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Master Thesis

Innovation among early stage entrepreneurs:

The role of human capital

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Abstract

This study examines the effect of human capital on innovation among early stage entrepreneurs. The contribution of this study is to extend the existing literature in four directions. First, there are five different human capital indicators included in this study. These are *Network, Education, Experience, Opportunity Based Entrepreneurship* and *Skills.* Second, this study distinguishes between *Product innovation* and *Process innovation.* Third, the respondents are all early stage entrepreneurs. Finally, this study is focused on the countries from the European Union. The sample that is used is constructed from the Global Entrepreneurship Monitor in 2009. It contains data from 18 countries from the European Union. The results provide evidence that human capital is a determinant of innovation among early stage entrepreneurs. First, all the human capital indicators have a positive effect on product innovation, except skills required to start up a new business. Second, all the human capital indicators have a positive effect on process innovation, except opportunity based entrepreneurship. However, the results only show that educational attainment has a positive significant result at the 5% significance level on the probability of having an innovation. This result is obtained for both measures of innovation. Although all the other results are not significant at the 5% significance level, skills required to start a new business has a positive relation with process innovation at the 10% significance level. This positive relation also occurs when only the countries with more than 100 observations are included. These countries are Spain, United Kingdom, Germany and Latvia.

Key words: Human capital, Innovation, Entrepreneurship

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1. Introduction

In a rapidly changing global economy with public budget constraints and increasing global competition, it is vital to innovate in order to secure our future standard of living. Europe's competitiveness and their capacity to create millions of new jobs, to replace those lost due to the crisis, depend on their ability to drive innovation in products, services, business and social processes and models[1]. Therefore, one of the most important policies of the European Union is the Innovation Union, the Europe 2020 flagship initiative. This policy is about helping companies to perform better and contributing to wider social objectives, such as growth, jobs and sustainability. Furthermore, the European countries are encouraged to invest 3% of their GDP in R&D by 2020. Expected is that this will create 3,7 million jobs and increase the EU's annual GDP by almost €800 billion[2]. In addition, according to the literature, innovation is considered as one of the major resources of economic welfare (Baumol, 2004; Schumpeter, 1942). Besides, the endogenous growth model of Römer (1986) and Solow model (1956) imply both that innovation has a positive relationship with economic growth.

A lot of innovation in Europe is done by large companies, such as ARM Holdings, L'Oreal, Google, Apple and Unilever NV[3]. These companies have large R&D departments, where they invest a lot of human and financial capital to obtain new products, services or technologies. However, innovative activity is not only done at large firms. Also small companies provide innovations. It is even a fact that small companies provide the most fundamentally novel innovations. In contrast to large firms, where most innovations are incremental improvements, like increased reliability, more user-friendly, flexibility in design (Baumol, 2004). Small firms depend on entrepreneurs. Entrepreneurs are the individuals who have the ideas and are willing to take risks necessary to create a new firm[4]. The creation of a new innovative firm requires many different tasks in order to obtain a successful business. Therefore, it is important to identify the determinants of innovation among small firms.

Several studies tried to explore the determinants of innovation in small firms (De Jong and Vermeulen, 2006; Hadjimanolis, 2000; Freel, 2003; Shipton et al., 2006; Wan et al., 2005). From these studies it can be derived that several determinants are related to innovation.

[1] http://ec.europa.eu
[2] http://europa.eu
[3] http://www.forbes.com/innovative-companies/list/
[4] http://ec.europa.eu/enterprise/policies/sme/promoting-entrepreneurship/index_en.htm

One of the most important determinants is human capital. Human capital is the stock of knowledge, competencies, habits and personal capabilities. According to Becker (1964) human capital is a means of production, just as machines are. The level of human capital is different for each individual.

This study investigates whether human capital is a determinant of innovation among early stage entrepreneurs. It is interesting to see whether the influence of human capital can foster the innovativeness of entrepreneurs. In line with this, the research question of this paper is as follows:

''Is human capital a determinant of innovation among early stage entrepreneurs?''

There are several studies which investigated the effect of human capital on entrepreneurship. Dakhli and De Clercq (2004) studied the relationship of human capital and innovation. They found strong empirical support for the positive relationship between human capital and social capital and innovation. In addition, Marvel and Lumpkin (2007) did research on the effect of human capital on innovation. Their study investigates different types of general and specific human capital that are associated with innovation outcomes. They found that particularly education and experience are significantly related to innovation.

This study explores the effect of human capital on innovation among early stage entrepreneurs. The contribution of this study is to extend the existing literature in four directions. First, there are five different human capital indicators included in this study. These are *Network, Education, Experience, Opportunity Based Entrepreneurship* and *Skills.* Second, this study distinguishes between *Product innovation* and *Process innovation.* Product innovation is used to characterize new or improved goods and services, whereas process innovation is equivalent to improvements in the ways to produce these good and services (Fagerberg, 2004). Third, the respondents are all early stage entrepreneurs, which includes nascent entrepreneurs and those who are involved in setting up a business, and the owners or managers of a new business up to 42 months or less. Finally, this study is focused on the countries from the European Union. Therefore, all the respondents are originated from the EU-27 countries.

The data for this research is from the Global Entrepreneurship Monitor (GEM). The GEM is a worldwide research project that sampled individual entrepreneurs using an adult population survey. The sample that is used is from the year 2009 and the data are on an individual level. Within the GEM dataset Total early-stage Entrepreneurial Activity (TEA) is used as the main measure for the amount of entrepreneurs and new ventures present in a country, also called early stage entrepreneurs.

The outline of this study is as follows. Chapter 2 discusses the previous literature, which includes an overview of the theory. Subsequently, the hypotheses are formulated. Chapter 3 contains the description of the data and methods, which are used for the analysis. Furthermore, in chapter 4 the results are shown and described. In chapter 5 the discussion of this study is provided, which includes a summary of the main results, policy implications and limitations. Finally, in chapter 6 the conclusion and possible future research are described.

2. Literature Review

This chapter contains the literature body for this research. The goal is to investigate the previous literature on the role of human capital in innovation. First the term innovation is discussed and more specifically product and process innovation. Subsequently, the term entrepreneurship and the determinants of innovation are described. Finally, the factors of human capital are discussed and specifically the theoretical and empirical evidence that links their role on product and process innovation. In line with these findings, the five hypotheses, one for each human capital factor on product and process innovation, are formulated.

2.1 Innovation

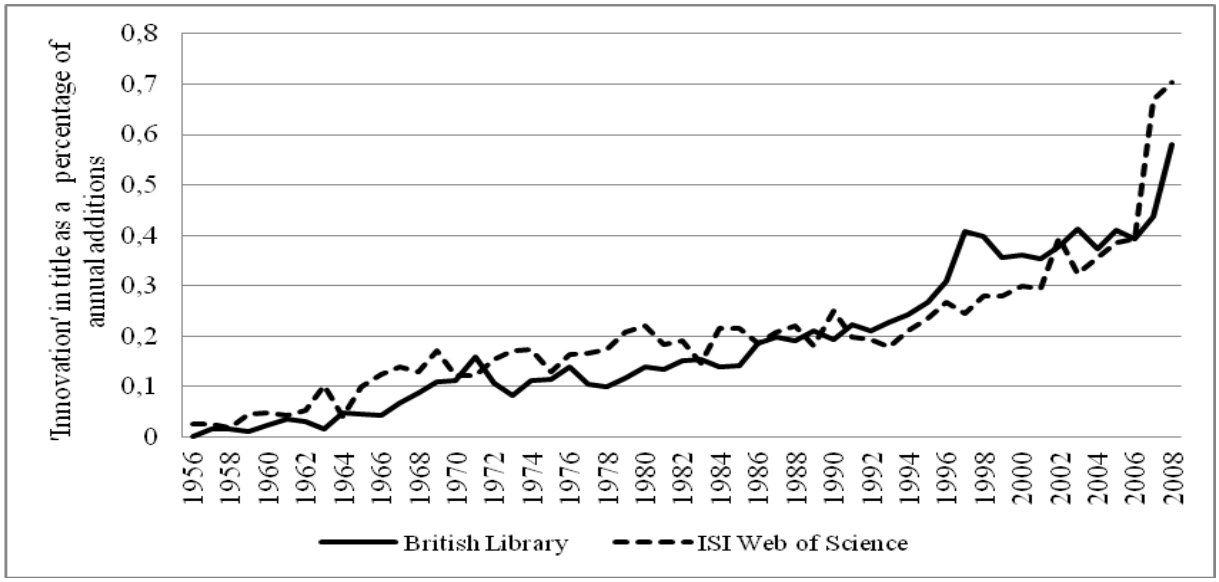
Innovation is considered to be a major resource to start up a new business. Generally, innovation creates more and new jobs and is therefore one of the major resources of economic development (Baumol, 2004). However, at short-term notice, innovation may be the cause of unemployment due to for example, automation, whereby employers be redeemed for machines. According to Schumpeter (1942) this phenomena is called 'creative destruction'. He describes this process whereby new products, new enterprises, and new organizational forms replace the old ones. Still, he states that innovation is the most important factor for economic growth. The world today would not been have there without innovation.

Also economic growth models emphasize the important role of innovation for economic growth. There are basically two main models here. The first model incorporates innovation as an endogenous factor (such as in the model of Römer, 1986); it assumes that innovation is endogenous and therefore one of the sources, such as labor and capital, to increase the long-run economic growth. The second model incorporates innovation as an exogenous factor (like the Solow Model, 1956). This model assumes that innovation occur from exogenous factors outside the model. Other sources to grow will reach a steady state, so that the only way to get economic growth is through innovation. It should however be noted that both models imply that innovation has a positive relationship with economic growth.

Our knowledge about innovation processes, their determinants and social and economic impact has been greatly enhanced since scholarly articles with the term 'innovation' in the

title emerged in the 1960s (Fagerberg, 2004). This is shown in Figure 1 and in the recent years the number of articles about innovation has drastically increased.

Figure 1. Growth of the innovation literature



Source: 'Innovation: a new guide' by Jan Fagerberg

Due to the increased articles of theorist about innovation, different definitions and views about innovation have arisen by several theorists. Therefore it is necessary to discuss what innovation genuinely is.

