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Exploring the characteristics of Knowledge-Based Entrepreneurship in Greek high-technology sectors

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Abstract

Knowledge-Based Entrepreneurship (KBE) is a very important socio-economic phenomenon that drives innovation, economic growth and development (Groen, 2005). This kind of entrepreneurship is characterized by high potential for technology upgrading. Moreover, KBE is an effective mechanism for the transformation of knowledge into innovation and new economic activity (Carlsson et al., 2007).

The present paper focuses on the Greek knowledge based enterprises, their innovative performance and growth. Assuming that KBE is a high-potential entrepreneurship, we study different factors which shape this type of entrepreneurship as it may represent a new source of development for the Greek economy. More specifically, we are interested in the skills and the educational attainment of employees, the main areas of expertise of founders, and their incentives to create new ventures, the way they perceive risk and take advantage of new technological and business opportunities. We also explore the sources of knowledge and the strategic choices of firms as well as the factors of the business environment which affect the quality and innovativeness of their products or services. Therefore, this research focuses on both the founder or the founding team as well as on the overall operations of the firms.

Furthermore, we develop a typology of knowledge based companies based on their various characteristics. Finally, we explore how these characteristics affect the performance of firms which in turn can generate economic growth, especially in the crisis period.

Analysis is based on a structured questionnaire circulated to a representative sample of new firms that have been established between 2000 and 2010 and belong to various high-technology sectors. The examined sectors have been classified according to the EC - NACE Rev. 1.1 in three groups: (1) high-technology manufacturing, (2) medium-high-technology manufacturing and (3) high-technology knowledge-intensive services. All composite variables used in the analysis were constructed following confirmatory factor analysis, and for the classification of the firms into groups we use analysis of variance and cluster analysis.

KBE perspective in exploring innovativeness and growth of newly established Greek firms, we derive useful conclusions for both the management of firms as well as for the public policies to promote innovation and entrepreneurship in

general.

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high-technology sectors¹**

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¹ This is part of my broader PhD study entitled: “Innovation and Knowledge-Based Entrepreneurship in high-technology sectors”, supervised by Professor Yannis Caloghirou.

Abstract

The present paper focuses on the Greek knowledge based enterprises, their innovative performance and growth. Assuming that KBE is a high-potential entrepreneurship, we study different factors which shape this type of entrepreneurship as it may represent a new source of development for the Greek economy. More specifically, we are interested in the educational attainment of founders and employees, the main areas of expertise of founders and the factors influencing the creation of new ventures. We also explore the sources of knowledge for the exploration of new business opportunities and the importance of networking in different firm operations. Therefore, this research focuses on both the founder or the founding team as well as on the overall operations of the firms.

Analysis is based on a structured questionnaire circulated to a representative sample of new firms that have been established between 2000 and 2010 and belong to various high-technology sectors. The examined sectors have been classified according to the EC - NACE Rev. 1.1 in three groups: (1) high-technology manufacturing, (2) medium-high-technology manufacturing and (3) high-technology knowledge-intensive services. To understand the exploitation differences on sources of knowledge and the networking among the founders, depending on their educational background, we performed analysis of variance.

KBE perspective in exploring innovativeness and growth of newly established Greek firms, we derive useful conclusions for both the management of firms as well as for the public policies to promote innovation and entrepreneurship in general.

1. Introduction

Knowledge-Based Entrepreneurship (KBE) is a very important socio-economic phenomenon that drives innovation, economic growth and development (Groen, 2005). This kind of entrepreneurship is characterized by high potential for technology upgrading. Moreover, KBE is an effective mechanism for the transformation of knowledge into innovation and new economic activity (Carlsson *et al.*, 2007).

Many scholars argue that a better term for “Knowledge-Based Entrepreneurship” would be “Innovative Entrepreneurship”, because this type of entrepreneurship involves the development and diffusion of product innovations or process innovations (e.g. Radosevic *et al.*, 2010).

Additionally, KBE can be embedded in diverse sectors – including traditional and high-technology sectors, manufacturing and services, existing and new industries. They are new, innovative and high knowledge intensity firms, which are involved in a process that translates knowledge into innovation.

This study examines the basic aspects of KBE, namely knowledge intensity and innovative performance. More specifically, it investigates the link between the educational background of the founders and the sources of knowledge of firms for exploring business opportunities as well as the role of networks in different firm operations.

We hypothesize that when a firm has at least one founder with a very high educational level then it's connected to specific sources of knowledge like in house Research and Development (R&D), universities and research institutes, scientific journals and research programmes. The educational background of founders also affects the networking in different firm operations. The main facilitators of networking are quite different between the founders who have completed only elementary or secondary education with those who have PhD or Master's degree.

2. Theoretical Aspects

Innovation

Innovation is not a new phenomenon. We can say that it is as old as humanity (Fagerberg, 2005). It's inherent in human nature looking for new ways to do things and getting them better by testing them in practice. The world would be completely different without the major innovations of recent past, such as airplanes, automobiles and telecommunications.

It is clear that all forms of innovation have a positive influence on the overall profitability of companies and thus economies. According to Chris Freeman, a prominent figure of theoretical innovation, the lack of innovation is equivalent to death. The necessary condition then, for the long term growth of the business activity in an advanced industrial country, is its ability to continuously produce innovative products.

To assume that innovation is equivalent “novelty” is quite a general hypothesis. Innovation related to new creations of economic and societal significance is mainly carried out by firms. These new creations can be divided into new products and new processes. Products are material goods and intangible services. The processes are organizational, technological or marketing ones.

OECD and Eurostat define innovation as: “the implementation of a new or significantly improved product (good or service) or process, a new marketing method or a new organisational method in business practices, workplace organisation or external relations” (OECD, 2005: 46). The four types of innovation identified in the Oslo Manual for measuring innovation are: product innovation, process innovation, marketing innovation and organizational innovation.

Innovation is an integral component of entrepreneurship and can be considered as a tool of the entrepreneur in order to gain business advantage over competitors. This follows from the theories developed by several important scholars, linking innovation with entrepreneurship. Some of these theories are presented in the following section.

Entrepreneurship and Innovation

Jean-Baptiste Say, a French economist who first coined the term entrepreneur in about 1800, defines the entrepreneur as a person who shifts economic resources out of an area of lower into an area of higher productivity and greater yield. For Peter Drucker innovation is the “special” tool of the entrepreneur. It is the means by which he / she exploits change as an opportunity for a different business or a different service (Drucker, 1985). However, the clearest connection between innovation and entrepreneurship goes back to the early work of Joseph Schumpeter. According to Schumpeter (1934): “The role of business is to reshape and transform the ways and methods of production by exploiting an invention or, more generally, using an untested in practice, technological ability to produce a new product or an older generation in a new way, opening up a new source of supply of materials or a new

outlet for products, by reorganizing a new type of industrialization”. The activity of individual innovative entrepreneurs leads to the so-called creative destruction, which is identified by Schumpeter as follows:

1. The introduction of a new good (or a significant improvement in the quality of a product that already exists).
2. The introduction of a new method of production (i.e. process innovation).
3. The creation of a new market (particularly an export market into new territories).
4. The conquest of a new source of supply of raw materials or semi-finished goods.
5. The creation of a new form of industrial organization (i.e. organizational innovation).

