

Working paper to be cited as:

Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

This working paper, after several reviews and modifications, was published as:

Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C. Entrepreneurial intention of engineering students and associated influence of contextual factors Revista de Psicología Social (2015), DOI: 10.1080/02134748.2015.1101314

Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors

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Abstract:

This research explores the incidence of individual and contextual factors on the entrepreneurial intention of engineering students, as they are called to be the founders of new technology-based firms, which are required in the Spanish economy for the generation of economic growth and employment. A quantitative study comprising 1004 engineering and architecture students has been conducted, in which both the contextual

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factors and antecedents of entrepreneurial intention from Ajzen's Theory of Planned Behavior have been examined. Specifically, contextual factors such as the perception of economic-administrative barriers and unemployment rates have been assessed. MANOVA and ANOVA analyses results show that individuals with a high entrepreneurial intention show a favorable attitude towards the behavior, perceive support in their social environment and see themselves capable of undertaking this task. Furthermore, these subjects perceive lower economic-administrative barriers, proving the influence of contextual factors. On the other hand, the role played by unemployment rates is unclear. Consequently, technical universities and governments, in their social responsibility to foster entrepreneurship in future young professionals, should take these factors into account to promote an encouraging climate for the development of an entrepreneurial spirit.

Keywords: entrepreneurship, economic crisis, unemployment, career expectations, new technology-based firms, contextual factors

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1. Introduction

The founding of new companies is regarded as one of the best ways of generating growth and reducing unemployment. But the creation of a new firm requires an individual, the entrepreneur, willing to risk his¹ time and money on the venture. Basically, the entrepreneur is the detonating and *sine-qua-non* condition for economic growth.

In Spain, one of the countries that has suffered the economic crisis of the last few years in a more dramatic manner in terms of unemployment and destruction of companies, fostering entrepreneurship has become a key action for policy makers. In this respect, a new law “Ley de Apoyo al Emprendedor y su Internacionalización” (Law for the Support and Internationalization of Entrepreneurs) was issued in September 2013 (Boletín Oficial del Estado, 2013). The major novelties of this law are, among others, (i) the limitation of financial responsibilities in the event of bankruptcy, (ii) a decrease in the capital or equities needed to start up a business, (iii) the establishment of fiscal incentives for entrepreneurs or (iv) the possibility of receiving the whole unemployment subsidy in a single payment if it is to be invested in founding a new company. Concern for the creation of new businesses was highlighted by our recently crowned king Felipe VI, who mentioned it in his crowning speech, “We face [...] the challenge to promote and encourage innovation, creativity and entrepreneurship as attitudes that are necessary for development and growth., In my opinion, all this is essential to ensure the progress and modernization of Spain and will undoubtedly help us, to win the battle for job creation, which is currently the main concern of Spaniards” (Casa Real, 2014).

¹ In order to facilitate reading the article, the masculine form is used, not necessarily meaning that the subject referred to is masculine.

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That is, job creation, entrepreneurship and growth are usually mentioned as closely interrelated concepts. From this it can be inferred that there is a well-established common belief in the appropriateness of fostering entrepreneurship by policy makers who aim to fight unemployment. However, criticism has arisen within the scientific community as to whether the promotion of any type of new venture is good public expenditure (Baumol, 2008; Congregado, Golpe, & Carmona, 2010; Shane, 2009). Specifically, it has been stated that it is the creation of new technology-based firms (NTBFs) that could bring economic development and growth (Acs & Szerb, 2007; D. Audretsch, 1995; Carree & Thurik, 2010), while that would not be the case for non-innovative companies (Shane, 2009).

Moreover, for the growth of a NTBF the human capital at the company's disposal has been found to be a critical factor (Colombo, Delmastro, & Grilli, 2004; Colombo & Grilli, 2005), as well as for its ability in accessing private funding (Colombo & Grilli, 2010). Among the most important determinants of a firm's human capital, the education and professional background of their founders and workers have been identified (Kim, Aldrich, & Keister, 2006). That is to say, the founding of successful technological ventures requires individuals with technical education and backgrounds who at the same time possess entrepreneurial attitudes and intentions.

Unfortunately, in countries and regions with high unemployment rates, a trend towards the creation of companies with very little or no innovation at all has been stated (D. B. Audretsch, Carree, & Thurik, 2002; Congregado et al., 2010; Fairlie, 2011; Hernández-Mogollón, 2014; Pfeiffer & Reize, 2000). This event is termed "recession push effect" (Congregado et al., 2010) or "refugee effect" (D. B. Audretsch et al., 2002) and is

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attributed to the push effect that unemployment causes for long-term unemployed individuals. This fact is highlighted by the results gathered by the Global Entrepreneurship Monitor (GEM) in Spain that depict the entrepreneurial activity in our country as a solitary occupation, the average investment being 20,000 € (Hernández-Mogollón, 2014).

In order to promote economic growth, there is a need for predicting who are the potentially most successful founders of NTBFs. Individual (age, gender, exposure to entrepreneurial role models or personality traits, for instance) or contextual (e.g., local unemployment rates or economic context) factors are not good predictors of entrepreneurial behavior when considered on their own (Krueger, Reilly, & Carsrud, 2000). The reason for this is that the creation of a company is the result of a reasoned thinking process, i.e. it represents a planned behavior. As such, it is best predicted by the intention present in the individual. The most commonly used intentional model is the classic Theory of Planned Behavior (TPB) presented by Ajzen in 1991 (Ajzen, 1991).

Contextual factors, in spite of not being variables able to predict the individual's action towards the founding of a new company, are known to hinder or foster entrepreneurial behaviors (Welter, 2011). Economic cycles, both of recessive or expansive type, and associated unemployment rates have an influence on the propensity of individuals to pursue an entrepreneurial activity (D. B. Audretsch et al., 2002; Congregado et al., 2010; Fairlie, 2011). Moreover, economic crisis has been identified as a contextual circumstance that affects the attitudes of the individual (Markovits, Boer, & van Dick, 2014).