First, it is important to make a distinction between invention and innovation. An invention is the first occurrence of an idea for a new product or service, while an innovation is the first attempt to carry into practise. According to Arrow (1962) an invention is interpreted as the production of knowledge. Fagerberg (2004) describes that an individual or a company needs several resources to turn an invention into an innovation. In addition, Schumpeter (1934) has pointed out that innovation may occur without invention, for example a change in productive methods of technological changes. On the other hand, an invention may also occur without innovation, for example a change in technological possibilities. He defined innovation as new combinations of existing resources. Moreover, according to Schumpeter an invention needs a person or organizational unit, who combines several resources to turn it in an innovation. Resources are sufficient financial capital, personal skills, market knowledge and so on. The person or organizational unit, who combines these factors, is called by Schumpeter the 'Entrepreneur'. Hence, the Schumpeterian entrepreneur is not an inventor, but he is an innovator.

Second, it is essential to point out that invention and innovation is a continuous process (Fagerberg, 2004). Take a look to the newest cars in the Formula 1. Nowadays, the cars are completely different to the first Formula 1 cars. There is a lot of new technology available for the new cars compared to the older ones. This is due to a lot of different inventions and innovations. The same counts for the information technology industry, where they continuous develop new computer software, hardware and so on. The developers need the old inventions and innovations to produce these new products. Thus, what most people think of as a single innovation is often the result of a lengthy process involving many interrelated innovations (Fagerberg, 2004).

2.1.1 Types of innovation

One has to consider which terms are used to classify innovation to do research. First, there are different types of innovations. For example, Schumpeter (1942) divided innovation in five different types, namely new products, new methods of production, new sources of supply, the exploitation of new markets and new ways to organize business. In contrast, other theorists distinguish between radical, incremental and new innovation (Garcia and Calatone, 2002). Second, there is also a difference in innovation at the macro and micro level. Not all innovations on micro level are also considered as an innovation on macro level. An existing product or process might already exist, but on a micro level, a specific industry, it can be an innovation. The most recognizable is the automation in a lot of industries, whereby labor is replaced by machines. For those it was an innovation, but for the information technology industry it was not.

This research is only focused on product and process innovation. The definition for both is as follows: Product innovation is used to characterize new or improved goods and services, whereas process innovation is equivalent to improvements in the ways to produce these good and services (Fagerberg, 2004). In this definition, there is no difference in radical or incremental and so on. The only difference is between product and process innovation and these innovations are on the micro level.

2.2 Entrepreneurship

Entrepreneurship is a popular field of research since the last two decades. Many researchers are investigating the consequences or the causes of entrepreneurship. A vital aspect of

entrepreneurship is that it drives the economy from a managed economy to entrepreneurial economy (Audretsch and Thurik, 2000). The managed economy entails large companies with large scale production, using natural sources, labour and capital as the sources of competitive advantage. By contrast, the entrepreneurial economy involves small companies using knowledge and ideas to be competitive. In the entrepreneurial economy one should think in terms of opportunities rather than in terms of resources, as it is based upon ideas and knowledge, rather than on investments creating more of the same (Thurik, 2008). Due to this shift, entrepreneurship is an important factor to take into consideration when making policies for countries or for the EU as whole. An economy based upon managing production requires totally different conditions than one where entrepreneurship capital needs to be stimulated. It can even be that policies and institutions which made the managed economy successful are contra productive in the entrepreneurial economy (Thurik, 2008). Therefore, economic theories without the influence of entrepreneurship are incomplete.

2.2.1 Definition of entrepreneurship

Several definitions of entrepreneurship can be found in the literature. For this reason, it is essential to point out that several definitions to explain entrepreneurship have been established by the academic literature. One of the reasons is that there are different subfields within entrepreneurship. Hence, there is a lot of research on the self-employment rates, nascent entrepreneurship, latent entrepreneurship and actual entrepreneurship. Yet there is no clear defined definition for entrepreneurship. Nevertheless, it is valuable to discuss what the most important theorists states about entrepreneurship.

First, in the book 'Researching Entrepreneurship' of Davidsson (2005) it is stated that the several definitions for entrepreneurship are caused by the lack of common understanding of what precisely entrepreneurship is. Davidsson says that there is no shortage of suggestions and gives a list with definitions of what various theorists thinks what entrepreneurship is. A few examples of this list are that entrepreneurship is a new entry, the creation of a new enterprise or taking advantage of opportunity by novel combinations of resources in ways, which they have impact on the market.

Second, according to the OECD entrepreneurship is the phenomenon associated with entrepreneurial activity. Entrepreneurial activity is explained as the enterprising human

action in pursuit of the generation of value, through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets (OECD, 2007).

In coming to a good definition, the Schumpeterian view on entrepreneurship must be taken into account. Schumpeter (1934) is one of the founders of economic theories and his book ''the theory of Economic Development'' is one the most important books in the field of economics. Schumpeter states that the entrepreneurship is an innovator, the one who carries out new combinations. The finding and implementing of these fertile combinations will result in economic development. This is the task for the entrepreneurs, and therefore, there is no economic development without the rise of entrepreneurs. Schumpeter called the activity to find new combinations of existing resources to innovate the 'the entrepreneurial function', which is fulfilled by entrepreneurs.

Moreover, from the perspective of the Austrian school of economics entrepreneurship is a relevant factor for driving economic growth. Kirzner (1978) stated that the economy is a dynamic model that is subject to constant changed in known technological possibilities, resources availabilities and needs and desires. This implies that the economy could not reach a state of equilibrium. He based on his approach on Mises (1949) exemplified by his quote:

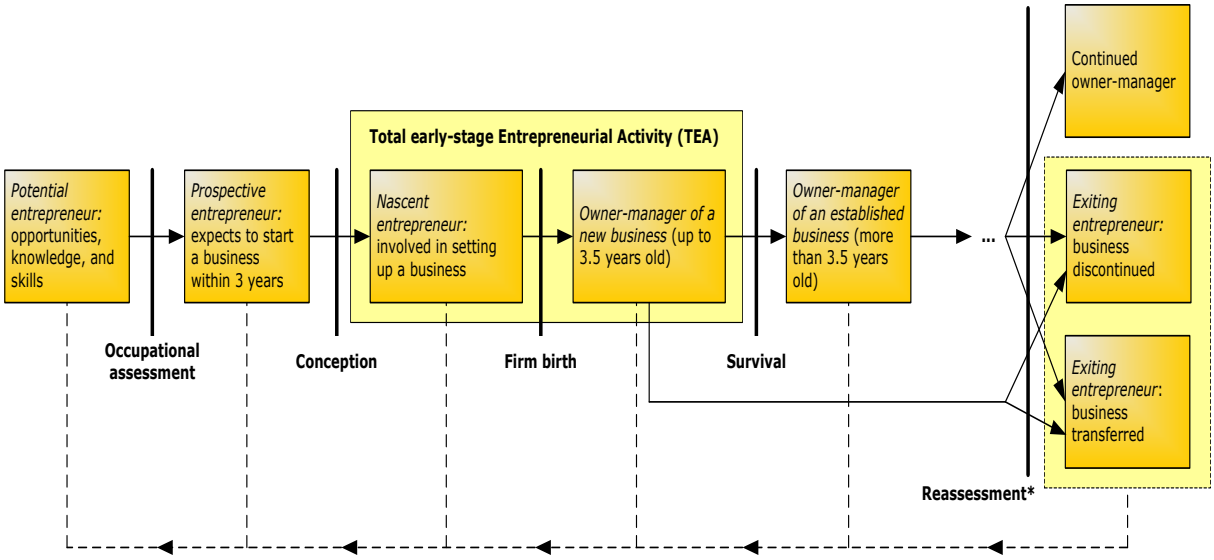
> *"The driving force of the market process is provided neither by the consumers nor by the owners of the means of production – land, capital goods, and labor – but by the promoting and speculating entrepreneurs... Profit-seeking speculation is the driving force of the market as it is the driving force of production (Mises, 1949, pp 328-329)."*

Based on this theory one can derive that entrepreneurs are opportunity seekers, whereby their goal is to create economic growth. Besides the opportunity seeker, there are also entrepreneurs, who are pushed by necessity. Koellinger and Thurik (2012) stated this as the push en pull factors to become an entrepreneur. The pull factor arises from seeking an opportunity and the push factor relates to becoming an entrepreneur through necessity. The push factor might arise due to unemployment, so that there is no other solution. On the other hand, the pull factor corresponds to the fact that individuals have ideas, which they want to exploit. Hence, for this reason they want to start a new business. This is in line with entrepreneur of Schumpeter, which is an innovator who carries out new fertile combinations.

2.2.2 Early stage entrepreneurs

One of the reasons why there is not one clear definition of entrepreneurship is because there are different fields within entrepreneurship. This research is focused on total early stage activity. Creating a business entails a long list of activities. An entrepreneur needs to find an opportunity to start a business. Subsequently, a business plan is needed and the allocation of the production, financing and other tasks has to be assigned. Therefore, this group of entrepreneurs is suitable to examine for this study due to the fact that these individuals are involved in setting up a business or already are starting entrepreneurs. In the figure below, the entrepreneurial process is shown. The box in the middle entails the total early-stage entrepreneurial activity.

Figure 2. Total Early-stage Entrepreneurs



Source: Hessels (2013)

As can be seen in Figure 2, the total early-stage entrepreneurs group consist of two kind of entrepreneurs, namely the nascent entrepreneurs, who are involved in setting up a business, and the owners or managers of a new business up to 42 months or less (Hessels et al., 2008). In order to make a clear distinction between nascent entrepreneurs and potential and prospective entrepreneurs, Wagner (2004) defines a nascent entrepreneur as a person who is now trying to start a new business, who expects to be the owner or part owner of the new firm, who has been active in trying to start the new firm in the past 12 months and whose start-up did not yet have a positive monthly cash flow that covers expenses and the owner-

manager salaries for more than three month. In contrast to potential and prospective entrepreneurs, who would prefer being entrepreneur, also called latent entrepreneurs.

Summarizing, it can be derived that the early stage entrepreneurs are involved in setting up a business or already are in entrepreneurial activity up to 3,5 years old. They are seeking opportunities and carry out new combinations in new or existing markets. Therefore, they are most of the time pulled into entrepreneurship. Furthermore, the new combinations carried out by early stage entrepreneurs might include innovative ideas, but this is not always the case. For this reasons, this group of entrepreneurs in particular is the most suitable group to examine the relationship between human capital indicators and innovation.