The development and the introduction of new technologies offer opportunities for KBE.

Sexton & Smilor (1986) indicate that entrepreneurs face a number of challenges in trying to implement new ideas and solve problems. Looking at one's intensity of entrepreneurship over the years, they observed that entrepreneurial activity is more pronounced during periods of economic, social or political upheaval (Morrison, 2000). This can be justified to some extent by the fact that methods of business development are no longer effective, and ultimately surviving ones do different things or the same things differently.

Innovation at the enterprise level can result either from the exploitation of research results or the exploitation of knowledge that emerges from its environment. Cohen & Levinthal (1990) dealt with the second aspect of innovation and defined the term “absorption capacity”. Rosenberg (1990) based on the work of American economists Arrow and Nelson on 50’s, explains the reasons why companies engage in basic or applied research, and notes that firms can have a special department that connects to the research carried out in universities. This connection is very important when one considers that despite the registration of intellectual property rights and patents, a company cannot fully exploit the results of research (“knowledge market” is economical incomplete). According to Shane (2000), the acquisition of new knowledge and the development of business opportunities depend on prior knowledge of an individual or an organization. Although, today there is dominant view of free access to knowledge, this phenomenon often leads to what economists call the “free rider problem”. That is done using goods and services without payment of a fee (such

as the stowaway is not paying ticket on public transport used). Respectively, these companies do not invest in research but they can reap the benefits without any charge. As mentioned above, Cohen & Levinthal developed the concept of absorption capacity considering the company as an independent entity, and its ability to absorb knowledge depending on: a) prior knowledge and b) the range of activities. Going one step further, we can highlight the investment continuity that the internal R&D department of a company must have, as the assimilation process depends on its past (path-dependent process) and prior knowledge, and gaps intervals to hold back the rehabilitation. Also, another important parameter that affects the assimilation process is the diversity of knowledge that the company has. The greater the diversity of knowledge the better the absorption capacity of innovation. Finally, given the holistic nature of absorptive capacity, it is worth mentioning that the communication between the different parts of the enterprise directly affects. The ability stems from inside the company and its strategy.

Zahra & George (2002) add the meaning of the learning process in the absorption capacity of knowledge. The absorption capacity is analyzed in two parts: 1) the potential absorption capacity, which is the reception of knowledge from the environment and 2) the realized absorptive capacity, which is the percentage of external knowledge transformed into innovations and products from the company. The relationship of these two complementary forms of absorption capacity expresses the efficiency of the firm. This efficiency depends on the acumen of the people or the teams of companies. However, the same knowledge can be used with a unique way by different people or teams.

Finally, a significant piece of literature of entrepreneurship refers to the innovation management, which directly related to the KBE. The management model of innovation varies with the type of business and its main activity. Generally, in those companies where innovation is not commercially demanding, the discovery of an innovation will lead to the development of corresponding products. However, when innovations are more complex then it is the responsibility of the entire company to be able to utilize the research results of the R&D department, making the necessary market research etc. Therefore, the innovation management is essential in companies that support their activities for the exploitation of new technologies (Trott, 2002).

Defining Knowledge-Based Entrepreneurship

Any form of entrepreneurship is based on the exploitation of some kind of knowledge, even when it comes to arbitrage² opportunities. KBE is a special form of entrepreneurship: it's linked to the so-called knowledge economy, which is characterized by the crucial role of information and communication technologies (ICT), the high proportion of knowledge-intensive activities, the growing ratio of intangible to tangible assets on corporate balance sheets, and the increased expenditures on R&D (Stam & Garnsey, 2008; Foray, 2004). KBE is also related to activities where the role of creating of new knowledge is central to value creation (KEINS, 2006). It focuses on realization of opportunities meant to improve the production and throughput of knowledge, rather than to maximize monetary profit. Wikipedia described KBE as the ability to recognize or create an opportunity and take action aimed at realizing the innovative knowledge practice or product.

Starting from a broad definition for entrepreneurship and incorporating into this the concept of knowledge, we define entrepreneurship as the process of creating something new with value by devoting the necessary time and effort in knowledge-intensive economic activities, taking economic, psychological and social risks, and taking as reward the financial and personal satisfaction and independence (Hisrich *et al.*, 2005; Bosma, 2010). This definition is based on three key characteristics of entrepreneurship. First, the process of creation, and even the process of creating something new that has value for both the entrepreneur himself and for the consumers. Second, the time and effort required to create something new, which must also be functional. The total time and effort is appreciated only by those involved in the business process. Finally, the third important aspect of entrepreneurship that stands out from the above definition is to assess the risks involved in obtaining the expected benefits. To study the phenomenon of KBE is important to take into account mainly the first of three key aspects of entrepreneurship.

In the context of this paper will adopt some basic characteristics for the KBE, provided by Malerba & McKelvey (2010). KBE is linked to:

- New firms.
- Innovative firms.

² Arbitrage is an investment opportunity that brings profit without risk (source: Wikipedia, <http://en.wikipedia.org/wiki/Arbitrage>).

- Firms which have a significant knowledge-intensive in their activities.
- Firms that exploit innovative opportunities not only in high-technology sectors but in diverse sectors.

Therefore, KBE is not only related to new firms (start-ups) as in the Global Entrepreneurship Monitor (GEM). KBE is referring to new and innovative firms with high knowledge intensity in their activities, involved in a process of transforming knowledge into innovation. These firms transform knowledge into new or significantly improved goods and services that may enter in market. They are also companies that exploit innovative opportunities in various sectors and achieve, through their strategy, a sustainable competitive advantage.

Another distinction can be made between KBE and new technology based firms (NTBFs). The literature on NTBFs is quite rich and mainly focuses on the technical resources (scientific, engineering) of firms, while the literature of KBE refers to the transformation of scientific and technological resources into economic value. Autio (1997) categorizes NTBFs into two groups: a) companies based on science, that those companies which exploit the results of scientific research in converting basic technologies or applications of specific technologies, and developing complex products and services for wider purposes, and b) companies that are based on analysis processes and systems and apply core technologies to develop products and services according to the specific needs of customers. The difference between these two types of companies and knowledge-intensive firms lies in the effect of the process of transformation of knowledge (scientific and technological) into innovation. For the NTBFs a radical innovation is the successful completion of the innovation process, while for KBE requires the successful commercialization of innovation and the acceptance by the market. Therefore, the resources required for this purpose, such as technological resources, is just one piece of the innovation process.