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In this research we posit that the current contextual threats existing in Spain for the creation of new companies affect differently those individuals with technical education that possess high entrepreneurial intention when compared to others with low entrepreneurial intention. While several studies regarding entrepreneurial intention among university students have been conducted (Dohse & Walter, 2011; J. A. Moriano, Gorgievski, Laguna, Stephan, & Zarafshani, 2011; Sánchez-Escobedo, Díaz-Casero, Hernández-Mogollón, & Postigo-Jiménez, 2011; Shinnar, Giacomini, & Janssen, 2012; Zellweger, Sieger, & Halter, 2011), some of them focusing on technical degrees (Ahmad, Baharun, & Rahman, 2004; Luthje & Franke, 2003) none of them analyze the differences among several technical studies in a negative economic frame. We present data from the entrepreneurial intention and related contextual factors of engineering and architecture students from the biggest and oldest technical university in Spain, the Universidad Politécnica de Madrid (UPM).

The remainder of the paper is organized as follows. In the first section the research and economic framework are presented, which lead us to the research question statement, the hypotheses to be tested and the proposed model. Section 3 presents the methodology used, while the results obtained are summarized in section 4. Finally, a discussion of the results and the conclusions of the study are provided.

2. Research framework

2.1. Spanish economic framework

The so-called “Great Recession” of the last few years has caused year-to-year decreases in Spanish GDP of -3.8% in 2009 and -1.6% in 2012, while per-capita GDP decreased -11% between 2007 and 2012 (World Bank, 2014). The survivability of small and

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medium enterprises (SMEs), which make up the majority of the industrial fabric in Spain, has also been affected, its number having decreased by 18% in the period 2007-2014 (Confederación Española de Organizaciones Empresariales, 2014). Regarding the unemployment rate, this has risen from 8% (2007) to 26% (2014), which means there are 5.9 million unemployed individuals, among whom 50% are long-term unemployed (INE, 2014). Even more dramatic is the rate of unemployment of young adults (below 25 years of age), which ranks 55% in 2014.

The aforementioned macro-economic figures find their correspondence in the founding of new businesses with the evolution of the Total Early-Stage Entrepreneurial Activity (TEA) observed by the Global Entrepreneurship Monitor (GEM), which has been steadily reduced during the economic recession. The TEA is defined as the percentage of entrepreneurial initiation activities with respect to the total population between 18 and 64 years old within a country. The figures for Spain show a decrease in the TEA over the past five years, from 7.3% (2007) to 5.2% (2013) (Hernández-Mogollón, 2014).

But not only has the rate of new business founding been reduced but also a shift in the type of ventures can be noted. During economic recessions, high unemployment rates push unemployed individuals towards the founding of new companies, as previously noted by other authors (D. B. Audretsch et al., 2002; Congregado et al., 2010; Fairlie, 2011; Pfeiffer & Reize, 2000). This “refugee effect” is identified in the data of GEM Spain in the increase in the necessity-driven TEA from 14.9% (2007) to 29.2% (2013). In the same period, the perceived opportunities for business creation decreased from 25% to 16% (Hernández-Mogollón, 2014).

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When compared to the rest of the countries of the EU, Spaniards show a lower perception of business opportunities and have a lower belief in the capacity of entrepreneurship to provide them with a high social status (Hernández-Mogollón, 2014). This may be attributed, on the one hand, to the perception of the bad economic situation and the associated difficulties and barriers that arise from it as an impediment for entrepreneurship and, on the other hand, to the high rates and duration of unemployment in Spain. This proves that for many Spaniards self-employment has come to be the main motivation for creating a new company.

All in all, the GEM depicts Spanish entrepreneurial activity in present times as a solitary occupation (self-employee) with no external investment (company is capitalized with entrepreneur's own savings), of a small size and low internationalization (Hernández-Mogollón, 2014). When a company is founded upon such premises, it is more likely that it will become one of those 53% of Spanish companies that do not have any other employee apart from the entrepreneur (Lofstrom, 2011).

2.2. The role of engineers and technical universities in economic growth

The aforementioned economic and entrepreneurial situation is particularly alarming, as the founding of technology-based companies has been cited as one of the best ways to increase productivity, wealth generation and job creation (Acs & Szerb, 2007; D. Audretsch, 1995; Carree & Thurik, 2010).

A distinction can therefore be made between the technological start-ups with high growth capabilities and those new companies in which the main scope is the self-employment of their creators. Moreover, the self-employment type of entrepreneurship often gives way to companies that remain over the years mainly as single-person

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businesses, created by low-skilled workers hoping to obtain higher salaries than the ones offered in the private sector as regular employees (Lofstrom, 2011).

To the contrary, highly educated individuals are able to overcome the entry barriers of technological industries (Lofstrom, Bates, & Parker, 2014), and possess the human capital required to lead a NTBF (Colombo et al., 2004; Colombo & Grilli, 2005, 2010), with education being one of the most determinant factors within human capital for the success in the survivability of the company (Dohse & Walter, 2011).

Individuals with higher formal education have been found to be more likely to pursue entrepreneurial opportunities (Arenius & Minniti, 2005), with the specific training in entrepreneurship of technical professionals being particularly decisive for the survivability of new ventures (Martín, Hernangómez, Rodríguez, Escudero, & Saboia, 2010; Molero & Maldonado, 2012).