2.3 Measurement of innovation

Innovation is difficult to measure, but the attempt effort to do so is worthwhile. Different types of measurement have been used by theorist to measure innovation. Measurement means commensurability, in other words, that there is at least some level on which entities are qualitatively similar, so that comparisons can be made in quantitative terms (Keith Smith, 2005). The first problem arises with the fact that innovation is by definition, novelty. Besides, when do we count something as an innovation? As said before, there are different types and degrees of innovativeness, incremental, drastic, product innovation and so on. In addition, innovation is a continuous process. Hence, which moment in time do we determine when the innovation counts? Keith Smith (2005) stated R&D expenditures, accumulated R&D capital, patents, patent citations and questionnaires as innovations measures. All these indicators have advantages and disadvantages in order to measure innovation. One of the important disadvantages is that R&D expenditures and accumulated R&D are input measures. On the opposite site, patents, patent citations and questionnaires are output measures. In both cases not all innovations are taken into account due to the fact that the input measures not always result in an innovation. In addition, not all innovation will be patented or not taken into account with the questionnaires. Furthermore, all these measures are hard to find for early stage entrepreneurs and therefore not applicable for this research. Fortunately, the GEM uses a consistently and internationally comparable measure of entrepreneurship, the Total Entrepreneurship Activity. These individuals where asked if

they innovate or not. Hereby, there is an unambiguous measure for innovation across different countries and suitable for this research.

2.3.1 Determinants of innovation

Most research on innovative activity is done by using data of large firms. However, innovative activity is not only done at large firms. Also entrepreneurs or incremental innovators provide innovations. Several empirical studies have tried to find out which factors are determinative for innovation. Acs and Audretsch (1988) did research into the difference of innovation in large and small firms. They found that the total number of innovations is negatively related to concentration and unionization. However, innovations are closely related to R&D expenditures and patented inventions, especially at the more aggregated level. Furthermore, skilled labor has a positive influence on innovation. The magnitudes of these effects were disparate between the sizes of the firms. These results are found in an investigation of 247 manufacturing firms.

In addition, Baumol (2004) mentioned that there is a sharp difference in contribution to the economy of an innovation offered by an entrepreneur compared to those provided by the large internal R&D laboratories of established firms. The independent innovator is responsible for most of the fundamentally novel innovations. In contrast, most innovations by large firms are incremental improvements, like increased reliability, more user-friendly, flexibility in design and so on. For these large firms it is more a routinely job. Furthermore, he stated that there is a difference in education. Most of the time, successful entrepreneurs have had only a basis education. In contrast to large firms, where they have an abundant of higher educated personnel.

Besides, De Jong and Vermeulen (2006) did extensive research on the determinant of product innovation in small firms across countries. Their dataset contains 1250 small firms across 7 industries. They found significant results after controlling for variations in age and size of the firms that manufacturing, knowledge-intensive services and financial service industries are more innovative compared to construction, wholesale and transport, retail services and hotel services.

Furthermore, Hadjimanolis (2000) examined a resource-based view of on the determinants of innovativeness in small firms. Twenty-five cases in the manufacturing sector were studied

in Cyprus. He looked at the characteristics of the owner or managers, such as the age, the education and prior experience and his capabilities and strategy. Besides, the characteristics of the firm and some technological assets, like R&D expenditure and the employment of engineers are investigated. Finally, the relationship between environmental factors, such as level of networking, and innovation were examined. Hadjimanolis (2000) found that the strategy of the owner and the development of resources are one of the important factors for innovation. Furthermore, R&D expenditure, variation in technological information sources and external training are important for innovation. Noteworthy, the education and the technological background of the owner have no effect on innovation. Other indicators were not significant and therefore not interpretable. One of the limitations of this case study is the small number of observations. Therefore, a large representative sample is needed to find more significant results. Hence, it is reasonable that there is no effect of education and technological background.

Besides, Freel (2003) tried to explore the degree of association between external linkages and firm level performance of innovation in a sample of 597 small manufacturing firms. The result of his study was that the influence of various types of networks is not always positively related with innovation. The relationship depends upon different aspects, such as the availability of the internal competencies of the manager and his employers and the type of innovation.

Furthermore, Shipton et al. (2006) invest the relationship between HR practise and product and technological innovation. In their study of 22 UK manufacturing firms, they found significant results that exploratory learning, training, appraisal, induction and team working are all predictors of product and technological innovation. In addition, the character of the manager has a huge influence in the innovativeness of their firm. In a study from 71 companies in Singapore, Wan et al. (2005) found that willingness to take risks, a belief in the importance of innovation and a willingness to exchange ideas are positive related with innovation in their firms.

It can be derived from the empirical studies that different features have influence on innovation. Vital determinants are the R&D expenditures of the firms and the internal capabilities and background of the owner or manager of the firm. The latter includes

different aspects whence innovation can be encouraged or not. These capabilities can be further developed by training, exploratory learning and so on. All the indicators can be brought together as human capital. Some individuals have higher levels of human capital than other. It is interesting to see whether the influence of human capital can foster the innovativeness of entrepreneurs. The relationship between human capital and innovation is investigated by several researchers. Noteworthy, the indicators of human capital in these studies are not consistent. Different scientists are using different indicators of human capital.

2.3.2 Human capital

In 1961 the human capital theory has been introduced by Schultz. Subsequently, it was Becker (1964) who did extensively empirical and theoretical research on the theory of human capital. In his view human capital is a means of production, just as machines and commodities. He states that education and experience are the most important indicators of human capital. A firm can invest in human capital via education or training. The economic model of human capital implies that a firm invests in one period and receive returns to the investment in the subsequent periods[5]. According to Becker, education or training of individuals increases the knowledge and skills and also the use of this, resulting in higher wages and more motivated individuals. Higher wages results in more opportunities to consume, whereby the economy growth is stimulated.

Accordingly, one can invest in education and training to increase the level of human capital. However, the type of education or training ensures also for a different growth of human capital. If a firm invest in a specific training that is only valuable for the firm itself, the recipient of the training has no extra level of human capital at another firm. Therefore, it is important to describe which type of human capital is used. Dahkli and De Clerq (2004) describes that there is a distinction between types of human capital. These three types are firm-specific, industry specific and individual specific human capital. Furthermore, they describe also the impact of each type of human capital on innovation.

First, firm specific human capital includes investments in the employer by the employee though training, which is only valuable within a specific firm. This type of human capital is

[5] http://www.scribd.com/doc/28783615/Human-Capital-Theory

not transferable to other firms. Because the employer cannot use this specific knowledge at another competitive firm, he becomes dependent on his employee. Hence, this results in bilateral dependency between the two, whereby the employee rather is inclined to invest in this type of human capital. According to Dahkli and De Clerq (2004) this type of human capital has limited impact on the level of innovativeness. This is caused by the fact that the knowledge is only useful in the company itself and not in a wider society or region.

The second type, industry specific human capital, contains investments in training by the employer in the employee, which is valuable for all the firms in a specific industry. This type of investment by the employee ensures no bilateral dependency. Hereby, there is a risk for the employee due to the fact that the employer is also more valuable for competitors in the same industry. This type of human capital has a small impact on the innovativeness. The knowledge can be used for a wider perspective than the first form. However, the knowledge is still restricted due to the fact that is only valuable in a specific industry. Dakhli and De Clerq (2004) states that this type of human capital plays an important role in the innovativeness of a specific industry. Especially, if the network partners from the same industry are working together.

The last type of human capital, individual specific human capital, refers to knowledge that is applicable to a wide range of firms and industries. This study is focused on the latter due to the fact that through this type of knowledge innovativeness can be realized in a wide range of industries. Furthermore, there are no restrictions for a specific area or company to utilize this knowledge. Examples of this type of human capital are education, work experience, managerial and entrepreneurial experience. This type includes also what Becker (1964) mentioned by human capital. Several studies examine the effect of this type of human capital on the probability to become an entrepreneur. De Clerq and Arenius (2003) examine the effect of education, skills to start up a new business and knowing existing entrepreneurs on the likelihood to launch a new venture. Their analysis is based on data of the GEM 2002 with a total of 4,536 individuals living in Belgium or Finland. They found that skills required for starting a new business are the most important factor to start up a new business. Furthermore, knowing an existing entrepreneur increase the probability to be an entrepreneur. However, in this study, individuals with a lower level of education, scilicet the ones with none post-secondary degree, are significantly more likely to be an entrepreneur

compared to the ones with a post-secondary degree. This result might be counterintuitive. Therefore, De Clerq and Arenius give the following three explanations. First, the unfavourable risk reward ratio related with entrepreneurial activity in Finland might drive high educated individuals away from entrepreneurship. Second, entrepreneurship courses are only followed by a small slide of the Belgium students, whereby it is less likely that these individuals become entrepreneurs. Finally, education has a positive correlation with skills to start a new business. This implies that education has an indirect effect on entrepreneurship. Education might enhance the self-confidence of the capabilities to start up a new business of the individual.

Besides, Davidsson and Honig (2003) studied the role of social and human capital among nascent entrepreneurs. Their study exists of 380 nascent entrepreneurs and they compare this group with a control group of 608 non-entrepreneurs. Both groups are drawn from a sample of the general population of Swedish adults with a total of 30,427 individuals. They found that formal education and work experience have a positive effect on nascent activity. In addition, individuals with previous start-up experience are more likely to be nascent entrepreneur than those who have none. This shows that human capital has a positive effect on entrepreneurial discovery. Furthermore, the social capital indicators have a mixed effect on being a nascent entrepreneur. Parents in business, encouraged by family and close friends in business are positive related with the probability to be nascent entrepreneur. Contrary, being married has a negative influence.

In addition, Dakhli and De Clercq (2004) studied the relationship of human capital and innovation. They used data from 59 different countries to examine the effect of human and social capital on innovation. They used education attainment, average income and life expectancy as variables of human capital. As indicators of social capital they used generalized trust, institutional trust, associational activity and norms of civic behaviour. Dahkli and De Clercq (2004) found strong empirical support for the positive relationship between human capital and social capital and innovation.