The concept of innovative opportunities is central to KBE. Holmen *et al.* (2007) define the innovative opportunity as the probability of a perceived economic value that exists in a new combination of resources and market needs, resulting from changes in scientific or technological knowledge base, customer preferences and relationships between economic players. The innovative opportunities consist of aspects of scientific and technological knowledge required in each specific market. It is a complex term that includes business, technological and productive opportunities.

In our conceptual approach contained the concept of innovation, which is more than a technology already known or a personal perception or an internal set of resources in a firm. The firm must combine all these elements depending on the characteristics of its sector, for understanding and exploiting of an opportunity. Therefore, the information must include an innovative opportunity in order to players exploit an idea are:

- A perceived economic value for someone.
- A perceived possibility that the resources needed to seize the opportunity can be mobilized.
- A perceived possibility that at least a part of economic value can be appropriated by the player seeking opportunity.

The activity sectors of KBEs are not limited only to high-technology sectors but also in traditional industries and sectors that are either existing or new. Their business models depend on the knowledge required to exploit innovation opportunities and the creation of value and growth at the enterprise level. Therefore, the definition of KBE connects firms with knowledge economy, as a mechanism that turns knowledge into innovation (and further into development). So, innovation can happen in any sector no matter how “traditional” it may be. For example, von Tunzelmann & Yoruk (2004) consider that the food industry is currently undergoing a transformation from low-technology sector to medium-tech sector or even to high-technology sector. For the purposes of this research we will focus on firms operating in high-technology sectors, which are considered as the pioneers sectors of the economy in terms of innovation.

3. Methodology

Sampling and Data Collection

During 2012 we administrated an extensive structured questionnaire to the owners / founders of 1162 young Greek firms. The data for these firms were compiled from two data sources: (1) Hellastat, a private financial and business information services company and (2) Amadeus, a Pan-European financial database.

The questionnaire was divided into four parts providing information on: (a) the founder or the founding team, (b) information the strategy of the firm, (c) the innovation and (d) growth of the firm. The questions were generally formulated as closed questions using a five-point ordinal Likert-type scale or closed-ended questions

to be answered by two or more options or by stating a value. The questionnaire was made accessible over the internet, and respondents were sent a direct link by e-mail. The criteria for firm selection in the original sample were the year establishment and the industry classification. Our sample consists of firms that are new by definition, i.e. ventures that have been established between 2000 and 2010. Furthermore, the selected operate in the following sectors: (1) high-technology manufacturing, (2) medium-high-technology manufacturing and (3) high-technology knowledge-intensive services (Table 1).

Table 1: Selected sectors

Manufacturing industries	NACE Rev 1.1 codes
High-Technology (HT)	24.4 Manufacture of pharmaceuticals, medicinal chemicals and botanical products; 30 Manufacture of office machinery and computers; 32 Manufacture of radio, television and communication equipment and apparatus; 33 Manufacture of medical, precision and optical instruments, watches and clocks; 35.3 Manufacture of aircraft and spacecraft
Medium-High-Technology (MHT)	24 Manufacture of chemicals and chemical product, <u>excluding 24.4</u> Manufacture of pharmaceuticals, medicinal chemicals and botanical products; 29 Manufacture of machinery and equipment n.e.c.; 31 Manufacture of electrical machinery and apparatus n.e.c.; 34 Manufacture of motor vehicles, trailers and semi-trailers; 35 Manufacture of other transport equipment, <u>excluding 35.1</u> Building and repairing of ships and boats and <u>excluding 35.3</u> Manufacture of aircraft and spacecraft
High-Tech KIS (HT KIS)	64 Post and telecommunications; 72 Computer and related activities; 73 Research and development

After an e-mail message and a follow-up call 209 complete questionnaires were returned. The sectoral distribution of the sample is presented in the following table:

Table 2: Description of sample

Sector	All firms	Sample
HT	71 (6,1%)	14 (6,7%)
MHT	371 (31,9%)	67 (32,1%)
HT KIS	720 (62%)	128 (61,2%)
TOTAL	1162	209

Year of establishment

One of the criteria for the firm selection was the year of establishment. The firms of our sample are new ventures that were established during the period 2000-2010. In Figure 1 it is illustrated the year of establishment of the firms which responded to the questionnaire:

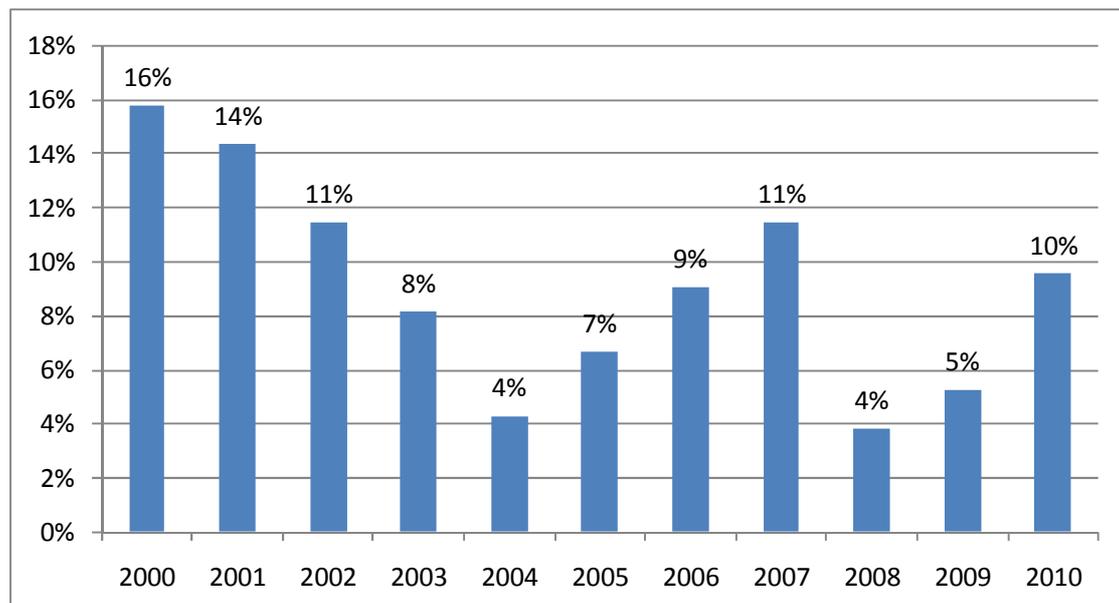


Figure 1: Year of establishment

The majority of them (69%) were set up during the period 2000-2006. In this time frame there was a strong momentum for the high-technology sectors in Greece (IOBE, 2008). Several firms also created amid the financial crisis period, i.e. after

2008 (19%). There are no statistically significant differences between sectors with respect to year of establishment³.

