nylander, M. 2004. Yrittäjän ja palkansaajan sosiaaliturvan erot. Available in: http://nylander.huset.fi/suomeksi/kirjalliset/artikel-4974-2546.html. Accessed: 8.2.2013.

OECD 2012. Financing SMEs and Entrepreneurs 2012: An OECD Scoreboard Complete Edition. OECD/Studies/Industry, Services & Trade 2012 (2), 1-198.

Ohloh 2013. Discover, Compare and Track Open Source. Available in: http://www.ohloh.net/. Accessed: 7.3.2013.

Open Source Initiative 2013. The Open Source Definition. Available in: http://opensource.org/osd. Accessed: 11.3.2013.

Open Source Initiative 2012. About the Open Source Initiative. Available in: http://opensource.org/about. Accessed: 7.3.2013.

Osterloh, M. & Rota, S. 2007. Open source software development—Just another case of collective invention? Research Policy 36 (2), 157-171.

Ovaskainen, T. 2011. Hyytävä lausunto Nokian irtisanomisista Suomessa. Available in: http://www.uusisuomi.fi/kotimaa/109199-hyytava-lausunto-nokian-irtisanomisista-suomessa. Accessed: 18.12.2012.

Panchal, J. H. 2009. Co-evolution of products and communities in mass-collaborative product development-a computational exploration. International Conference on Engineering Design (ICED'09).

Parviainen, M. 2013. Personal notification. Dubai.

Peltoniemi, J. 2011. Ixonos lopettaa Salossa, avaa Soulissa. Available in: http://www.tietokone.fi/uutiset/ixonos_lopettaa_salossa_avaa_soulissa. Accessed: 19.12.2012.

Peverelli, P. J. & Song, J. 2012. Chinese Entrepreneurship - a Social Capital Approach. Heidelberg: Springer.

Pietiläinen, T. 2011. Google kosiskelee jo Nokian insinöörejä. Available in: http://www.hs.fi/talous/artikkeli/Google+kosiskelee+jo+Nokian+insin%C3%B6%C3%B6rej%C3%A4/1135263766730. Accessed: 28.12.2012.

Pirkanmaan Vasemmistoliitto 2011. Osaamiskeskuksilla uusia tietotekniikan työpaikkoja Pirkanmaalle. Available in: http://pirkanmaa.vasemmisto.fi/ajankohtaista/tiedotteetkannanotot.html. Accessed: 10.3.2013.

Pohjanpalo, K. & Ben-Aron, D. 2012. Finland Imagines Life Without Nokia. Available in: http://www.businessweek.com/articles/2012-04-19/finland-imagines-life-without-nokia. Accessed: 28.12.2012.

Porter, M. E. cop. 1980. Competitive strategy : techniques for analyzing industries and competitors. New York: Free Press.

Porter, M. E. 1998. The competitive advantage of nations: with a new introduction. (New ed. edition) Basingstoke: Macmillan.

Prahalad, C. K. & Hamel, G. 1990. The Core Competence of the Corporation. Harvard business review 68 (3), 79-91.

Puusa, A. 2008. Tieteellinen artikkeli: Käsiteanalyysi tutkimusmenetelmänä. Premissi (4), 36-43.

Raeste, J. 2007. Stora Enso sulkee tehtaita rajussa saneerauksessa. Available in: Stora Enso sulkee tehtaita rajussa saneerauksessa. Accessed: 28.12.2012.

Ramos, R. 2009. 'Open Source' Entrepreneurs: Change Agents for a Stalled Economy. Available in: http://www.businessweek.com/bwdaily/dnflash/content/mar2009/db20090330_797548.htm. Accessed: 11.3.2013.

Remneland-Wikhamn, B., Ljungberg, J., Berquist, M. & Kuschel, J. 2011. Open innvation, generavity and the supplier as peer: The case of Iphone and Android. International Journal of Innovation Management 15 (01), 205-230.

Repo, H. 2012. Stora Enso leikkaa 500 työpaikkaa - Ruoveden tehdas kiinni. Available in: http://www.tekniikkatalous.fi/metsa/stora+enso+leikkaa+500+tyopaikkaa++ruoveden+tehdas+kiinni/a849650#. Accessed: 28.12.2012.

Ridder, A. 2012. External Dynamic Capabilities: Creating Competitive Advantage in Innovation via External Resource Renewal. Innovation seminar 12.9.2012, Haas School of Business, University of California Berkeley.

Riehle, D. 2007. The Economic Motivation of Open Source Software: Stakeholder Perspectives. Computer 40 (4), 25-32.