For this reason, technical universities play a key role in economic development as a technology transfer vehicle to society. It is not the universities which found companies, but the individuals that pursue their studies in these educational institutions. In this sense, the Massachusetts Institute of Technology can be cited as an example of a technical university that has largely contributed to the economic growth of the USA, as more than 4000 companies have emerged from it, employing over 1.1 million people (Prodan & Drnovsek, 2010).

The UPM, founded in 1971 as a merger of existing independent engineering schools, is the biggest and oldest technical university in Spain and has been ranked as the top Spanish research University over the last five years (European Research Ranking, 2014). This score is obtained as a result of the funding and project participation

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performance, the networking activity and alliances, and the diversity of research areas.

Over 42,000 students are currently enrolled in the UPM, which speaks of the importance of this university in the Spanish economy and its entrepreneurial potential.

In this research, data on the entrepreneurial intention and related factors of UPM's students have been gathered aiming to shed light on the influence of the attitudes towards entrepreneurship and the perception of contextual factors.

2.3. Intention: the triggering factor of actions and behaviors

When speaking about entrepreneurship it is important to bear in mind that it is an individual pursuing an action. If everything goes as expected, this action may bring him success and financial reward. If not, it may mean his own bankruptcy, which could even affect his family assets.

It is then clear that the decision to found a company is an intentional process, in which the individual will take a reasoned decision according to what he understands to be an interesting market niche, accounting for the support of his closer environment and with the belief that he has the knowledge required to be successful.

If engagement in entrepreneurial activities does not happen by accident, but as the result of a reasoned choice, then entrepreneurship is a planned behavior, and it can be best predicted by intentional models (Krueger et al., 2000). In these models, intentions are the immediate antecedent to behaviors, while the former are triggered by attitudes. Attitudes, however, are thought to be affected by individual or contextual variables (Ajzen, 1991; Souitaris, Zerbinati, & Al-Laham, 2007).

When we refer to individual variables we mean gender, age, exposure to entrepreneurial role models, personality traits or the lack of employment of the individual. On the other

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hand, contextual or situational variables stand for the unemployment rates where the individual lives, the difficulties in accessing financial credits, or the existence of administrative constraints for the creation of new companies.

The main cognitive models to analyze entrepreneurial intention are Shapero's Entrepreneurial Event (EE) (Shapero & Sokol, 1982), and Ajzen's Theory of Planned Behavior (TPB) (Ajzen, 1991). Entrepreneurial intentions can be defined as the conscious state of mind that directs personal attention, experience, and behavior toward planned entrepreneurial behavior (Krueger et al., 2000). Both EE and TPB models study the importance of the desirability and feasibility towards entrepreneurship; however Ajzen subdivides desirability into two new factors, managing to explain how cultural and social environment affect behavior (Ajzen, 2001).

In this research we rely on the Theory of Planned Behavior (TPB) model from Ajzen (1991), whose effectiveness in predicting both intentions and behaviors has been proved by other authors (Armitage & Conner, 2001; Fayolle & Gailly, 2004; Kolvereid & Isaksen, 2006; Krueger et al., 2000). In his theory, Ajzen proposed that the intention is determined by three socio-cognitive factors: attitude toward performing the behavior, subjective norms concerning action, and a belief in one's ability to perform the behavior successfully, in this case, the foundation of a new company. As previously mentioned, individual and situational variables are antecedents of attitudes (see Figure 1).

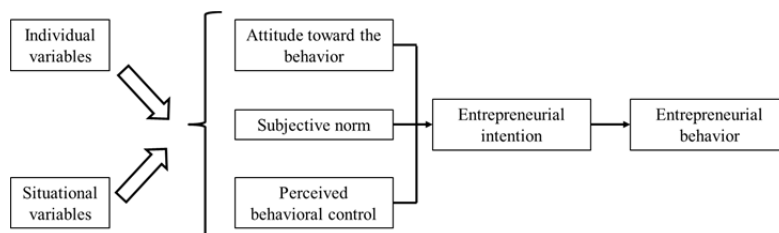


Fig. 1. Theory of Planned Behavior

Working paper to be cited as:

Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

Of the three attitudinal antecedents of the entrepreneurial intention, two of them represent the desirability of pursuing the behavior, namely the attitude toward the behavior (ATB) and the subjective norm (SN). On the other hand, the perceived behavioral control (PCB) represents the feasibility of performing the behavior.

The first attitudinal factor, ATB, evaluates the degree of accordance with a concrete behavior. In our case, this factor reflects how appealing being an entrepreneur is to the individual. This element has a major importance in the resulting intention, as no matter how favorable social support and feasibility are, the absence of desire to become an entrepreneur implies the least intention of actually becoming one. According to this, we hypothesize that

H1a. Individuals with high entrepreneurial intention will rank high on the positive personal attitude towards entrepreneurship (ATB) of the TPB model.

The second factor, SN, represents the social pressure perception towards fulfilling a specific behavior, as individuals seek the acceptance of peers and reference models by acting according to what they perceive as desirable for them. Two levels of social support may be taken into account, (i) close social references, formed by family and friends, and (ii) broader social environment. Both have been linked to entrepreneurial intention, and therefore we posit,

H1b. Individuals with high entrepreneurial intention will rank high on perception of support from their social environment (SN) of the TPB model towards the founding of a new venture.

Last, PCB is a factor that may facilitate or impede performance of the behavior, according to the perceived self-capability of the individual. It accounts for elements

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dependent on the individual, such as skills, knowledge or willpower, which are of capital importance in deciding whether to perform the behavior. Hence,

H1c. Individuals with high entrepreneurial intention will rank high on perceived behavioral control (PCB) of the TPB model.