Furthermore, Marvel and Lumpkin (2007) did research on the effect of human capital on innovation. Their study investigates different types of general and specific human capital that are associated with innovation outcomes. Marvel and Lumpkin used education, the

number of employers the entrepreneurs had worked for and number of years of professional work experience as measures of general human capital. As measures for specific human capital, they used prior knowledge of ways to serve markets, customer problems, markets and technology. Their sample consists of 145 technology entrepreneurs, who recently started a venture, from the United States. Marvel and Lumpkin found significant results that education of the entrepreneur, the number of work experience, prior knowledge of technology are positively related to innovation. However, prior knowledge of ways to serve markets showed a negative significant result. Furthermore, the other human capital variables show positive relationships with innovation, except for the variables prior knowledge of customer problems. However, these results are not significant and therefore not interpretable.

In addition to the human capital theory, there is the theory of Lazear (2005). According to Lazear entrepreneurs must be jacks of all trades. His argument is that the creation of a new business requires many different activities to be performed. Therefore, entrepreneurs do not need to be an expert in any single skill; they must be sufficiently good at a wide variety of tasks to make sure that the business does not fail. Lazear hypothesizes that entrepreneurs are generalists who are good at a variety of skills. In addition, individuals who want to become entrepreneurs should have a more generalized human capital investment strategy. Data from the Stanford MBA alumni back up this conjecture. Hessels et al. (2014) extends this study in three directions. First, they provide a theoretical framework linking new business creation with an entrepreneur's skill variety. Second, they allow in the model of Lazear for both generalists and specialists to possess skill variety. Third, they test the model empirically using data from Germany and the Netherlands. They found that individuals with more varied work experience are more likely to succeed in starting up a new business. In addition, having experience in a variety of areas seems to facilitate the creation of a new business. However, this does not mean that those with varied skills are necessarily what Lazear (2005) called 'more balanced individuals'. They still may excel in one specific skill. Hessels et al. (2014) found that being a generalist, which proxies having balanced skills, does not matter for success in setting up a business. Thus, having varied work experience does not necessarily imply that someone is a specialist and vice versa. Especially, this counts for entrepreneurs who want to start with an innovative idea. Innovation positively moderates

relationship between having varied experience and being successful in setting up a business. The entrepreneur's skill variety in particular facilitates the establishment of innovative new business. Finally, entrepreneurs with more varied work experience are more likely to introduce innovations that have not only technical, but also commercial value.

2.4 Hypotheses

This study examines the role of human capital on innovation among early stage entrepreneurs. Previous literature, in most cases, shows a positive relationship between human capital variables and innovation. Different indicators of human capital are used to measure their effects on innovation. Several studies make a distinction between general, specific human capital or human and social capital. This study is only focused on human capital and uses the five following indicators of human capital: network, education, prior experience, opportunity based entrepreneurship and skills to start up a new venture. These five indicators are discussed in the five different hypotheses below.

According to Becker (1964) education and experience are the most important indicators of human capital. Furthermore, if an early stage entrepreneur thinks there is a good opportunity for starting a new business, it might be caused by a novel idea. Hence, this human capital indicator will influence the probability to innovate. In addition, it requires skills to implement the innovation. Finally, the entrepreneur's network might enlarge the probability to innovate due to discuss each other's thoughts.

Interesting is to examine how these indicators affect product and process innovation. It could be that some indicators relates positively to product innovation and negatively related to process innovation or vice versa. In addition, it is also rewarding to indicate which human capital variable has the strongest relationship with product or process innovation among early stage entrepreneurs. Previous literature does not provide evidence that human capital indicators have a different impact on product compared to process innovation. Therefore, the hypotheses for product and process innovation are both formulated in the same direction.

Hypothesis 1

The first human capital variable is the network of the early stage entrepreneur. According to De Clerq and Arenius (2003), knowing an existing entrepreneur increases the probability to

become self an entrepreneur. Furthermore, Freel (2003) mentions that the influence of networks on innovation depends on different aspects, such as the competencies of the manager itself. The type of network in this research is the personal network, whereby the individual has the knowledge and experience available of an existing entrepreneur. Moreover, if the entrepreneur knows someone personally who started a business, this individual already knows the whole process to introduce an innovation. Therefore, it is expected that the network of early stage entrepreneurs are positively related to product and process innovation. This leads to the following hypotheses:

1a: The individual's network is positively correlated with product innovation among early stage entrepreneurs.

1b: The individual's network is positively correlated with process innovation among early stage entrepreneurs.

Hypothesis 2

The second human capital indicator is education. Becker (1964) states that education and experience are the most important indicators of human capital. He mentions that these features increases the knowledge and skills to use them, resulting in more opportunities. Hence, education increases knowledge, which increases the opportunity to discover possibilities and to exploit new combinations. In addition, several studies found a positive relationship between education and innovation (Dakhli and de Clerq, 2004, Marvel and Lumpkin, 2007, Shipton, 2006). Although some studies found a negative relationship between educational attainment and innovation (Hadjimalos, 2000, De Clerq and Arenius, 2003), it is expected that higher educated entrepreneurs rather be innovative compared to lower educated ones. Besides, both studies give an explanation for this remarkable result. Therefore the following hypotheses are formulated:

2a: Educational attainment is positively correlated with product innovation among early stage entrepreneurs.

2b: Educational attainment is positively correlated with process innovation among early stage entrepreneurs.

Hypothesis 3

The third indicator of human capital is experience. Experience implies that the early stage entrepreneur has owned and shut down a business in the past 12 months. It can be derived that entrepreneurs, who have these experience, are more likely to carry out new combinations. Also Becker (1964) states that more experience creates more skills to use this knowledge. Furthermore, Marvel and Lumpkin (2007) found that the number of work experience have a significant positive relationship with innovation. In addition, the experience of an early stage entrepreneur affects innovation due to the fact that the individuals foresee how to implement the innovation. The last reason is also consistent with the economic model of human capital that implies that one invests in one period and receives returns in the subsequent periods. If an entrepreneur gains experience by means of starting a new venture and also shut down this business, the individual has more knowledge how to start up a new venture and how to implement the possible innovation. Besides, Hessels et al. (2014) states that entrepreneurs with more varied work experience are more likely to introduce innovations. These innovations have not only technical, but also commercial value. Therefore, it is expected that there is a positive relationship between experience of the early stage entrepreneurs and innovation. In line with this, the following hypotheses are formulated:

3a: Previous entrepreneurial experience of early stage entrepreneurs is positively correlated with product innovation.

3b: Previous entrepreneurial experience of early stage entrepreneurs is positively correlated with process innovation.

Hypothesis 4

The fourth indicator of human capital is opportunity based entrepreneurship. This indicator entails whether the individual thinks there is a good opportunity for starting a new venture. According to Koellinger and Thurik (2012) the individuals, who thinks there is a good opportunity, are pulled into entrepreneurship. They do not become entrepreneur through necessity, but through new ideas or new combination, which they want to exploit. In addition, some theorists explain entrepreneurship by taking advantage of opportunity by

novel combinations of resources in ways, which they have impact on the market. Besides, the shift from a managed economy towards an entrepreneurial economy ensures that one think in terms of opportunities rather than in terms of resources. Hence, it is based upon ideas and knowledge rather than on investments creating more of the same (Thurik, 2008). Furthermore, if individuals realize that their network, educational attainment, experience and their skills have a positive influence to carry out new fertile combinations, it is expected that also opportunity based entrepreneurship has a positive influence. All in all, it is expected that opportunity based entrepreneurship has a positive influence on both innovation measures. This leads to the following hypotheses:

4a: Opportunity-based entrepreneurship is positively correlated with product innovation among early stage entrepreneurs.

4b: Opportunity-based entrepreneurship is positively correlated with process innovation among early stage entrepreneurs.

Hypothesis 5

The last indicator of human capital is skills. This measure implies whether the early stage entrepreneur has the skills to start up a new venture. Skills are necessary to start up a new venture successful. Without skills, the entrepreneur does not know how to start and it is impossible to make an underpinning plan for every activity. For this reason, it is expected that skills have an influence on whether an early stage entrepreneur innovates or not. Furthermore, Becker (1964) mentions that individuals with more skills become more motivated. This might result that early stage entrepreneurs will carry out their new combinations rather than without these skills. In addition, Acs and Audretsch (1988) and De Clerq and Arenius (2003) also found a positive relation between skills and innovation. The latter labelled skills as the most important determinant of innovation. Furthermore, individuals who want to become entrepreneurs should have a more generalized human capital investment strategy according to Lazear's theory (2005). In addition, Hessels et al. (2014) states that in particular nascent entrepreneur's skill variety facilitates the establishment of innovative new business. In line with this thought, the last two hypotheses are as follows:

5a: Having skills required to start up a new venture is positively correlated with product innovation among early stage entrepreneurs.

5b: Having skills required to start up a new venture is positively correlated with process innovation among early stage entrepreneurs.

3. Data and Method

This chapter deals with the data and method that are used in this study. First, the data and the variables are discussed. Subsequently, the method and the model, which are used in the empirical analysis, are explained.

3.1 Data

The sample, which is used in order to answer the research question, is from the Global Entrepreneurship Monitor (GEM). The GEM is a worldwide research project that sampled individual entrepreneurs using an adult population survey. Its goal is to measure the degree of entrepreneurial activity, to expose the important drivers of entrepreneurship attitudes and to advise national governments with policies concerning entrepreneurial activity[6]. The data are randomly collected with a minimum of 2000 individuals in each country. These individuals answered the survey during door to door or by telephone interviews.

The GEM dataset used in this study is obtained during the year 2009 and the data are on individual level. GEM offers comparable data across countries due to its research consistency and stability, making it a representative sample for this study. Within the GEM dataset Total early-stage Entrepreneurial Activity (TEA) is used as the main measure for the amount of entrepreneurs and new ventures present in a country, also called early-stage entrepreneurs. This measure consists of both owners or managers of young business up to 42 months old and nascent entrepreneurs, who are involved in setting up a new business (Hessels et al., 2008). These entrepreneurs and business owners, which are in involved in TEA, are asked to evaluate the novelty of their product or service and the newness of their technology.

Although all European countries are included in the GEM, the sample for this research only exists of 18 countries from the European Union. This is caused by the fact that the early stage entrepreneurs are not present in each country of the European Union. Still, a total of 1806 observations remain.

3.2 Dependent variables

The dependent variables for this research are the variables which relate to innovation. In the dataset there are two variables which give answer whether an individual innovates or not. The first dependent variable is the variable *Product innovation*. This variable gives answer

[6] http://www.gemconsortium.org/Data-Collection

whether all, some, or none of your potential customers consider this product or service as new. If all potential customers consider this product or service as new, it implies an innovation. Hence, if the answer is that some or none of your potential customers consider this product or service as new, it is not an innovation.