Variables

As noted above, we are interested in examining how the educational background of founders affects the sources of knowledge and the networking in different firm operations. The required indicators are related to the knowledge both the founder and the company.

Knowledge of founders is measured by two variables:

Educational attainment of founders: We measure educational attainment using an ordinal variable which takes the following values: 1 – Elementary / Secondary education; 2 – Bachelor degree; 3 – PhD / Master. If there is a founding team, then we derive the highest educational attainment at all members of each founding team.

Main areas of expertise of founders: We measure the main areas of expertise for each founder (i.e. technical / engineering knowledge, marketing, general management and other).

The following set of variables measure the firm's knowledge and networking. Knowledge intensity is gauged using a Likert-type scale (1: Not important; 5: Extremely important) that asks respondents to assess the role of specific sources of knowledge for the exploration of new business opportunities.

The sources of knowledge are either **internal** (In-house R&D) or **external** associated with the **value chain** (clients, suppliers and competitors), the **science and research** community (universities, research institutes, research programmes and scientific journals), several **open sources** (exhibitions and conferences, internet) or **collaborative R&D** (strategic alliances).

We asked respondents to indicate the significance (1: No impact; 5: Huge impact) of networking in different types of operations and activities (single items):

- Recruiting skilled labor
- Collecting information about competitors
- Accessing distribution channels
- Attracting funds

³ An ANOVA test of significance shows that differences between sectors regarding year of establishment are statistically non-significant (ANOVA F=0.712, Sig=0.492).

- Marketing and promotion
- Exploring new technology opportunities
- Developing new products or services
- Understanding of customer needs
- Managing production and operations
- Arranging taxation and other legal issues
- Exploring export opportunities

4. Empirical results

Figures 2 and 3 report the descriptive statistics for the size of firms and the size of founding teams respectively. The empirical results presented below are connected with two key features of KBE that are mentioned above: knowledge and innovation. We will first examine the educational background of founders. However, since most of the firms were set up by a founding team and not a founder, it is appropriate to find the highest educational attainment of founder/s in each firm.

We also examine the main areas of founder expertise and the factors influencing the firm creation. Furthermore, we investigate the educational level of human capital. Then we will see the answers we got regarding the innovative performance of firms. The questions to be dealt with are: a) what percentages of firms innovate? b) Innovation derived from? c) Innovation is new for whom? We still try to see how the background of founders is related to the sources of knowledge of firms and to networks which each firm develops.

Size of firms

The vast majority (93%) of firms are microenterprises and small firms. More specifically, microenterprises (1-9 employees) account for 52% of the sample and small firms (10-49 employees) represent 41% of the sample. 7% of the firms employ 50-249 employees.

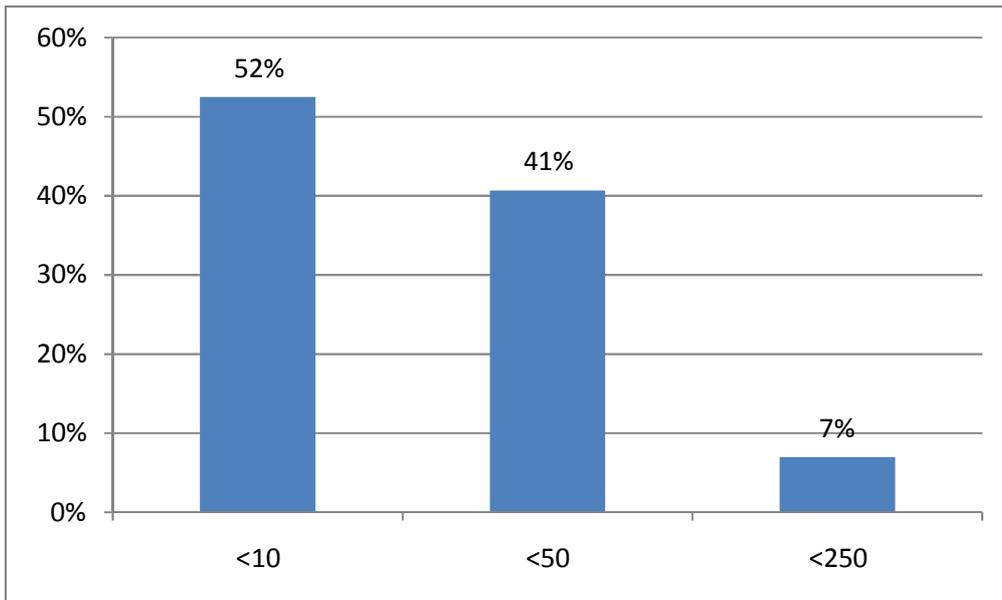


Figure 2: Number of employees

Size of founding teams

Firms usually have a founding team of 2 or 3 members and only 24% have only one founder. A large share of firms (40%) has 2 founders, 21% have 3 founders, and only 16% of firms have 4 or more founders.

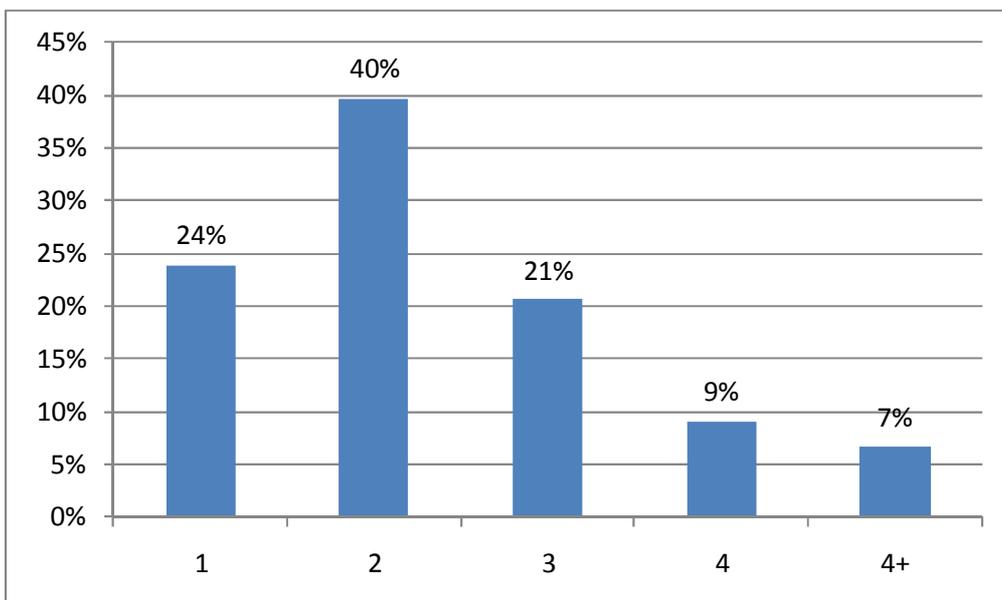


Figure 3: Number of founders

Educational attainment of founders

The educational level of founders appears to be very high. This is demonstrated by the fact that 28.1% of them have a master's degree and 10.1% a PhD. 49.7% have a bachelor or an equivalent degree. Only 4.9% of the founders have completed only elementary or secondary education and 7.2% have completed only vocational education.