2.4. Contextual factors affecting entrepreneurial intention

As mentioned in the previous section, in the Theory of Planned Behavior, individual and contextual (or situational) factors are identified as antecedents of attitudes, suggesting that they have an indirect influence on entrepreneurial intention. Yet, individual and contextual factors when taken on their own cannot predict entrepreneurial intention (Krueger et al., 2000). That is, males in their late thirties are the most common entrepreneurs in Spain (Hernández-Mogollón, 2014), but this does not mean that these concrete individual factors (gender and age) can be used as predictors of entrepreneurial intention. Likewise, being unemployed does not predict that the individual will have the intention of creating a company.

However, entrepreneurial intention is pursued within an economic context. Welter (2011) states that context establishes boundaries for the foundation of new companies and determines the existence of opportunities. Moreover, the recent economic crisis has been found to affect the work related attitudes in Greek individuals (Markovits et al., 2014). Based on these findings, we posit that the current recession generates a number of economic-administrative barriers (EAB), which are also factors related with entrepreneurial intention. These barriers constitute constraints that challenge the creation of companies, such as financial and credit difficulties, administrative obstacles and lack of institutional support, among others (Shinnar et al., 2012). Specifically, this

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type of obstacle has been found to play a significant role in the entrepreneurial behavior of technical students (Luthje & Franke, 2003). If the perception of EAB is high, entrepreneurship can be discouraged, thus reducing the chances of creating a company.

Therefore we hypothesize that these barriers affect the entrepreneurial intention,

H2. Individuals with high entrepreneurial intention will rank low in the perception of economic-administrative barriers (EAB).

On the other hand, there is evidence of the positive correlation of local unemployment rates with the proportion at which new companies are founded, due to the above-mentioned “refugee effect” (D. B. Audretsch et al., 2002; Congregado et al., 2010; Fairlie, 2011; Gohmann & Fernandez, 2014; McMullen, Bagby, & Palich, 2008; Pfeiffer & Reize, 2000)

The high unemployment rates in Spain, especially amongst adults below 25 years of age, suggest that university students who are finalizing their degrees will be facing unemployment when they enter the labor market. These unemployment perspectives will probably affect their career intentions and aspirations, in terms of economical ambitions and emigration prospects when working for companies. Likewise, they may also foster their entrepreneurial intentions toward self-employment or the founding of technology-based companies.

However, the professional aspirations of students from technical degrees in Spain may not be so affected by the bad economic prospects as in other university degrees. Technical professionals have traditionally enjoyed a much higher employability in Spain, the rates being close to full employment in the expansive economic cycles. Even now, in a recessive cycle, of all the technical professions, only the ones related to the

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building sector show an increase in unemployment regarding previous years. Although their unemployment ratios are still half of the national average ratio (see Table 1), it is worth noting that they have experienced a rapid increase during the recession years.

If, as previously mentioned, high unemployment rates cause an increment in new business foundation, the observed differences in the unemployment rates of technical professions may trigger differences in entrepreneurial intentions among technical degree students. Hence, in our last hypothesis we posit,

H3. The higher the unemployment rate for a profession, the higher the entrepreneurial intentions of students in related degrees.

Table 1 Unemployment ratios of technical professions in Spain

	Unemployment ratio [%]
Aeronautical Engineering	1.0 ^a
Architecture	26.0 ^a
Civil Engineering	12.5 ^a
Mechanical Engineering	5.0 ^a
Telecommunications Engineering	7.6 ^a
Average Spain	25.8 ^b

Source: a Professional associations, engineering schools and press published data.

b (INE, 2014)

In conclusion, the theoretical background for our study can be summarized in the research question, “Are the students with higher entrepreneurial intention scoring higher in the attitudinal factors of the TPB and at the same time being sensitive to the contextual factors in which they are embedded?”

The theoretical model that accounts for both the research question and stated hypotheses is presented in Figure 2.

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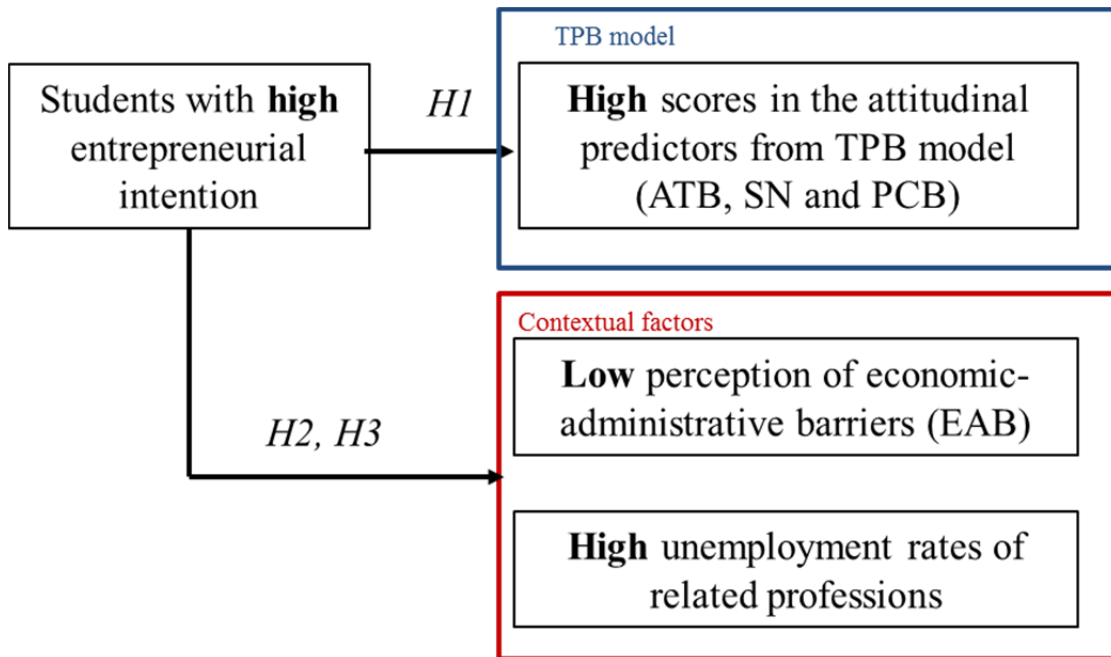