The second dependent variable is *Process innovation*. This variable gives answer whether their technologies or procedures required for this product or service have been available for less than a year, or between one to five years, or longer than five years. If the technologies or procedures required for the product or service have been available for less than a year, it is considered as a process innovation. Hence, if the technologies or procedures required for this product have been available between one to five years or longer than five years, it is not a process innovation.

Both variables are constructed as a dichotomous variable and take value 1 if the individual innovates and take value 0 if the individual does not innovate. In addition to the two independent variables, there is an independent variable, which combines the two types of innovation. This combined variable has three outcomes and takes value 0 in the case where an individual has no product or process innovation. If the individual has a product or a process innovation, it takes value 1. Finally, if the individual has both a product and a process innovation, the independent variable takes value 2.

3.3 Independent variables

The main independent variables in this analysis are the variables which are related to human capital. The following five different variables in the dataset explain human capital and together they are equivalent. All these variables are dichotomous.

The first variable of human capital is the variable *Network*. This variable takes value 1 if the individual knows someone personally who started a business in the past 2 year and takes value 0 if the individual does not.

The second variable of human capital is the variable *Education*. This variable consists of six categories. Therefore this variable is divided into two different categories. It takes value 1 if the individual has at least a post-secondary educational attainment and takes value 0 if the

individual does not. This is also done by De Clerq and Arenius (2003), who also used data of the GEM.

The third variable is the variable *Experience*. This variable takes value 1 if the individual has, in the past 12 months, sold, shut down, discontinued or quit a business and takes value 0 if the individual does not have this experience.

The fourth variable is the variable *Opportunity*. This variable takes value 1 if the individual thinks that there will be good opportunities for starting a business in the next six months and takes value 0 if the individual does not think it is a good opportunity.

The last variable of human capital is the variable *Skills*. This variable takes value 1 if the individual has the knowledge, skill and experience required to start a new business and takes value 0 if the individual does not.

3.4 Control variables

This study includes several control variables in order to check for unobservable characteristics. Different characteristics of the entrepreneur might have an impact on the innovativeness of their new firm. Therefore, the control variables are: *Age*, *Gender*, the specific *Country* where the individual is coming from and their *Income*.

The first control variable that is included is the variable *Age*. The age of early stage entrepreneurs might have an impact whether they innovate or not. If an individual innovates, the cash flows will not start immediately. Therefore, it is possible that young individuals, who have a long time horizon, will innovate rather than older ones. In addition, Lévesque and Minniti (2006) found empirical evidence that younger individuals are more likely to start a new firm than older ones. Entrepreneurship is 'a young man's game' and the willingness to invest time in starting new firms declines when getting older. Therefore, it might be that older individuals are less likely to start a new firm with an innovative idea than younger ones. The variable age is a continuous variable and ranges from the age 16 till 66 years old.

In many researches men are more likely to be an entrepreneur than women. Therefore, *Gender* is included as a control variable. Gender is a dichotomous variable and takes value 1 for men and 0 for women. Moreover, significant differences in gender were found in the

study of Tominc and Rebernik (2006). They identified these differences within each of the three countries they investigated, namely Hungary, Croatia and Slovenia.

In addition, in the summary report of the GEM 2001, there are plain differences visible between the age and gender of the early stage entrepreneurs. This counts also for the specific country where the individual is coming from.

Furthermore, every entrepreneur needs access to finance for his start-up and the continuity of his firm. This counts also for early stage entrepreneurs, who are willing to innovate. For this reason, the *Income* of the respondents is included as control variable.

Although several studies found significant relationship between the characteristics of an entrepreneur and their innovative performance, the empirical study of Avermaete et al. (2004) found no evidence of this relationship.

Finally, this analysis includes *Countries* as a control variable. The dataset contains 18 of all European countries and every country has a different amount of observations. In Table 1, the countries and their frequencies of respondents are shown. As can be seen in this table, there are different number of observations per country. Spain and UK have the most observations, 402 and 437 respectively. In contrast, Italy, Denmark and Serbia only have 26 observations or less. Therefore, this analysis will control for the country, where the individual is coming from. All countries are considered as a dichotomous variable and if an individual comes from a specific country, it takes value 1 and 0 otherwise.

Table 1. Origin of respondents and number of observations per country

Country of Origin:	Frequency	Percent	Cumulative
Greece	56	3.10	3.10
Netherlands	39	2.16	5.26
Belgium	53	2.93	8.19
Spain	402	22.26	30.45
Hungary	68	3.77	34.22
Italy	21	1.16	35.38
Switzerland	59	3.27	38.65
UK	437	24.20	62.85
Denmark	26	1.44	64.29
Norway	78	4.32	68.60
Germany	149	8.25	76.85
Iceland	81	4.49	81.34
Finland	36	1.99	83.33
Latvia	107	5.92	89.26
Serbia	24	1.33	90.59
Croatia	62	3.43	94.02
Slovenia	58	3.21	97.23
Bosnia and Herzegovina	50	2.77	100.00
Total	**1,806**	**100.00**	

Note: Number of observations per country

3.5 Method

In order to answer all the hypotheses and the main research question, the Logistic regression model is used to explain the effect of our independent variables on the probability that early stage entrepreneurs will innovate. Both dependent variables are constructed as a dichotomous variable and takes value 1 if the individual innovate and takes value 0 if the individual does not innovate. Hence, the predicted probability will be in interval of 0 and 1 and this can be examined with a Logistic regression model.

Before the Logistic regression models were examined, recoding of the variables has been done. This research is focused on the early stage entrepreneurs and therefore only these individuals are taken from the sample. In addition, both dependent variables are categorized

into two groups, the ones that innovate and the ones that do not innovate. Furthermore, the following measures are conducted to make sure that the results from the regressions are correct. First, the t-test and the Spearman correlation are examined to find whether the independent variables and the dependent variable are related. Finally, to control for heteroskedasticity the robust standard errors are used in the regressions.

The results of the logit regressions are not directly interpretable. Therefore, the average marginal effects will be examined in order to interpret the effects of the dependent variables on the independent variables.

3.6 Model

The model that is used for this analysis is the Logistic regression, because the dependent variables are latent variables. Hence, the predicted probability will be in the interval of 0 and 1. The equation of this model is as follows:

Equation 1 =

$$\Pr(y = 1|x_1, x_2, x_k) = \frac{\boldsymbol{exp}(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k)}{\mathbf{1} + \boldsymbol{exp}(\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k)}$$

For each human capital indicator there are two hypotheses formulated. Hypotheses A states that the five variables of human capital relate positively to product innovation among early stage entrepreneurs. The equation for these hypotheses is as follows:

Equation 2 =

$$\Pr(Product = 1|skills, education, experience, network, opportunity, age, gender, country, income) = \frac{\boldsymbol{exp}\begin{pmatrix}\beta_0 - \beta_1 skills - \beta_2 education - \beta_3 experience - \beta_4 network - \beta_5 opportunity \\ - \beta_6 age - \beta_6 gender - \beta_6 country - \beta_6 income\end{pmatrix}}{\mathbf{1} + \boldsymbol{exp}\begin{pmatrix}\beta_0 - \beta_1 skills - \beta_2 education - \beta_3 experience - \beta_4 network - \beta_5 opportunity \\ - \beta_6 age - \beta_6 gender - \beta_6 country - \beta_6 income\end{pmatrix}}$$

Hypotheses B states that the five variables of human capital are positively related to process innovation among the early stage entrepreneurs. The equation for these hypotheses is as follows:

Equation 3 =

$$\Pr(Process = j|skills, education, experience, network, opportunity, age, gender, country, income)$$
$$= \frac{\boldsymbol{exp}\begin{pmatrix}\beta_0 - \beta_1 skills - \beta_2 education - \beta_3 experience - \beta_4 network - \beta_5 opportunity \\ - \beta_6 age - \beta_6 gender - \beta_6 country - \beta_6 income\end{pmatrix}}{\mathbf{1} + \boldsymbol{exp}\begin{pmatrix}\beta_0 - \beta_1 skills - \beta_2 education - \beta_3 experience - \beta_4 network - \beta_5 opportunity \\ - \beta_6 age - \beta_6 gender - \beta_6 country - \beta_6 income\end{pmatrix}}$$

In addition to the above models, there is also an ordered logit regression examined for the two innovations combined. The new combined dependent variable has three outcomes, namely no innovation, one of the two types of innovation and both innovations. Hence, there is an ordering in the outcomes. This regression is done in order to see if the human capital variables have the same effect on product and process innovation combined. Thus, the x_N are the same as in the above models. The equation of the ordered logit model is as follows:

Equation 4 =

$$\Pr(y = j|x_1, x_2, x_k) = \frac{\boldsymbol{exp}(\tau_j - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_k x_k)}{\mathbf{1} + \boldsymbol{exp}(\tau_j - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_k x_k)} - \frac{\boldsymbol{exp}(\tau_{j-1} - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_k x_k)}{\mathbf{1} + \boldsymbol{exp}(\tau_{j-1} - \beta_1 x_1 - \beta_2 x_2 - \cdots - \beta_k x_k)}$$

As can be seen in equation 4, the τ_j in this formula is used to indicate the thresholds. In this study there are three categories, which mean there are two thresholds. An early stage entrepreneur, who has both types of innovation, is in the third category. In order to get in the third category, the individual has to pass the second threshold. Therefore this threshold is used in the first part of the equation. In the second part of the equation, the first threshold is used.

4. Results

In this chapter the results of the empirical analysis are discussed. The literature review gives a direction for the expected outcomes of the empirical results. The main aim of this empirical analysis is to scrutinize the effect of the five factors of human capital on the two variables of innovation. First, the descriptive statistics are shown in order to get a first impression of the dataset. Second, the results of the logit regressions are described. In order to derive if the results are significant or not, the 5% significance level is applied.

4.1 Descriptive analysis

In order to obtain a general view of the relationship between the independent and the dependent variables, a t-test is examined on the comparison of the means between individuals, who innovate and those who do not innovate. The group of the non-innovators consist of 888 observations, whereas the group of the innovators consist of 918 observations. Overall there are 1,806 observations. Table 2 shows the t-tests for all the independent variables on product innovation.