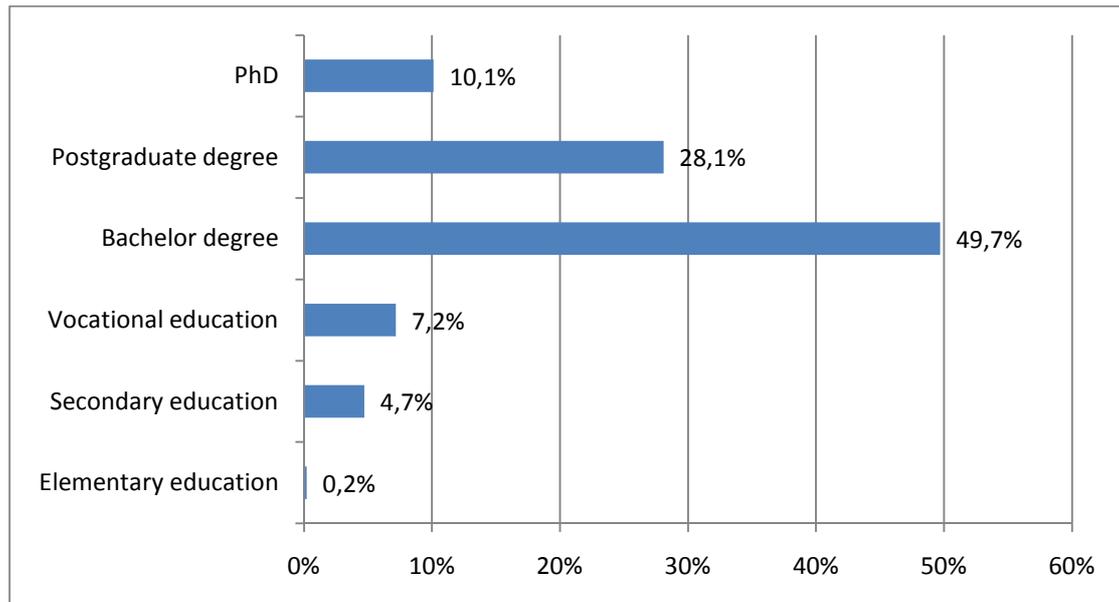


Figure 4: Educational attainment of all founders

Figure 5 presents the results about the highest educational attainment of founders in each firm. 8 out of 10 of all companies have founders (or at least one founder in the founding team) holding at least a University degree. 48% of the firms have at least one founder with postgraduate studies. Bachelor degree or equivalent is the founders' highest degree for the 31% of the firms. Finally, a very small number of companies, about 9%, have founders who completed only elementary, secondary or vocational education. Therefore, most firms have founders with a strong educational background.

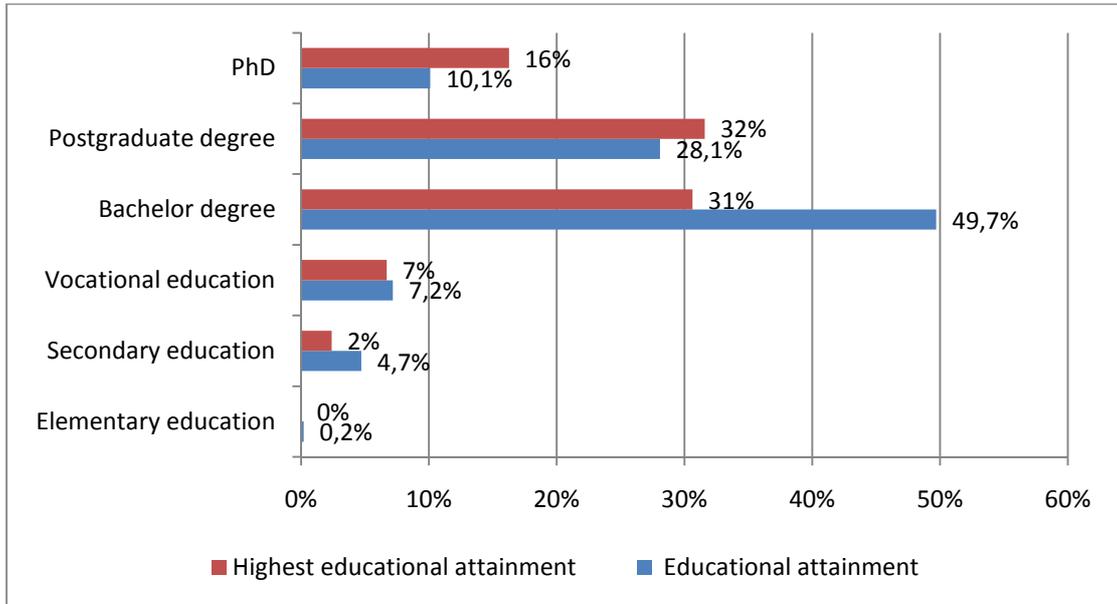


Figure 5: Highest educational attainment of founder in the firm

Main areas of founders' expertise

Figure 6 presents the results concerning the main areas of founders' expertise. Respondents indicated the two most important areas of knowledge and skills that better reflect their professional identity. Most founders (56%) gave as the first choice the technical and engineering knowledge and as the second choice the general management (27%). Therefore the dipole "technical and engineering-general management" reflects better the main areas of expertise of most founders.