Fig. 2. Conceptual model

3. Methodology

3.1. Sample and procedures

The research target population included Spanish engineering and architecture students. The final sample in this study comprised a total of 1004 students collected from different degrees at the Universidad Politécnica de Madrid (UPM). Of these, 67.2% are men and 31.9% women, with 0.9% of respondents not giving information in this respect. These data seem congruent with the fact that the number of men in technical degrees is usually higher than the number of women (Otero & Salamí, 2009) and with the UPM's undergraduates' specific gender distribution (Ministerio de Educación Cultura y Deporte, 2013). As regards age, the mean in the sample is 20.55 and the standard deviation 2.95.

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The study was conducted in five different degrees with a great tradition in technical studies and which count among the most demanded ones at the UPM (Universidad Politécnica de Madrid, 2013), namely, Aeronautical Engineering (AER), which comprises 32% of the sample, Architecture (ARC), which accounts for 18% of the sample, Civil Engineering (CIV), that constitutes 21% of the collected data, Mechanical Engineering (MEC), which makes up to 24% of the total data and Telecommunications Engineering (TEL), comprising 5% of the sample. Data from students in their first and last semester of the degree were collected, this distribution being balanced with 50.4% of the respondents enrolled in their first and 49.6% in their last semester at university.

The data were collected at the beginning of the 2012/2013 winter term (September-October 2012) in a frame of 4 weeks, a short enough period to reduce the risk of time-variant influences. During this time, no relevant news or events happened that could have had an impact on the students' opinions. With the teachers' consent, a survey was handed out during class after a short explanation of the project.

3.2. Measures

Entrepreneurial intention (EI) was measured by six items of the survey that address the students' purpose to start their own firm. These items, based on Liñán and Chen's intercultural study (Liñán & Chen, 2009), are general sentences that explore different aspects of intention. They include statements that regard the readiness to be an entrepreneur, entrepreneurship as a professional goal, the level of effort to become an entrepreneur, the determination to start and run a firm, the thoughts dedicated to entrepreneurship and the intention to start a firm someday. As for all other constructs, these issues were addressed using a seven-point Likert scale (1= total disagreement, 7=

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total agreement). The average in these six items yielded the final measure for EI, which will be the independent variable in our study.

Attitude towards the behavior (ATB) was also based on Liñán and Chen's (2009) research, and the five items that form this measure are related to the attractiveness entrepreneurship has for the respondents. Their average emits our first dependent variable.

Subjective norm (SN) was assessed with three items of the aforementioned study (Liñán & Chen, 2009) which included the approval for entrepreneurial activity respondents perceived from their close social environment (parents and siblings, friends and colleagues). An additional item addressed the perception of society's support. The average in these four items yielded the final measure for SN.

Similarly, *perceived behavioral control (PBC)* was composed of six items from Liñán and Chen's (2009) scale, that were directed to the perception of self-capacity to become an entrepreneur, i.e. if the individual perceives it would be easy and possible for ^{him} to create his own firm. As before, the variable was created from the average in the items that constituted it.

Perception of economic-administrative barriers (EAB) was measured by four items that included questions regarding the difficulty to obtain a bank credit, the legal and bureaucratic obstacles to entrepreneurship, the possibility of finding an idea for a new business and the perception of qualified firms that offer supportive services to new companies. In this case, high scores in the seven-point Likert scale showed more facilities in the creation of a new firm and therefore a low perception of EAB, while low scores represented the perception of high EAB. The average in these items yielded our

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

EAB variable that encloses the so-called “basic conditions” for setting up a new firm, which include economic and administrative issues.

Finally, the *degree* studied was also taken into account, as dissimilarities in professional options, mainly related to unemployment ratios, are expected to constitute an important factor for differences in EI. As previously stated, five degrees were included in the analysis: Aeronautical Engineering (AER), Architecture (ARC), Civil Engineering (CIV), Mechanical Engineering (MEC) and Telecommunications Engineering (TEL).

Gender has been frequently linked to entrepreneurial intention (BarNir, Watson, & Hutchins, 2011; Díaz-García & Jiménez-Moreno, 2010). Consequently, it is taken into account in our study as a control variable in order to inspect and verify the higher entrepreneurial intention scores found for men in previous studies (Huber, F., Poech, A., & Brodie, 2012; Juan Antonio Moriano, Palací, & Morales, 2006; Van der Zwan, Verheul, & Thurik, 2011).

3.3. Analyses

In order to examine in-depth differences in EI, we first selected students with higher and lower scores in the independent variable, as is usually done in studies which are intended to assess differences in opposite scores of the same variable (González, Ibáñez, & Cubas, 2006; Hernández Zamora, Olmedo Castejón, & Ibáñez Fernández, 2004; Ortiz Barón, Apocada Urquijo, Etxebarria Bilbao, Fuentes Rebollo, & López Sánchez, 2008). This way, the analyses directed to assessing whether students with high entrepreneurial intention scored higher in the TPB variables - namely ATB, SN and PBC - and lower in the EAB variable were conducted with 20% of the total sample distributed in two extreme groups labeled “low EI” and “high EI”. In order to maintain the gender

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

proportion, as its effect on EI was confirmed with analysis of variance (ANOVA), both groups were formed with 10% of each gender. This way, the “low EI” group comprised 33 women with an EI score lower than 1.5000 and 63 men whose EI score was lower than 1.8333, while the “high EI” group included 34 women who had scored above 5.666 in EI and 66 men with an EI score higher than 5.8334. Consequently, 196 subjects divided into “low EI” (9.6% of the total sample) and “high EI” (10% of the total sample) groups were included for multiple analysis of variance (MANOVA) in order to assess differences in the variables tested in H1 and H2.