Roivas, P. 2012. Nokia lahjoittaa Jollalle Meego-patentteja. Available in: http://www.puhelinvertailu.com/uutiset.cfm/2012/07/10/nokia_lahjoittaa_jollalle_meego-patentteja. Accessed: 11.3.2013.

Saastamoinen, M. 2013. Personal notification. E-mail.

Saffu, K. & Manu, T. 2004. Strategic capabilities of Ghanaian female business owners and the performance of their ventures. Ontario.

Salmela, S. 2013. Netti madaltaa ensimmäisen oman yrityksen perustamiskynnystä. Salo: Salon Seudun Sanomat.

Salo, I. 2011. Nokialta vapautuvat resurssit ohjelmisto-clusterin luomiseen. Available in: http://atuubi.yle.fi/keskustelu/id-20013006?page=1. Accessed: 28.12.2012.

Schiff, A. 2002. The Economics of Open Source Software: A Survey of the Early Literature. Review of Network Economics 1 (March).

Schillo, S. 2011. Entrepreneurial Orientation – What is it and How can it be Useful for Policy and Program Development?. Available in: http://innovationentrepreneurship.com/?p=115. Accessed: 4.2.2013.

Shahidi, M. & Smagulova, A. 2008. The Challenges of Entrepreneurship In Dynamic Society. Central Asia Business 1 (1), 34-45.

Sitra 2013. Sitra luo uutta bisnestä teollisilla symbiooseilla. Available in: http://www.sitra.fi/uutiset/2013/sitra-luo-uutta-bisnesta-teollisilla-symbiooseilla. Accessed: 1.3.2013.

Souppouris, A. 2012. Nokia is licensing patents to MeeGo startup Jolla (update: no, it isn't). Available in: http://www.theverge.com/2012/7/10/3148663/nokia-jolla-sharing-meego-patents. Accessed: 19.12.2012.

Sourceforge 2013. About. Available in: http://sourceforge.net/about. Accessed: 10.3.2013.

St. Amant, K. & Still, B. 2007. Handbook of research on open source software: technological, economic and social perspectives. London: Information Science Reference.

Storhammar, E. & Virkkala, S. 2003. Maaseutuyritysten innovaatioprosessit : kaupungin ja maaseudun vuorovaikutuksen näkökulma. Jyväskylä: Jyväskylän yliopisto, taloustieteiden tiedekunta, tutkimuskeskus.

Suoranta, M. & Jones, R. 2012. Leveraging Resources by Using Networks and Relationships – Entrepreneurial Marketing in Small Software Technology Firms. 17th Nordic Conference on Small Business Research, May 23 - 25, 2012, Helsinki, Finland. Helsinki: 17th Nordic Conference on Small Business Research.

Takala, T. & Lamsa, A. 2001. Tulkitseva kasitetutkimus organisaatio-ja johtamistutkimuksen tutkimusmetodologisena vaihtoehtona. Liiketaloudellinen aikakauskirja , 371-392.

Takalo, T. 2010a. Industrial Organization and Economics of Innovation, Lecture6. Available in: http://users.jyu.fi/~heoltale/KTTA720/Lecture6_20101110.pdf. Accessed: 8.3.2013.

Takalo, T. 2010b. Industrial Organization and Economics of Innovation, Lecture1. Available in: http://users.jyu.fi/~heoltale/KTTA720/Lecture1_20101027.pdf. Accessed: 8.3.2013.

Talouselämä 2012. 18.12.2012. Accenture lähtee Oulusta, 275 saa potkut. Available in: http://www.talouselama.fi/uutiset/accenture+lahtee+oulusta+275+saa+potkut/a2160749. Accessed: 19.12.2012.

Taloussanomat 2012. 20.3.2012 Stora Enso rakentaa ison tehtaan Kiinaan. Available in: http://www.taloussanomat.fi/perusteollisuus/2012/03/20/stora-enso-rakentaa-ison-tehtaan-kiinaan/201225613/12. Accessed: 28.12.2012.

Taloussanomat 2012. 3.10.2012. TEM: Suomen investointivaje jopa 30 miljardia euroa. Available in: http://www.taloussanomat.fi/kansantalous/2012/10/03/tem-suomen-investointivaje-jopa-30-miljardia-euroa/201239098/12. Accessed: 8.2.2013.

Taloussanomat 2012. 3.11.2012. Googlen Androidin huikea markkinaosuus: 75 %. Available in: http://www.taloussanomat.fi/informaatioteknologia/2012/11/03/googlen-androidin-huikea-markkinaosuus-75-/201241318/12. Accessed: 21.2.2013.