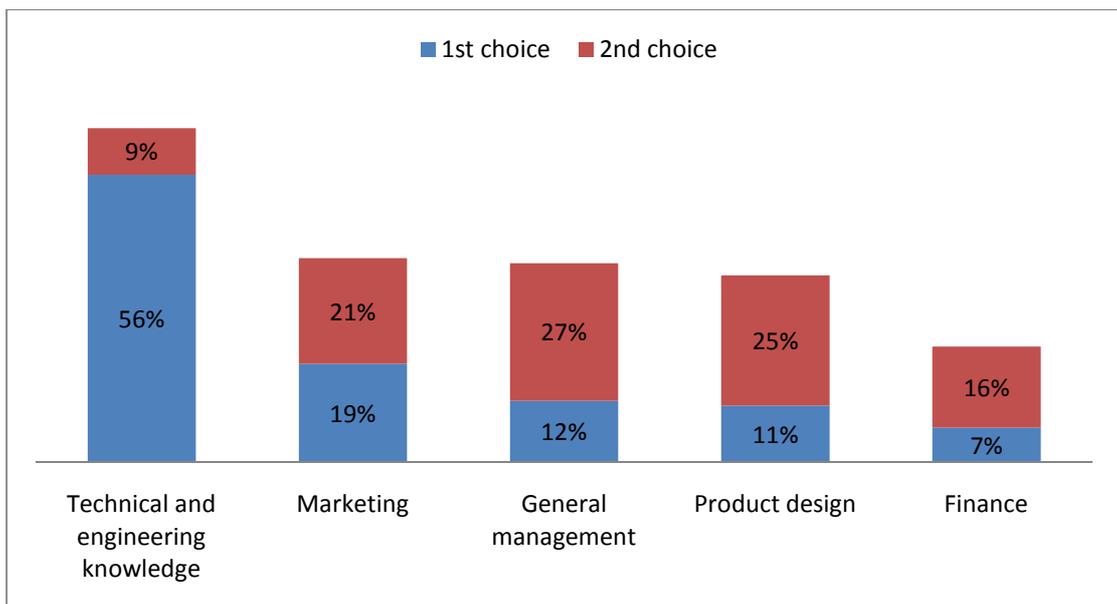


Figure 6: Main areas of expertise of founders

Educational attainment of employees

The educational level of employees is high. 1 out of 2 of employees holds a bachelor degree. 18% of employees have a master's degree and 4% a PhD. 27% of employees have less educational level. In more details, 14% of employees have completed the vocational education, 12% have completed the secondary education and only 1% has completed the elementary education.

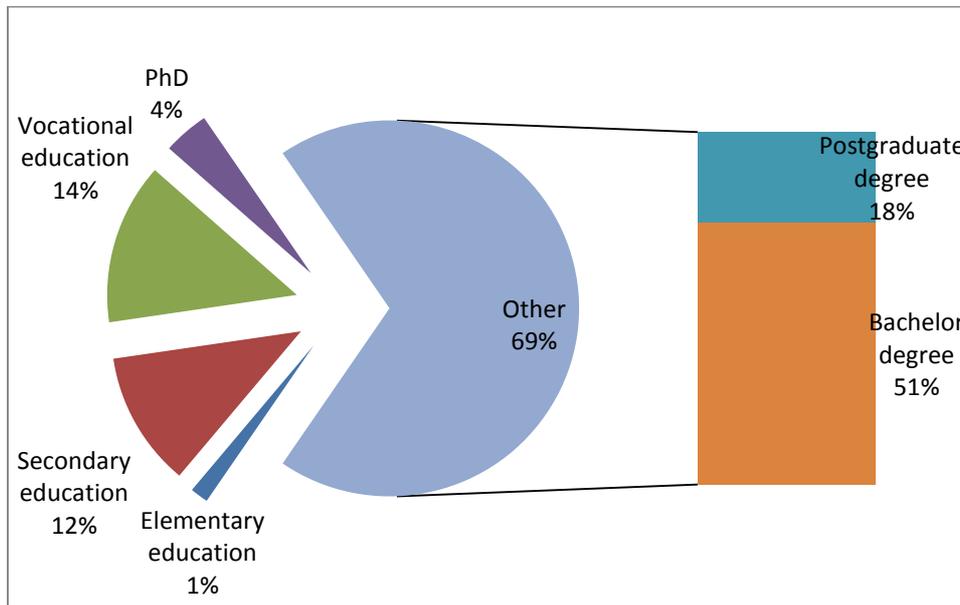


Figure 7: Educational attainment of employees

Factors influencing firm formation

Figure 8 shows the factors influencing the creation of new ventures. The red bar pictures the same factors for the period after the year 2008. The year 2008 is very crucial for the Greek economy because then appeared the first signs of economic crisis. Therefore, it's important to examine the same factors affecting the firm formation for the period 2008-2010.

The most important factor for the firm creation is the opportunity from a new market need and follows the market knowledge. These two factors appear to be of the same important for the period after 2008. Next are the work experience in the current activity field and the expectation for revenue growth.

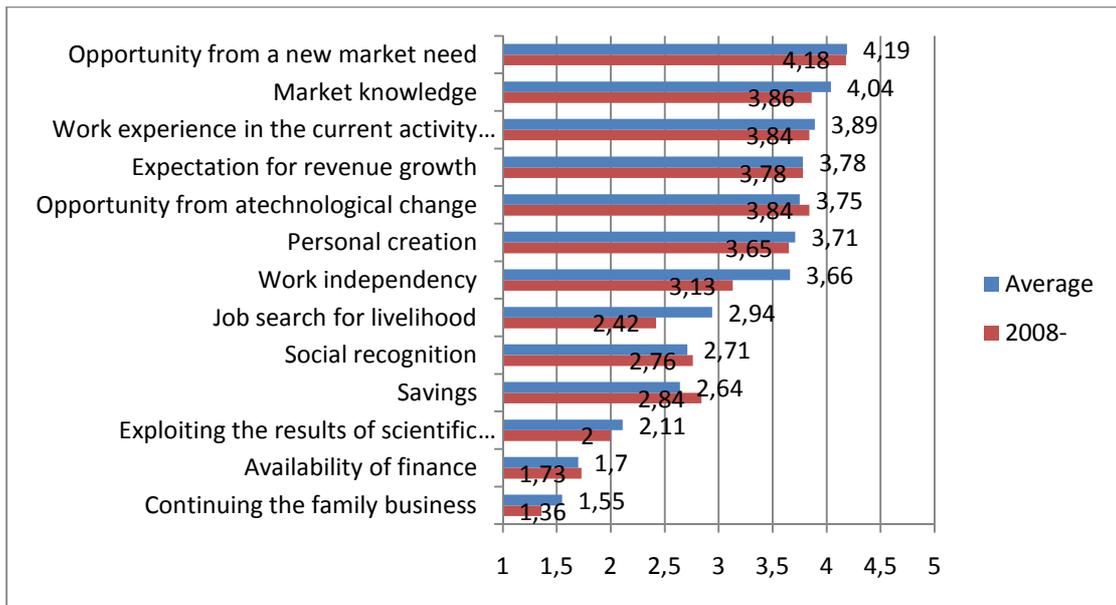


Figure 8: Factors influencing firm formation

Innovation performance of firms

We begin our discussion about the innovative performance of the sampled firms by presenting the type of innovation which firms introduced the past three years. As shown in the following figure, 6 out of 10 firms have introduced some kind of innovation during the last three years. More specifically, 52% of the firms have introduced improved or new products/services into the market and 29% of the firms have introduced some kind of process innovation. There is also a 20% of the firms that have introduced both product and process innovation.