To test the direct effects of unemployment data linked to each degree posted in H3, analysis of variance (ANOVA) was used with the total sample.

4. Results

4.1. Descriptive statistics

When the total sample, consisting of 1004 students, is considered, EI's mean is 3.63 and its standard deviation 1.49 (see Figure 3 for complete data). These values are close to the central point of the Likert scale, which, as stated before, went from 1 to 7. If we consider each of the TPB variables, we find the highest mean for SN (\bar{x} : 5.48; s: 1.04), followed by ATB (\bar{x} : 4.89; s: 1.21) and the lowest mean for PBC (\bar{x} : 3.34; s: 1.16). Concerning the perception of economic-administrative barriers (EAB), the total mean is 3.51 and its standard deviation 1.15. Therefore, students perceive, in general, a high support for entrepreneurship from their social environment and have a positive attitude toward this professional option. On the other hand, they perceive themselves as medium-low capable of it and they acknowledge the existence of economic-administrative barriers for entrepreneurship.

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

By degree, the means in EI are: AER 3.33, ARC 3.99, CIV 3.58, MEC 3.77 and TEL 3.73. By gender, men, with a mean of 3.72, show a higher entrepreneurial intention, than women whose mean in EI is 3.44. The ANOVA analysis that was used to test H3 and that may be consulted later in the text showed the gender differences to be significant ($F_{4,975}=16.525$, $p \leq .001$), therefore it will be taken into account as a control variable for subsequent analyses. Variance homogeneity was also confirmed with Levene's test ($F_{19,975}=1.223$, $p > .005$).

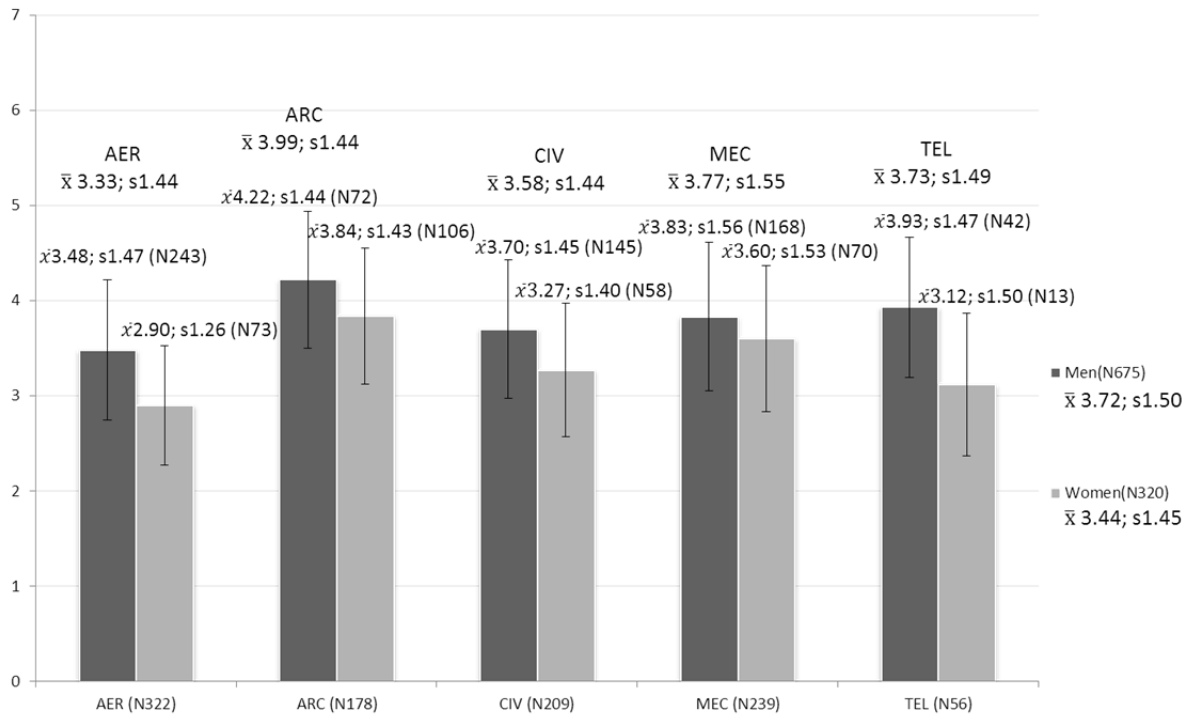


Fig.3 Descriptive statistics for EI by degree and gender

4.2. Empirical results

In order to test differences in the variables studied in H1, namely attitude towards the behavior (ATB), subjective norm (SN) and perceived behavioral control (PBC) and also in H2 which comprised the contextual factor of economic-administrative barriers

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

(EAB), multiple analysis of variance (MANOVA) was conducted. The MANOVA (4x2x2) compared the means in each of the four variables studied by EI group (“low EI” versus “high EI”) and gender (see Table 2 for results). Concerning the differences for the “low EI” and “high EI” groups, the data show significant results for the four dependent variables considered in the analysis. As regards gender, differences are found for ATB and SN. No interaction effect (EI group by gender) was found.