Teece, D. 2011. Innovation Expert David Teece Brings Dynamic Capabilities to Classroom. Available in: http://newsroom.haas.berkeley.edu/article/innovation-expert-david-teece-brings-dynamic-capabilities-classroom. Accessed: 12.12.2012.

Teece, D. J., Pisano, G. & Shuen, A. 1997. Dynamic Capabilities and Strategic Management. Strategic Management Journal 18 (7), 509-533.

Toivonen, S. 2012. Sen pituinen se - matkapuhelinten valmistus on historiaa Salossa. Available in: http://yle.fi/uutiset/sen_pituinen_se_-_matkapuhelinten_valmistus_on_historiaa_salossa/6181308. Accessed: 2.2.2013.

University of Santa Barbara 2012. Open Source Software Licenses. Available in: http://tia.ucsb.edu/open_source.aspx. Accessed: 21.2.2013.

University Of Tampere 2012. Re-establishing the Finnish ICT Industry kehittää hyvinvointiteknologiaa ja älyliikennettä. Available in: http://www.uta.fi/ajankohtaista/yliopistouutiset/ilmoitus.html?id=73357 Accessed: 19.12.2012.

Uusi Suomi 2012. 10.2.2012. Jyrki Katainen: ”Hyvinvointiyhteiskunta murenee”. Available in: http://www.uusisuomi.fi/kotimaa/120068-jyrki-katainen-%E2%80%9Dhyvinvointiyhteiskunta-murenee%E2%80%9D. Accessed: 1.1.2013.

Uusi Suomi 2011. 17.2.2011. Ministeri ihmettelee villejä Nokia-lukuja. Available in: http://www.uusisuomi.fi/kotimaa/109384-ministeri-ihmettelee-villeja-nokia-lukuja. Accessed: 18.12.2012.

Uusi Suomi 2011. 18.1.2011. Stora Enso rakentaa jättitehtaan. Available in: http://www.uusisuomi.fi/raha/108377-stora-enso-rakentaa-jattitehtaan. Accessed: 28.12.2012.

Välimäki, M. 2005. The rise of open source licensing : a challenge to the use of intellectual property in the software industry. Helsinki: Turre Publishing.

Von Hippel, E. & von Krogh, G. 2003. Open Source Software and the "Private-Collective" Innovation Model: Issues for Organization Science. Organization Science 14 (2), 209-223.

Von Krogh, G. & Spaeth, S. 2007. The open source software phenomenon: Characteristics that promote research. The Journal of Strategic Information Systems 16 (3), 236-253.

West, J. & Gallagher, S. 2006. Patterns of open innovation in open source software. In H. Chesbrough, W. Vanhaverbeke & J. West (Eds.) Open Innovation: Researching A New Paradigm.Oxford: Oxford University Press, 82-106.

Wikipedia 2013. Google Play. Available in: http://en.wikipedia.org/wiki/Google_Play. Accessed: 10.3.2013.

Wu, L. 2007. Entrepreneurial resources, dynamic capabilities and start-up performance of Taiwan's high-tech firms. Journal of Business Research 60 (5), 549-555.

YLE 2013. 1.1.2013. Presidentti kiirehtii hallitusta ja työmarkkinajärjestöjä ratkaisuihin. Available in: http://yle.fi/uutiset/presidentti_kiirehtii_hallitusta_ja_tyomarkkinajarjestoja_ratkaisuihin/6433703. Accessed: 1.1.2013.

YLE 2012. Nokian ja Ollilan historia. Available in: http://ohjelmat.yle.fi/mot/mot_23_4/nokian_ollilan_historia. Accessed: 16.3.2013.

YLE 2011. 11.2.2011. Pekkarinen: Government Help for Nokia Job Cuts. Available in: http://yle.fi/uutiset/pekkarinen_government_help_for_nokia_job_cuts/5321036. Accessed: 18.12.2012.

Appendix 1

The Open Source Definition

Introduction

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:

1. Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code

The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

3. Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups

The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavor

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License

The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product

The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

10. License Must Be Technology-Neutral

No provision of the license may be predicated on any individual technology or style of interface.

Source: Open Source Initiative 2013. The Open Source Definition. Available in: http://opensource.org/osd.

Appendix 2

Source: Ohloh 2013. Discover, Compare and Track Open Source. Available in: http://www.ohloh.net/. Accessed: 7.3.2013.