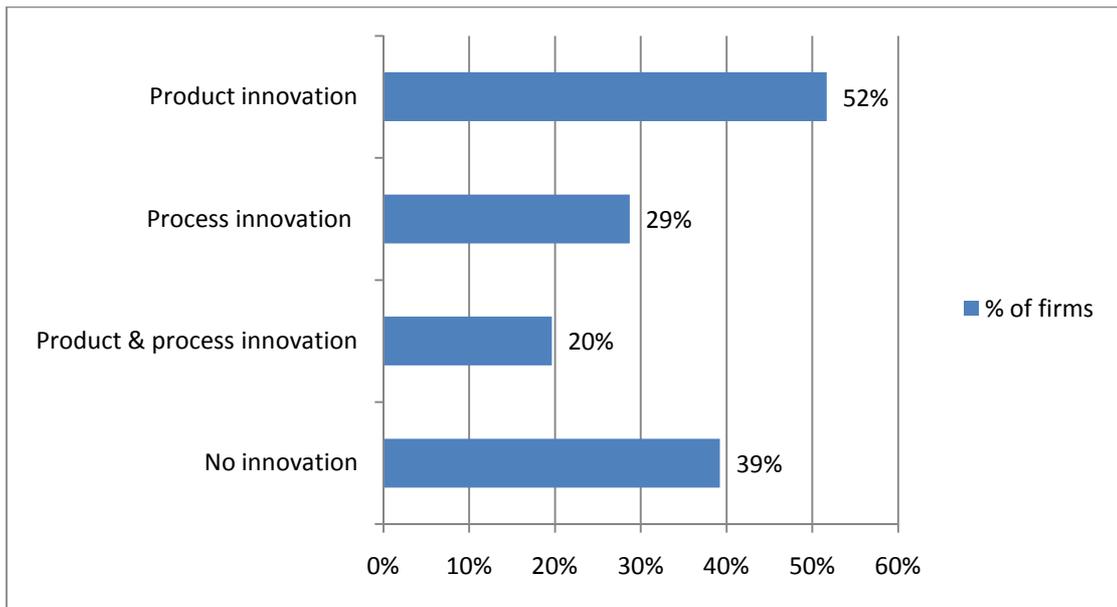


Figure 9: Innovative performance during the past three years

Next we consider the way in which this innovation derived. Most (41%) of the firms stated that their innovation derives from exploitation of R&D activities. Furthermore, there is a high percentage (31%) of firms which introduced or adapted technology from abroad. Less (28%) are those firms that exploited their business practices for the introduction of innovation and those which imported goods from abroad (20%).

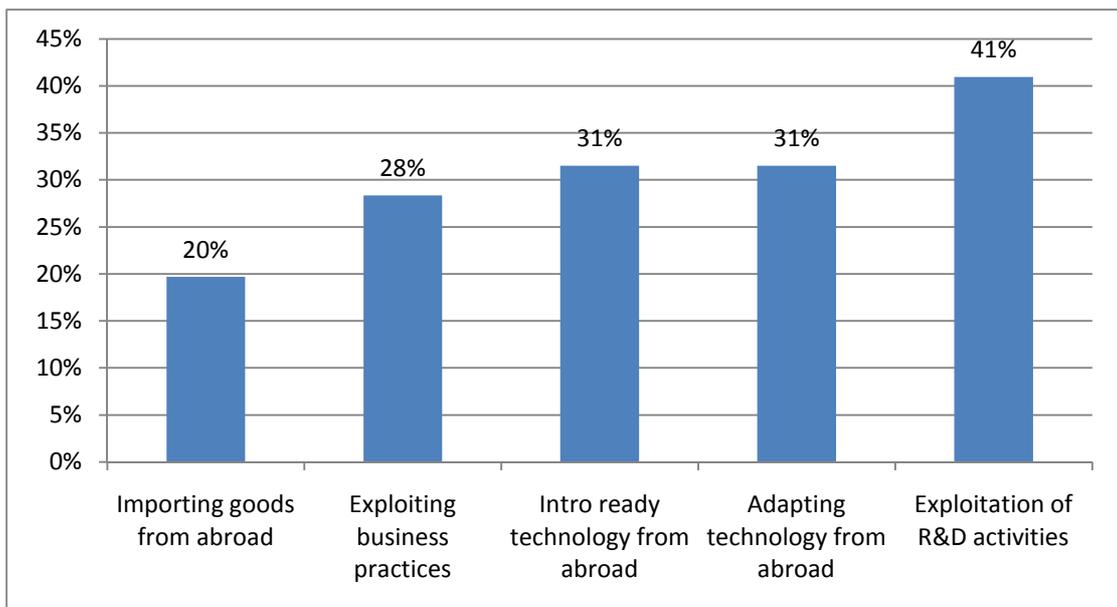


Figure 10: Innovation derived from?

The last figure shows if these innovations are new to the firm, new to the market or new to the world. As we see, the majority (44%) of firms have introduced some kind of innovation which is new to the firm. The innovations of the 39% of the firms are new to the market and only 17% of the firms introduced innovations that are new to the world. This ratio is about the same with the corresponding results from AEGIS project⁴, which also analyzes the phenomenon of knowledge-intensive entrepreneurship in ten European countries.

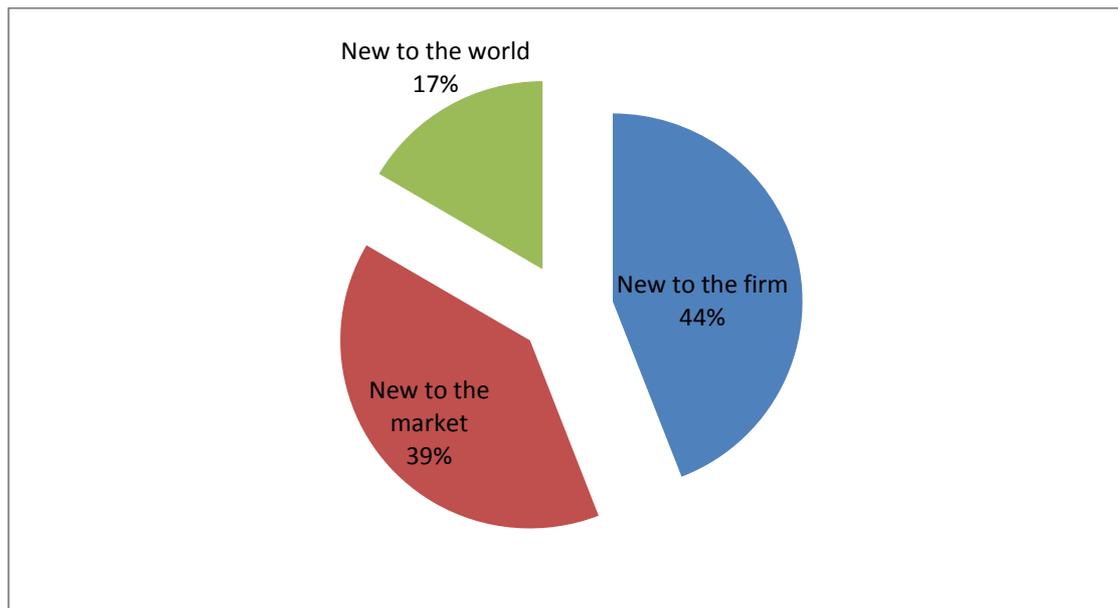


Figure 11: New for whom?