Table 2. Descriptive statistics: T-test product innovation

	Non-innovators	Innovators	Pr(|T| > |t|)
Network	0.672	0.680	0.736
Education	0.503	0.565	0.008
Experience	0.110	0.114	0.787
Opportunity	0.537	0.560	0.332
Skills	0.912	0.904	0.556
Age	42.513	46.815	0.206
Gender	0.670	0.671	0.965
Income	2.425	2.365	0.129

Note: Means of human capital variables on product innovation

No significant differences of the mean are found for the independent variables *Network, Experience, Opportunity and Skills*. In contrast, there is a significant difference in mean for *Education* on the probability that an individual has a *Product innovation*. For the individuals, who have a product innovation, it is found that 56,5% has at least a post-secondary educational attainment compared to 50,3% for individuals, who do not innovate. This higher share for the latter group compared to the former is found to be significantly higher at the

5% significance level due to a p-value of 0.008. Hence, on average the chance to have at least a post-secondary educational attainment is higher for early stage entrepreneurs, who have a product innovation compared to early stage entrepreneur, who do not have a product innovation.

Also the t-test is examined for the control variables. Pointedly, innovators are older than non-innovators and that the average income of all early stage entrepreneurs lies between the middle and upper tertile. However, both results are not significant at the 5% significance level. In addition, no significant difference in mean is found for the control variable *Gender*. Furthermore, the t-test for the control variable *Country* is not examined due to the fact that the code of each country is arbitrary. Therefore, there is no added value to do this.

Table 3 shows the results of the t-test of all the independent variables against the *Process innovation*.

Table 3. Descriptive statistics: T-test process innovation

	Non-innovators	Innovators	Pr(|T| > |t|)
Network	0.668	0.690	0.325
Education	0.510	0.577	0.006
Experience	0.108	0.119	0.478
Opportunity	0.554	0.539	0.540
Skills	0.898	0.926	0.045
Age	45.381	43.524	0.599
Gender	0.653	0.701	0.037
Income	2.361	2.449	0.032

Note: Means of human capital variables on process innovation

This table shows significant differences for the groups of early stage entrepreneurs, who have a process innovation, compared to ones, who do not have a process innovation, for the variables *Education and Skills*. For the individuals, who have a process innovation, it is found that 57,7% have at least a post-secondary educational attainment compared to 51,0% for individuals, who do not innovate. This result is significant at 5% significance level due to a p-value of 0.006. Hence, on average the chance to have at least a post-secondary educational attainment is higher for early stage entrepreneurs, who have a process innovation compared

to early stage entrepreneur, who do not have a process innovation. In addition, for individuals, who have a process innovation, it is found that 92,6% have the skills to start up a new business compared to 89,7% for individuals, who do not innovate. This result is significant at the 5% significance level due to a p-value of 0.045. In contrast, there are no significant differences found for the variables *Network, Experience and Opportunity*.

Furthermore, the control variables are also included in this table. It is found that 70,1% of the individuals, who have a process innovation, is a male. For the individuals, who do not have a process innovation, it is found that only 65,3% is male. This result is significant at the 5% significance level due to a p-value of 0.037. Moreover, it is found that the average in mean for income is higher for individuals, who have a process innovation, compared to the individuals, who are not innovating. Besides, no significant differences in mean are found for the other control variables.

In Table 4 the Spearman correlation for the independent variables *Product innovation* and *Process innovation* is established. For both independent variables the correlation is examined against all the variables of human capital and the control variables.

Table 4. Spearman correlation product and process innovation

	Product innovation	Process Innovation	Network	Education	Experience	Opportunity	Skills	Age	Gender	Country	Income
Product innovation	**1,000**										
	-										
Process innovation	**0.215**	**1,000**									
	0.000**	**-**									
Network	**0.008**	**0.023**	**1,000**								
	0.736	0.325	-								
Education	**0.062**	**0.064**	**0.033**	**1,000**							
	0.008**	0.006**	0.161	-							
Experience	**0.006**	**0.017**	**0.022**	**0.009**	**1,000**						
	0.787	0.478	0.360	0.718	-						
Opportunity	**0.023**	**-0.014**	**0.0430**	**0.033**	**-0.040**	**1,000**					
	0.332	0.540	0.069*	0.157	0.088+	-					
Skills	**-0.014**	**0.047**	**0.046**	**0.065**	**0.040**	**0.116**	**1,000**				
	0.556	0.045*	0.051+	0.006**	0.086+	0.000**	-				
Age	**0.008**	**-0.017**	**-0.103**	**0.099**	**0.094**	**0.043**	**0.139**	**1,000**			
	0.733	0.477	0.000**	0.000**	0.000**	0.069+	0.000**	-			
Gender	**0.001**	**0.049**	**0.076**	**-0.049**	**0.093**	**-0.015**	**0.046**	**0.015**	**1,000**		
	0.965	0.037*	0.001**	0.037*	0.000**	0.513	0.050*	0.532	-		
Country	**0.001**	**-0.008**	**0.081**	**-0.083**	**0.003**	**0.045**	**-0.012**	**-0.070**	**0.011**	**1,000**	
	0.972	0.736	0.001**	0.000**	0.003**	0.058+	0.612	0.003**	0.628	-	
Income	**0.015**	**0.045**	**0.048**	**0.059**	**-0.008**	**0.053**	**0.073**	**0.048**	**0.061**	**-0.016**	**1,000**
	0.529	0.057+	0.042*	0.012*	0.743	0.025*	0.002**	0.043*	0.009**	0.493	-

Notes: ** denotes 1% significance; * denotes 5% significance; + denotes 10% significance. The bold numbers are the correlations and the numbers below them shows the p-value.

Notice first in Table 4 that there is a significant positive correlation between product and process innovation. It shows a correlation of 0.215 with a significance level of 0.000. Due to this result, it is make sense to examine an ordered logit regression of all the independent variables on the two dependent variables combined.

Secondly, the only significant result for product innovation against the dependent variables is the correlation between *Product innovation* and *Education*. It shows a correlation of 0.062 with a significance level of 0.008. The other correlations of the independent variables with product innovation are not significant and therefore are not interpretable.

Furthermore, the variables *Education, Skills and Gender* are all positively correlated with *Process innovation*. *Education* has a correlation of 0.064 with *Process innovation* and is significant at the 5% significance level due to a p-value of 0.006. In addition, process innovation has a correlation of 0.047 with skills and this result is significant at the 5% significance level due to a p-value of 0.045. Furthermore, gender has a correlation of 0.049 and a p-value of 0.037 and therefore being male has a positively correlation with process innovation. Moreover, at the 10% significance level, also the correlation between process innovation and income is significant. It is found that the correlation is 0.048. However, the other correlations of the independent variables with process innovation are not significant and therefore are not interpretable.

Finally, there is no sign of multicolinearity due the fact that there is no strong correlation between the independent variables.

4.2 Logit regressions

In the next part of this chapter, the results of the logit regressions of the product and process innovation are shown. For both dependent variables, the estimated coefficients and marginal effects are shown.

4.2.1 Product innovation

Table 5 shows the results of the logit regression and the average marginal effects for every variable of human capital on the probability of *Product innovation*.

Table 5. Results product innovation

Dependent Variable: Product Innovation		
	[1]	[2]
	Logit Regression	Average Marginal effects
Network	0.006	0.001
	(0.106)	(0.025)
Education	0.226*	0.055*
	(0.101)	(0.024)
Experience	0.047	0.010
	(0.153)	(0.037)
Opportunity	0.042	0.010
	(0.101)	(0.024)
Skills	-0.028	-0.007
	(0.170)	(0.041)
Age	0.001	0.000
	(0.001)	(0.000)
Gender	0.030	0.007
	(0.103)	(0.025)
Country	YES	YES
Income	YES	YES
Constant	0.342	
	(0.337)	
Pseudo R2	0.029	0.029
Observations	1,806	1,806

Notes: **denotes 1% significance; * denotes 5% significance; + denotes 10% significance. Robust standard errors are reported in parentheses.

From this table it can be observed that *Education* has positive relationship with *Product innovation*. The magnitude of the effect is 0.055 and is statistically significant at the 5% significance level due to a p-value of 0.024. This means that on average, early stage entrepreneurs, who have at least a post-secondary educational attainment, increases the probability of having a product innovation with 5,5 percentages point, ceteris paribus. This

result is compared to early stage entrepreneurs, who do not have at least a post-secondary educational attainment. Therefore, the null-hypothesis of beta being equal to zero is rejected. Hence, hypothesis 2a remains due to the support that this hypothesis receives from this result.

The other results of all the coefficients are not statistically significant and therefore it is not possible to reject the null-hypotheses of beta being equal to zero. Hence, these results are not interpretable. This implies that hypothesis 1a, 3a, 4a and 5a cannot be rejected.

4.2.2 Process innovation

Table 6 shows the results of the logit regression and the average marginal effects for every variable of human capital on the probability of *Process innovation*.

Table 6. Results process innovation

Dependent Variable: Process Innovation		
	[1]	[2]
	Logit Regression	Average Marginal effects
Network	0.042	0.009
	(0.112)	(0.024)
Education	0.324**	0.070**
	(0.107)	(0.023)
Experience	0.032	0.007
	(0.158)	(0.035)
Opportunity	-0.093	-0.020
	(0.106)	(0.023)
Skills	0.155	0.033
	(0.189)	(0.040)
Age	0.000	0.000
	(0.001)	(0.000)
Gender	0.178	0.039
	(0.110)	(0.024)
Country Dummies	YES	YES
Income Dummies	YES	YES
Constant	-0.493*	
	(0.355)	
Observations	1,806	1,806
Pseudo R-squared	0.049	

**Notes: ****denotes 1% significance; * denotes 5% significance; + denotes 10% significance. Robust standard errors are reported in parentheses.

The magnitude of *Education* in this model is 0.070 and the effect on *Process innovation* is positive. This implies that on average, early stage entrepreneurs, who have at least a post-

secondary education attainment, increases the probability of having a process innovation with 7,0 percentages points, ceteris paribus. This result is significant at the 5% significance level due to a p-value of 0.002. Therefore, the null-hypothesis of beta being equal to zero is rejected. Hence, hypothesis 2b remains due to the positive coefficient.