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Table 2. MANOVA (4x2x2) results for ATB, SN, PBC and EAB by EI group and gender

Source	Dependent variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	ATB	442.640	3	8.147.547	143.233	0.000
	SN	42.292	3	14.097	14.368	0.000
	PBC	213.873	3	71.291	63.342	0.000
	EAB	38.195	3	12.732	6.304	0.000
Intersept	ATB	3753.514	1	3753.514	3643.782	0.000
	SN	5608.743	1	5608.743	5716.600	0.000
	PBC	1957.022	1	1957.022	1738.812	0.000
	EAB	1970.875	1	1970.875	975.846	0.000
Gender	ATB	5.161	1	5.161	5.010	0.026
	SN	6.507	1	6.507	6.633	0.011
	PBC	1.551	1	1.551	1.378	0.242
	EAB	0.489	1	0.489	0.242	0.623
EI Group ("high EI" vs "low EI")	ATB	372.542	1	372.542	361.650	0.000
	SN	24.905	1	24.905	25.384	0.000
	PBC	178.434	1	178.434	158.538	0.000
	EAB	37.712	1	37.712	18.673	0.000
Gender*Group	ATB	2.286	1	2.286	2.220	0.138
	SN	2.521	1	2.521	2.570	0.111
	PBC	1.644	1	1.644	1.461	0.228
	EAB	4.173	1	4.173	2.066	0.152
Error	ATB	197.782	192	1.030		
	SN	188.377	192	0.981		
	PBC	216.095	192	1.125		
	EAB	387.774	192	2.020		
Total	ATB	4967.712	196			
	SN	6350.938	196			
	PBC	2672.667	196			
	EAB	2648.979	196			
Corrected Total	ATB	640.422	195			
	SN	230.669	195			
	PBC	429.968	195			
	EAB	425.969	195			

Looking at the data in detail (see Table 3) we find that students with a high entrepreneurial intention show higher scores in ATB than students who rank low in EI ($F_{1,192}=361.65$, $p \leq .001$). It is meaningful that for this variable students with a high EI score show a very positive attitude towards entrepreneurship (\bar{x} : 6.16 in a seven-point

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

scale), while those with a low EI score have a mean under the central score of the scale (3.18). On the other hand, for SN the means in both groups are high (5.17 and 5.99), depicting that all students perceive support from their social environment should they decide to create a firm. Nevertheless, students with a high entrepreneurial intention perceive a stronger support than those in the “low EI” group ($F_{1,192}=25.38$, $p\leq.001$). If we consider the third variable from the TPB model, namely PBC, we find that students who score high on EI also show a higher perception of self-capacity for entrepreneurship ($F_{1,192}=158.55$, $p\leq.001$) their mean being 4.40, and therefore medium-high, while students with a low EI show a very low score (\bar{x} : 2.32). These results lead us to confirm H1a-c: individuals with high entrepreneurial intention rank high in the three variables (ATB, SN and PBC) of the TPB model.

Concerning our second hypothesis, we find that, although all students perceive the existence of economic-administrative barriers, with mean scores close to the center of the scale (3.77 for “high EI” group and 2.95 for “low EI” group), those in the “high EI” group have a lower perception of these contextual constraints than the students who score low on EI ($F_{1,192}=18.67$, $p\leq.001$). Therefore, H2 is also confirmed, as students with a high entrepreneurial intention rank lower on the perception of economic-administrative barriers.

Table 3. Means in the four dependent variables by EI group and gender.

Dependent variable	Means			
	<u>“Low EI” group</u>	<u>“High EI” group</u>	<u>Men</u>	<u>Women</u>
ATB	3.18	6.16	4.82	4.46
SN	5.17	5.99	5.46	5.84
PBC	2.32	4.40	3.45	3.25
EAB	2.95	3.77	3.40	3.29

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

Additionally, MANOVA results show significant differences by gender for the ATB ($F_{1,192}=5.01$, $p \leq .05$) and the SN variables ($F_{1,192}=6.63$, $p \leq .05$). Specifically, men show a higher attitude (\bar{x} : 4.82) towards entrepreneurship and therefore find it more attractive as a professional option than women (\bar{x} : 4.46), while the SN mean for the latter is significantly higher, which shows a higher perception of support in the social environment for women (\bar{x} : 5.84) than for men (\bar{x} : 5.46). No differences by gender were found concerning PBC and EAB (see Table 2).

Finally, to test the direct effects of unemployment data linked to each degree posted in H3, analysis of variance (ANOVA) was used with the total sample. The ANOVA (5x2x2) results for EI by degree, gender and academic year are presented in Table 4. The data show significant differences in EI for degree ($F_{4,975}=9.572$, $p \leq .001$), gender ($F_{4,975}=16.525$, $p \leq .001$) and gender by academic year ($F_{4,975}=10.330$, $p \leq .001$). Once the variance homogeneity had been proved (Levene test; $F_{19,975}=1.223$, $p > .05$), we considered HDS Tukey *post hoc* contrasts. In detail, the results show significantly higher EI scores for Architecture students in comparison to Aeronautical Engineering ($p \leq .001$) and also to Civil Engineering students ($p \leq .05$), their means being 3.99, 3.33 and 3.58 respectively (for more detailed descriptive data see Figure 3). The difference between Mechanical Engineering (\bar{x} : 3.77) and Aeronautical Engineering students was also significant ($p \leq .01$). Regarding gender, men (\bar{x} : 3.72) obtain higher EI values than women (\bar{x} : 3.44). The interaction between gender and year showed that women in their last semester at university presented significantly lower scores in EI.

Table 4 ANOVA (5x2x2) results for EI by degree, gender and academic year

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
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Corrected Model	152.73	19	8.038	3.832	0.000
Intersept	5364.215	1	5364.215	2557.429	0.000
Degree	80.312	4	20.078	9.572	0.000
Gender	34.661	1	34.661	16.525	0.000
Year	4.339	1	4.339	2.069	0.151
Degree *Gender	11.211	4	2.803	1.336	0.255
Degree * Year	6.144	4	1.536	0.732	0.570
Gender * Year	21.667	1	21.667	10.33	0.001
Degree *Gender * Year	5.51	4	1.378	0.657	0.622
Error	2045.066	975	2.098		
Total	15319.582	995			
Corrected Total	2197.796	994			

In summary, H3 is not completely supported by the results, as students with high EI are not necessarily enrolled in degrees linked to professions with high levels of unemployment. Specifically, CIV students show an opposite pattern (high unemployment rate but low EI) and MEC students' results show higher EI scores than other degrees for a profession with high employment rates. On the other hand, H3 is confirmed for ARC (high unemployment and high EI) and AER (nearly full employment and low EI) students.