Sources of knowledge and networks: the importance of the founders' background

In this section we will try to investigate the link between the educational background of the founders and the sources of knowledge of firms for the exploration of new business opportunities. Tables 3 to 6 present the results from the analysis of variance and, more specifically, the multiple comparisons tests (Duncan test⁵) on the sources of

⁴ The AEGIS project aims to analyze knowledge-intensive entrepreneurship and related strategies and policies from a variety of disciplines and research methodologies such as economics, organization theory, strategic management, finance, economic history, economic geography, sociology, science and technology studies, and policy studies (source: <http://www.aegis-fp7.eu/>).

⁵ Makes pairwise comparisons using a stepwise order of comparisons identical to the order used by the Student-Newman-Keuls test, but sets a protection level for the error rate for the collection of tests, rather than an error rate for individual tests. Uses the Studentized range statistic (source: IBM SPSS

knowledge of the firms compared to the highest educational attainment of founder in the firm. Using the same technique, we also present the results from the comparison between the networking of firms and the highest educational attainment of founders (tables 7-10). All results listed are statistically significant.

Some sources of knowledge are more important for companies that have founders with post-graduate degree (PhD included) than those whose founders have completed only elementary or secondary education. As shown in Table 3, in house R&D is an important source of knowledge for post-graduate degree holders versus those who are non university degree holders. Therefore, this kind of internal source of knowledge becomes more important for founders with higher educational background.

Table 3: The importance of the educational background of founders for “In house R&D” as source of knowledge

In house R&D			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
Elementary-Secondary education	19	2,37	
Bachelor degree	88	2,82	2,82
PhD-Master	98		3,40
Sig.		,178	,083

The following table compares another source of knowledge related to the science and research community: the universities and research institutes. There is statistically significant difference between different types of education of the founders. This source of knowledge is more important for founders with PhD or Master’s degree than those who completed only the elementary or secondary education.

Table 4: The importance of the educational background of founders for “Universities and research institutes” as source of knowledge

Universities and research institutes			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
Elementary-Secondary education	19	1,58	
Bachelor degree	88	2,10	2,10
PhD-Master	98		2,52
Sig.		,054	,123

Another source associated with the science and research community is the “Scientific journals”. There is statistically significant difference between the highly educated and lower educated founders, with the former to prefer more the specific source of knowledge.

Table 5: The importance of the educational background of founders for “Scientific journals” as source of knowledge

Scientific journals			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
Elementary-Secondary education	19	1,74	
Bachelor degree	88	1,98	1,98
PhD-Master	98		2,37
Sig.		,372	,148

Finally, the research programmes which are either nationally-funded or EU-funded (FP) are “two-speed” sources. Firms that have at least one founder with a Master’s or a PhD degree exploit more the research programmes as a source of knowledge to explore new business opportunities related to the companies where the highest educational level is the elementary or secondary education.

Table 6: The importance of the educational background of founders for “Research programmes” as source of knowledge

Research programmes			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2

Elementary-Secondary education	19	1,95	
Bachelor degree	88	2,09	2,09
PhD-Master	98		2,60
Sig.		,610	,070

Below we examine how the educational background of founders affects the way in which each company leverages networks for its functions. We see from Table 7 that the founders with higher education level (PhD / Master) utilize more the networks for the recruitment of skilled labor relative to entrepreneurs who have only basic education (elementary / secondary education).

Table 7: The recruitment of skilled labor as main facilitator of networking

Recruiting skilled labor			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
Elementary-Secondary education	18	2,39	
Bachelor degree	87	2,90	2,90
PhD-Master	98		3,14
Sig.		,087	,405

This operation seems to affect and whether the firm innovates. As seen in Table 8, there is a statistically significant difference in innovation between companies using their networks for recruitment of skilled labor and those who do not. Firms that use their networks for recruitment of skilled labor are those who usually have product and process innovation and contrary, the firms which don't use their networks for this purpose they don't innovate.

Table 8: Connection between the recruitment of skilled labor and innovation

Recruiting skilled labor			
Duncan			
Innovation	N	Subset for alpha = 0.05	
		1	2
No innovation	71	2,77	
Process innovation	18	2,78	
Product innovation	63	3,10	3,10

Product and process innovation	39		3,44
Sig.		,324	,264

Here are two business functions exploited by the networks forming companies with founders who have a low educational background. The first operation is the “understanding of customer needs” (Table 9) and the second is the “arrangement of taxation and of other legal issues” (Table 10). These features are more common in entrepreneurs who have completed only elementary or secondary education in relation to the founders who have PhD or Master.

Table 9: The understanding of customer needs as main facilitator of networking

Understanding of customer needs			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
PhD-Master	98	3,73	
Bachelor degree	87	4,18	4,18
Elementary-Secondary education	18		4,28
Sig.		,065	,699

Table 10: The arrangement of taxation and of other legal issues as main facilitator of networking

Arranging taxation and other legal issues			
Duncan			
Highest educational attainment of founders	N	Subset for alpha = 0.05	
		1	2
PhD-Master	98	2,63	
Bachelor degree	87	3,17	3,17
Elementary-Secondary education	18		3,61
Sig.		,062	,129

5. Conclusions

The new established Greek firms operating in high-technology sectors have a significant stock of knowledge and innovate greatly. They consist of founders with a very high educational level and they have highly qualified employees. The main areas of expertise of founders are the technical / engineering knowledge and the general management. 6 out of 10 firms innovate by mainly exploiting R&D activities. These innovations are usually new to the firm.

Within this article we studied the link between the educational attainment of the founders and the sources of knowledge and networking of each firm. The highly educated founders choose more scientific and research knowledge sources to explore new business opportunities, such as in house R&D, universities and research institutes, scientific journals and research programmes, compared with the founders having lower educational background who prefer other sources.

Regarding the networking of firms, the educational background of the founders also plays an important role on the different types of operations and activities. Firms that have founders with Master or / and PhD utilize more their networks for recruiting skilled labor. As we saw, this function affects the development of innovations. Firms that use their networks for this operation are those developing both product and process innovation. Firms founded by entrepreneurs of lower educational attainment (elementary / secondary education) mainly use their networks for other purposes, such as the understanding of customer needs and the arrangement of taxation and of other legal issues.

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