However, the other results of all the coefficients are not statistically significant and therefore not interpretable. This implies that all the null-hypotheses of beta being equal to zero are not rejected. Hence, 1b, 3b, 4b and 5b cannot be rejected.

4.2.3 Results ordered logit regression innovation

In Table 7 the results of the ordered logit regression and the average marginal effects for every variable of human capital on the probability of both innovation measures combined.

Table 7. Results innovation combined

Dependent Variable: Innovation combined		
	[1]	[2]
	Logit Regression	Average Marginal effects Outcome 2
Network	0.036	0.006
	(0.097)	(0.017)
Education	0.297**	0.053**
	(0.094)	(0.017)
Experience	0.031	0.006
	(0.145)	(0.026)
Opportunity	-0.028	-0.005
	(0.093)	(0.016)
Skills	0.050	0.009
	(0.148)	(0.026)
Age	0.000	0.000
	(0.000)	(0.000)
Gender	0.105	0.018
	(0.093)	(0.016)
Country Dummies	YES	YES
Income Dummies	YES	YES
Observations	1,806	1,806
Pseudo R-squared	0.016	

**Notes: ****denotes 1% significance; * denotes 5% significance; + denotes 10% significance. Robust standard errors are reported in parentheses.

In the right column in Table 7 the average marginal effects are shown for predicted outcome 2, i.e. y=2. This means that only the marginal effects are shown on the probability to have a

product and a process innovation combined. Still, the independent variable *Education* has the only significant result. The magnitude of education in this model is 0.053 and the effect on product and process innovation combined is positive. This implies that on average, early stage entrepreneurs, who have at least a post-secondary education attainment, increases the probability of having a product and process innovation combined with 5,3 percentages points, ceteris paribus. This result is significant at the 5% significance level due to a p-value of 0.002. Therefore, the null-hypothesis of beta being equal to zero is rejected. Hence, this is in line with hypothesis 2a and 2b due to the positive coefficient. However, the other results of all the coefficients are not statistically significant and therefore not interpretable.

4.2.4 Robust tests

In order to see if the human capital has the same effect on innovation, some robust tests are examined. In Table 1 can be seen that there are different number of observations per country. Therefore, three logit regressions are examined to check for robustness of the countries. Only the countries with more than 100 observations are included. These countries are Spain, United Kingdom, Germany and Latvia. In the table below the marginal effects of all regressions are showed.

Table 8. Results robust test countries

Dependent Variable: Innovation			
	[1] Average Marginal effects Product innovation	[2] Average Marginal effects Process innovation	[3] Average Marginal effects Innovation combined
Network	-0.023	0.017	-0.002
	(0.032)	(0.030)	(0.021)
Education	0.062*	0.062*	0.050*
	(0.031)	(0.029)	(0.020)
Experience	0.066	0.040	0.045
	(0.048)	(0.045)	(0.037)
Opportunity	0.003	-0.021	-0.007
	(0.031)	(0.029)	(0.021)
Skills	0.017	0.124**	0.046+
	(0.054)	(0.047)	(0.028)
Age	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Gender	0.018	0.035	0.021
	(0.032)	(0.030)	(0.020)
Countries			
United Kingdom	0.058	-0.106**	-0.019
	(0.036)	(0.035)	(0.028)
Germany	0.038	-0.081+	-0.016
	(0.048)	(0.046)	(0.032)
Latvia	0.017	-0.200**	-0.063*
	(0.055)	(0.048)	(0.030)
Income Dummies	YES	YES	YES
Observations	1,095	1,095	1,095

**Notes: ****denotes 1% significance; * denotes 5% significance; + denotes 10% significance. Robust standard errors are reported in parentheses.

First, table 8 shows that only *Education* is significantly positively related to product innovation. The magnitude of the effect is 0.062 and is statistically significant at the 5% significance level due to a p-value of 0.031. This means that on average, early stage entrepreneurs, who have at least a post-secondary educational attainment, increases the probability of having a product innovation with 6,2 percentages point, ceteris paribus. This result is compared to early stage entrepreneurs, who do not have at least a post-secondary educational attainment.

Second, *Education* and *Skills* shows to be significantly positively related to *Process innovation*. The marginal effects show that entrepreneurs with a high education attainment 6,2 percentage points more likely to have a process innovation compared entrepreneurs with medium or low educational attainment, ceteris paribus. Furthermore, entrepreneurs who have skills required, increases the probability to have a process innovation with 12,4 percentage point, ceteris paribus. In addition, the probability to have a process innovation decreases significantly for entrepreneurs from United Kingdom and Latvia compared to entrepreneurs from Spain.

Finally, the third table shows that the independent variable *Education* has the only significant result on the probability to have a product and a process innovation combined. The magnitude of education in this model is 0.05 and the effect on product and process innovation combined is positive. This implies that on average, early stage entrepreneurs, who have at least a post-secondary education attainment, increases the probability of having a product and process innovation combined with 5,0 percentages points, ceteris paribus. This result is significant at the 5% significance level due to a p-value of 0.020. Furthermore, the variable skills is only significant interpretable at the 10% significance level. Taking into account this significance level, the probability to have a product and process innovation increases with 4,6 percentage points if the entrepreneurs have the skills compared to an entrepreneurs, who have not. In addition, the probability to have a product and process innovation decreases significantly for entrepreneurs from Latvia compared to entrepreneurs from Spain.

In addition, there is a logit regression examined to check for robustness of the significant variables in the t-tests. From the significant results of the t-tests, it can be derived that these results have a difference in mean for the ones that innovates compared to the individuals who do not innovates. Therefore, it is expected to find significant results in the regressions. These significant results can be found in Table 2 and Table 3. Table 2 only shows a significant difference for the groups of early stage entrepreneurs, who have a process innovation, compared to ones, who do not have a process innovation, for the variable *Education*. Furthermore, Table 3 shows significant differences in mean for *Education, Skills and Income* on the probability that an individual has a *Process innovation*. These two regressions are performed on the total sample of 1,806 early-stage entrepreneurs.

Table 9. Results robust tests significant variables t-test

Dependent Variable: Innovation		
	[1] Average Marginal effects Product Innovation	[2] Average Marginal effects Process Innovation
Education	0.062**	0.058**
	(0.024)	(0.023)
Skills		0.064+
		(0.039)
Gender		0.048*
		(0.024)
Income Dummies		YES
Observations	1,806	1,806

**Notes: ****denotes 1% significance; * denotes 5% significance; + denotes 10% significance. Robust standard errors in parentheses are reported in parentheses.

Table 9 shows that the magnitude of *Education* in the left model is 0.062 and significant at the 5% significance level. This implies that education attainment increases the probability with 6,2 percentage points to have a product innovation, if education is only included in the model.

In the right table, it can be derived that *Education* and *Gender* have a positive effect on the probability that individuals have a *Process innovation*. These results are significant at the 5% significance level. The marginal effects show that entrepreneurs with a high education attainment 5,8 percentage points more likely to have a process innovation compared entrepreneurs with medium or low educational attainment, ceteris paribus. Furthermore, being male increases the probability with 4,8 percentage points to have a process innovation compared to being female, ceteris paribus. Finally, the variable *Skills* is only significant interpretable at the 10% significance level. Taking into account this significance level, the probability to have a process innovation increases with 6,4 percentage points if the entrepreneurs have the skills compared to an entrepreneurs, who has not.

5. Discussion

In this chapter the results are analysed and discussed. First, the findings from this study are summarized. Each effect of the human capital indicators is separately discussed for both innovation measures. Consequently, explanations for the obtained results will be provided. Furthermore, the possible theoretical implications are discussed. Finally, the limitations of this study are listed and discussed.

5.1 Summary of the results

The results of this study fulfil the expectations beforehand in some extent. First, all human capital indicators have a positive effect on product innovation, except skills required to start up a new business. Although the results show positive effects on product innovation, the only significant result is the variable education. Table 5 shows that on average, early stage entrepreneurs, who have at least a post-secondary educational attainment, increases the probability of having a product innovation with 5,5 percentages point, ceteris paribus. In addition, the t-test shows only a significant difference in mean for education on the probability that an individual has a product innovation. Besides, the Spearman correlation shows a correlation of 0.062 with a significance level of 0.008 between education and product innovation. These results are in line with the hypothesis that educational attainment is positively correlated with product innovation among early stage entrepreneurs. Furthermore, the robustness checks of countries and of the significant variables in the t-tests, give no different results. The difference is that if education is only included in the model, the average marginal effect increase till 6,2 percentage point. This result also occurs when only the countries with more than 100 observations are included. In contrast to educational attainment, the other human capital indicators show insignificant results in the regression. Therefore, it is not possible to conclude that the human capital indicators have a relationship with product innovation. Hence, the other four hypotheses for product innovation are rejected.

Second, all the human capital indicators have a positive effect on process innovation, except opportunity based entrepreneurship. However, the only significant result is the variable education. Table 6 shows an average marginal effect of 0.070. This implies that on average, early stage entrepreneurs, who have at least a post-secondary education attainment, increases the probability of having a process innovation with 7,0 percentages points, ceteris

paribus. Hence, the only hypothesis that is in line with the expectations is that educational attainment is positively correlated with process innovation among early stage entrepreneurs. Hence, the other hypotheses are rejected. Although the other human capital indicators show no significant result in Table 6, the t-test of process innovation shows significant difference in mean for education, skills and gender on the probability that an individual has a process innovation. Due to these results, an extra regression is examined to check for robustness of the significant variables. Table 9 still shows that educational attainment is a significant human capital indicator on the probability of having a process innovation. This result also occurs when only the countries with more than 100 observations are included, see Table 8. In addition, Table 8 shows that skills required to start a new business is significant if only individuals from Spain, United Kingdom, Germany and Latvia are included. This implies that on average, early stage entrepreneurs, who have the skills required to start a new business, increases the probability to have a process innovation with 12,4 percentage point, ceteris paribus. Furthermore, if the significance level is magnified to the 10% significance level, skills required to start a new business is also significant in Table 9. This means that on average, early stage entrepreneurs, who have the skills required to start a new business, increases the probability to have a process innovation with 6,4 percentage point, ceteris paribus. Therefore, the hypothesis that skills required to start up a new venture is positively correlated with process innovation among early stage entrepreneurs is not rejected at the 10% significance level.