5. Discussion and conclusions

Our study focuses on the entrepreneurial intention (EI) of engineering students as they will supposedly be the future young professionals that may contribute to economic growth by creating new technology-based firms (Acs & Szerb, 2007; D. Audretsch, 1995; Carree & Thurik, 2010). A model was tested in which it was hypothesized that students with a high entrepreneurial intention would also score high in the three predictors of Ajzen's (1991) Theory of Planned Behavior. This was confirmed in the analysis. Contextual factors were also taken into account, as the specific economic and

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

administrative framework is considered of relevance for the development of EI, and therefore the behavior of entrepreneurship itself (Welter, 2011). The perception of economic-administrative barriers in their local environment as well as the unemployment rates were examined and differences according to EI were found for the former. On the other hand, the role played by the future professional perspectives and unemployment rates for entrepreneurial intention is unclear.

5.1. Implications

As has been stated, widening the knowledge regarding engineering students' entrepreneurial intention is a relevant issue due to its impact on economic growth, particularly pertinent for countries like Spain that has been especially affected by the current economic crisis.

Our results show that students whose entrepreneurial intention is high differ from those with a low EI in their attitude towards performing the behavior, in the support they perceive in their social environment, in the capacity they attribute to themselves as future business creators and in their perception of economic-administrative barriers. Therefore, if technical universities and governments, in their social responsibility, seek to foster entrepreneurship in future young professionals they should take these factors into account. Society needs engineers who like the idea of becoming an entrepreneur (ATB), who perceive support in their close but also wider social environment (SN), who see themselves as capable of creating their own firm (PBC) and who do not perceive high economic-administrative barriers to it (EAB), all of it contrary to the general perception in the Spanish population that, in comparison to other EU countries, shows a lower perception of business opportunities and a lack of belief in entrepreneurship as a

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

desirable occupation (Hernández-Mogollón, 2014). In this sense, the inclusion of business courses in engineering studies (Galloway, Anderson, & Brown, 2006) or the development of government policies specifically directed to facilitate entrepreneurship among this population and, more importantly, an effort to publish and transfer this information, seem like interesting measures to be taken in our country.

On the other hand, our results regarding the influence of unemployment rates for a specific profession on the EI of students in related degrees have not been conclusive. Nevertheless, an influence between the degree studied and the entrepreneurial intention has been found, with Architecture students showing the highest value (\bar{x} : 3.99). It is worth noting that Spanish entrepreneurs are described as solitary, with low capitalization and internationalization (Hernández-Mogollón, 2014), which is in agreement with the new ventures traditionally founded by architects in our country. These are usually home office architectural firms of small size that should be considered as self-employment, rather than innovative technology-based companies. As mentioned before, this type of entrepreneurship remains over time as single-person businesses, not necessarily contributing to the economic growth of the country. Mechanical Engineering students rank the second in entrepreneurial intention (\bar{x} : 3.77). This could be due to the versatility of the degree, which offers specialization in different industrial fields, energy, construction and business administration among others. Despite the IT sector's burgeoning, Telecommunications Engineering students occupy the third position in entrepreneurial intention (\bar{x} : 3.73). Finally, the lowest entrepreneurial intention scores have been found in Civil (\bar{x} : 3.58) and Aeronautical Engineering students (\bar{x} : 3.33). Therefore, the expected relationship between unemployment rates

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Morales-Alonso, G., Pablo-Lerchundi, I., Núñez-Del-Río. M.C., Entrepreneurial intention of engineering students in Spain and associated influence of contextual factors (2014), Working Paper.

and entrepreneurial intention is supported by the results for Architecture students, whose entrepreneurial intention is the highest, their unemployment rate also being high, and by Aeronautical Engineering students with the opposite pattern (low unemployment rate and low entrepreneurial intention). In contrast, the Civil Engineering students were expected to have high entrepreneurial intention, as the Spanish construction sector suffers high unemployment rates, while the Mechanical Engineering students were not supposed to show entrepreneurial intentions due to high employment in their profession. Neither of the latter has been found.

These results, in combination with the results concerning perception of economic-administrative barriers, lead to the conclusion that the contextual factors relevant for the entrepreneurial intention are not so much related to unemployment figures, but to the general perception of an economic, administrative and opportunity-favorable climate perceived among young people. Consequently, an effort should be made to create this encouraging climate for the development of an entrepreneurial spirit among technical degree students.

5.2 Limitations and future research

Despite the important findings, the present study is not without limitations. First, the sample has been gathered in a rather localized context, both in region and in time period. Also, the Telecommunications Engineering sample should be widened aiming to verify the results in this professional sector. Further research is necessary in order to establish if the results are applicable to other countries and to other economic cycles. Nevertheless, these results on the entrepreneurial intention of engineering students

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under a deep economic depression represent novel data which contribute to broadening the scientific expertise on the subject.

Second, this study focuses on intentions and not on actual behaviors. Although the link between the two has been established (Armitage & Conner, 2001; Fayolle & Gailly, 2004; Kolvereid & Isaksen, 2006; Krueger et al., 2000), the survey could be extended to young professionals in technical fields who have actually created new companies.

Finally, other relevant factors that could affect entrepreneurial intentions, such as the influence of parental role models, should be explored in order to widen the picture of young engineers who may be potential business owners.

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