In addition to the regression for both types of innovation, an ordered regression is examined in order to measure the effect of the human capital indicators on product and process innovation combined. In line with the results from the first two regressions, the only significant average marginal effect is education. Table 7 shows that on average, early stage entrepreneurs, who have at least a post-secondary education attainment, increases the probability of having a product and process innovation combined with 5,3 percentages points, ceteris paribus. The other human capital indicators show insignificant results. The reason that skills required is no more significant at the 10% significance level is due to the fact that this effect is abolished because of the combined dependent variable. Besides, the average marginal effect is only 0.009.

5.2 Significant results

It can be derived that educational attainment is the only significant result at the 5% significance level from the regression performed. Regardless the insignificance of the other human capital indicator, educational attainment also shows the strongest relation with product and process innovation. That educational attainment has an effect on innovativeness counts not as a surprise. Individuals increase their knowledge and skills during their education, whereby the chance increases that they discover new possibilities. Thereby, the chance is also enhanced that these individuals know how to implement these possibilities. Also, according to the previous literature, higher educational attainment increases the probability to have a product innovation (Dakhli and de Clerq, 2004, Marvel and Lumpkin, 2007, Shipton, 2006).

The positive relation at the 10% significance level between skills required to start a new business and process innovation could be explained by the fact that skills are required to implement the process innovation successfully. Also, the positive Spearman correlation between skills and process innovation confirms this. In addition, this positive relation is also found by Acs and Audretsch (1988) and De Clerq and Arenius (2003). Furthermore, Hessels et al. (2014) found that nascent entrepreneur's skill variety in particular facilitates the establishment of innovative new business. Thereby, this positive relation also occurs when only individuals from Spain, United Kingdom, Germany and Latvia are included. However, skills required to start a new business is not significant at the 5% significance level with process innovation if all the countries are included. In addition, skills required are also not significant at any significance level with product innovation. This result can be explained by the fact that the skills required to start up a business are not the same skills to discover new opportunities. This also corresponds with the positive significant correlation between opportunity based entrepreneurship. It is possible that an early stage entrepreneur has much skills and experience in starting up a new business, but has not the creativity to start a new business with an innovative idea. Nevertheless, the correlation between skills and education shows a positive significant result, which implies an indirect effect of skills through education on process innovation. Besides, an early stage entrepreneur needs the skills to turn the knowledge and experience required during the education into innovative combinations and to implement them.

5.3 Insignificant results

The other three human capital indicators network, previous entrepreneurial experience and opportunity based entrepreneurship show insignificant results. An explanation for these insignificant results could be that the effects are too small to detect given the relatively small sample size. If the sample is too little, the standard error is large. If the sample is too little, the standard error is large. The Z-score of the human capital indicators is determined from the equation 'beta divided by the standard error'. The Z score corresponds with the P-value, which implies the significance level. This means that if the standard error is large, the significance level of all the coefficients decreases.

In addition, an explanation for these results can be caused by the measures themselves. For example, the measure *Experience.* This measure only includes the question if an individual has owned and shut down a business in the past 12 months. It does not include whether this experience is positive or negative. It could be that an individual has a negative experience with his previous innovative idea, whereby this individual has a bias to innovate again.

Furthermore, previous literature already shows that the network of entrepreneur depends on different aspects, such as the competencies of the manager himself (Freel, 2003). Although the individual has the knowledge and experience available of an existing entrepreneur, it could be that this network does not foster to innovate. It could be that this network is only convenient to start up a new business. The last is also found by the study of De Clerq and Arenius (2003).

The insignificant result of opportunity based entrepreneurship is in contrast with the thoughts of Koellinger and Thurik (2012). They say that individuals, who think there is a good opportunity, are pulled into entrepreneurship. They do not become entrepreneur through necessity, but through new ideas or new combination, which they want to exploit. However, the result of this study shows that not every innovative early stage entrepreneur is pulled into entrepreneurship. Furthermore, opportunity based entrepreneurship indicates that the individual thinks there is a good opportunity for starting a new business. Such a good idea however, does not necessarily mean that this is an innovative idea.

Finally, the insignificant result of experience is the biggest surprise of this study. This result is in contrast with the previous literature. Marvel and Lumpkin (2007) found that the number

of work experience has a significant positive relationship with innovation. In addition, Becker (1964) mentioned that experience creates more skills to use them. Besides, he stated that education, which shows a significant result, and experience are the most important indicators of human capital. Furthermore, Hessels et al. (2014) states that entrepreneurs with more varied work experience are more likely to introduce innovations that have not only technical, but also commercial value. Lastly, one should think that an individual foresee how to implement the innovation if the individual has the experience of starting a new business.

5.4 Policy implications

The potential policy implications are focused on the significant results from the regressions. The first implication for the European Union refers to educational attainment. From all the results education always has a positive relation with product and process innovation. This implies that a post-secondary educational attainment is positively related to innovation. Hence, the European Union has to focus on education attainment in the context of the policy of the Innovation Union. Individuals increase their knowledge and skills during their education, whereby the chance increases that they discover new possibilities. This leads to innovations, which results in securing our future standard of living.

The second implication refers to skills required to start up a business. From the results, it shows that an early stage entrepreneur, who has the knowledge, skill and experience to start up a new business is positive related to process innovation. Therefore, the Innovation Union has to focus on the knowledge due to education. Furthermore, skills and experience can only occur when individuals already have started a business or through seminars. Hence, the policy must be focused on entrepreneurial education, where potential early stage entrepreneurs require the skills to implement a new innovative business. The motivation for this implication is that these skills lower the entry barriers to start a new business. In addition, the early stage entrepreneur is more likely to do this with a process innovation.

It is important to take into consideration that these implications are not completely clear due to possible limitations. In addition, future research is needed to state that these implications have the desired effect and that these are the only ones.

5.5 Limitations

During this study, several limitations arise. Therefore, the results of this study must be treated carefully and more research on this topic needs to be done to make clear policies for countries or for the EU as whole.

First, the dataset only contains observations from the year 2009. Hereby, no differences over time are included due to the cross sectional dataset. This kind of dataset refers to data collected with many observations at the same point of time. Instead of using cross sectional dataset, it might add value to repeat the same study with a panel dataset to examine the correlation over a longer time frame. However, it is common to use a cross sectional dataset to compare differences among subjects. This study compares the relationship of human capital and innovation among early stage entrepreneurs. Thence, this dataset is suitable for this study, because this study compares innovators against non-innovators. Besides, the early stage entrepreneurs are involved setting up a business or just have started one. Therefore is it plausible that the answers about human capital and innovation will not differ over time. In addition, there is no panel data available at the moment and the GEM dataset is considered as one of the most value datasets about entrepreneurship.

Second, the GEM dataset is self-reported data, which might cause a bias. This kind of data can have validity problems. Respondents might answer questions to maximize or minimize their problem. If the respondent is asked to say whether he has the knowledge, skill and experience to start a new business, there is no interviewer who can interfere and ask whether this answer is really true. In other words, the response provides an answer about his self-perceived skills which might be different in case other individuals would answer this question for him. An example for this is that men often think they are really good auto-drivers. However, a lot of them also cause car accidents.

Third, the dataset does not contain all European Countries. This study is focused on the 27 countries, which together represent the European Union. However, the dataset only includes 18 countries. Some important countries, like France and Portugal, are not included. Although the missing countries are included in the GEM dataset, these countries have no observations of early stage entrepreneurs. This is caused by the fact that no data is present of early stage entrepreneurs in these countries. Due to this limitation there might be specific

dynamics from the not included countries missing, resulting in a different magnitude of correlation between the human capital indicators and both innovation measures.

Finally, this analysis includes five human capital variables and two innovation measures. Although these variables are chosen according to existing literature, there could be other human capital indicators that are important in explaining the probability to have a product or process innovation. This limitation also counts for the control variables. Controlling for more possibly indicators, which influence the probability to have an innovation, will improve the analysis. In the next chapter one can find examples of these possible human capital and control variables.

6. Conclusion

This study examines the effect of human capital on innovation among early stage entrepreneurs. More specifically, the indicators of human capital are network, education, experience, opportunity based entrepreneurship and skills required to start up a business. In addition, for innovation there is a distinction between product and process innovation. Product innovation is used to characterize new or improved goods and services, whereas process innovation is equivalent to improvements in the ways to produce these good and services. From previous literature, it was expected that all the human capital indicators have a positive effect on both measures of innovation. The sample that is used is constructed from the GEM in 2009. It contains data from 18 countries from the European Union. The total number of observation is 1,806. The individuals from the sample are all early stage entrepreneurs. This group consist of two kind of entrepreneurs, namely the nascent entrepreneurs, who are involved in setting up a business, and the owners or managers of a new business up to 42 months or less.

It can be concluded that human capital is a determinant of innovation among early stage entrepreneurs. First, all the human capital indicators have a positive effect on product innovation, except skills required to start up a new business. Second, all the human capital indicators have a positive effect on process innovation, except opportunity based entrepreneurship. However, the results only show that educational attainment has a positive significant result at the 5% significance level on the probability of having an innovation. This result is obtained for both measures of innovation. The other human capital indicators are not significant at the 5% significance level. Although all the other results are not significant at the 5% significance level, skills required to start a new business has a positive relation with process innovation at the 10% significance level. This positive relation also occurs when only the countries with more than 100 observations are included.

Furthermore, potential policy implications for the Innovation Union should be focused on post-secondary educational attainment and skills required to start up a business. By means of post-secondary educational attainment and seminars focused on entrepreneurship, the probability an early stage entrepreneur will start a new innovative business increases. Individuals increase their knowledge and skills during their education, whereby the chance increases that they discover new possibilities. In addition, the possession of these skills

reduces the entry barriers to start a new business for early stage entrepreneurs, whereby they are more likely to start with an innovation. These innovations will result in securing our future standard of living where Europe is competitive and has the capacity to create new jobs.

This study shows that human capital is a determinant of innovation among early stage entrepreneurs. However, the analyses only supports that educational attainment has a significant effect on innovation. In order to find support that all the indicators have a significant effect, future research is needed. One of the most important aspects for future research refers to the possible small number of observations. These observations can be increased by adding all the 27 European countries or more observations from the included countries. In addition, future research should broaden this study by adding more indicators of human capital or control variables. For example, a variable which measures whether the parents of the individual are entrepreneurs. If the parents of an individual are entrepreneurs, the probability might increases that this individual also wants to become an innovative entrepreneur. For the control variable one can think of the income and the education of the parents.

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