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## Desirability of Technology Entrepreneurship among Bulgarian STEM Students: The Role of Entrepreneurship Education

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**Abstract:**

*The aim of this study is to examine the role of entrepreneurship education for the development of desirability of technology entrepreneurship among STEM students (STEM refers to any subject that falls under the disciplines of science, technology, engineering or mathematics) in 15 Bulgarian universities. A survey was administrated to students in STEM majors in 15 Bulgarian universities in 2015 and 2016. The sample for this study is composed of 879 STEM students, who are not nascent entrepreneurs or nascent intrapreneurs (in a process of starting a business) or established business owners or intrapreneurs (have already started a business).*

*The results reveal that STEM students included in the sample are an important source of potential entrepreneurs. This study demonstrates that entrepreneurship education is positively associated with desirability of technology entrepreneurship among Bulgarian STEM students after controlling for age, gender, entrepreneurial role models, social network support, previous experience in a technology company, perceptions of environment. Other factors with positive effect on the desirability of technology entrepreneurship include role models and support from family and friends. The empirical results have important practical implications for higher education institutions and policy makers. Greater emphasis should be placed on entrepreneurship education for STEM students in Bulgarian universities. We recommend an entrepreneurial perspective to be introduced in other courses as well. Business faculties should provide doctoral programs in entrepreneurship to train a future generation entrepreneurship academics who will be capable of using up-to-date methods in entrepreneurship education.*

*The present study attempts to fill several research gaps identified in the literature on technology entrepreneurship and entrepreneurship education. The study responds also to the calls for more research exploring the role of entrepreneurship education particularly in the field of technology entrepreneurship.*

**Keywords:** Desirability, technology entrepreneurship, STEM students.

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## 1. Introduction

The intersection of entrepreneurship and technology may contribute to economic development, may generate value for firms and may enhance the wealth at regional and national level in the globalized world (McPhee and Bailetti, 2012; Bailetti, 2012). According to Borges *et al.* (2010), scientific inquiry in technology entrepreneurship began in the 1960s with the contributions of Roberts (1968; 1969) and Cooper (1970; 1971). As a scientific field, technology entrepreneurship is still in its infancy (Beckman *et al.*, 2012; Bailetti, 2012). Academic research in technology entrepreneurship has generated a complex and interdisciplinary literature which relies on diverse theoretical backgrounds and addresses a wide number of topics (Ratinho *et al.*, 2015). Most research in technology entrepreneurship investigates the formation, management and development of new technology ventures and the factors for the development of technology entrepreneurship (Ratinho *et al.*, 2015; Ferreira *et al.*, 2015; Bailetti, 2012; Spiegel and Marxt, 2011). This research does not provide answers to the question why people create new technology ventures (Shane and Venkataraman, 2003). The available research in the field of technology entrepreneurship relies mainly on the case study approach and few apply comparative approach and statistical methods (Zhang *et al.*, 2008). There is a lack of understanding about pre-venture processes in technology entrepreneurship and particularly the formation of positive attitudes towards technology entrepreneurship. Mosey *et al.* (2017) call for more research exploring the role of entrepreneurship education particularly in the field of technology entrepreneurship.

The provision of entrepreneurship courses and programs is a widespread practice in most developed and developing countries including countries from Central and Eastern Europe (Solomon and Fernald, 1991; Klandt, 2004; Katz, 2003; Matlay, 2001; Blenker *et al.*, 2011). Entrepreneurship education is seen as an important factor for building entrepreneurial capacity (Hannon, 2006). The role and the need for entrepreneurship education and training are justified by the view that entrepreneurship is a discipline (Drucker, 1985) that “can be taught” (Kuratko, 2005; Gorman *et al.*, 1997). This standpoint finds a considerable support in entrepreneurship theoretical and empirical research (Veciana, 1999). Indeed, the investigation of entrepreneurial traits failed to provide conclusive evidence about who the entrepreneur is (Gartner, 1989). Instead, Gartner (1989) emphasizes that behaviours rather than personality traits differentiate entrepreneurs from non-entrepreneurs and calls for shifting attention to what the entrepreneur does (behavioural approach). While psychological traits are impossible or difficult to change, the entrepreneur’s skills and abilities, which determine entrepreneurial behaviour can be learned (Veciana, 1999).

According to the European Commission (2008) entrepreneurship education “*is not yet sufficiently integrated in higher education institutions’ curricula*” especially in STEM fields (Barr *et al.*, 2009). Despite the increasing literature on entrepreneurship education, the understanding of the impact of entrepreneurship education is still very

limited (Fayolle and Gailly, 2009). The role of entrepreneurship education in Central and Eastern Europe, and particularly the impact of entrepreneurship education on entrepreneurial attitudes of students in this context has attracted little research attention. Therefore, the aim of the present study is to investigate the influence of entrepreneurship education on the desirability of technology entrepreneurship among Bulgarian STEM students controlling for other individual differences.

## **2. Technology Entrepreneurship**

Technology entrepreneurship is a distinct research line at the nexus of Entrepreneurship and the Management of Technology and Innovation (Spiegel and Marxt, 2011; Hsu, 2008; Mosey *et al.*, 2017). It was acknowledged that the field of technology entrepreneurship tends to be organized around a phenomenon rather than being oriented around any particular academic field (Hsu, 2008). Bailetti (2012) highlights the lack of generally accepted definition of technology entrepreneurship. A great diversity of terms and definitions of the concept of technology entrepreneurship are used in the literature. The terms adopted by researchers to describe this phenomenon include technology entrepreneurship, technology-based entrepreneurship, technological entrepreneurship, technical entrepreneurship, engineering entrepreneurship, techno-entrepreneurship, high-technology entrepreneurship, high technology-focused entrepreneurship, etc.

Burgelman *et al.* (2004) define technological entrepreneurship as “*activities that create new resource combinations to make innovation possible, bringing together the technical and commercial worlds in a profitable way*”. Petti (2009) posits that technology entrepreneurship involves “*recognizing, discovering and even creating entrepreneurial opportunities from technological developments*”. Garud and Karnøe (2003) conceptualize technology entrepreneurship as a distributed agency involving not only technology entrepreneurs themselves but also customers, actors who develop complementary assets and those in institutional forums. All these actors may actively participate in the entrepreneurial process to shape the emerging technology in different ways. Spiegel and Marxt (2011) argue that technology entrepreneurship encompasses “*all questions related to the successful formation, exploitation and renewal of products, services and processes in technology-oriented firms*” and examine how these companies can create, sustain and enhance their competitive advantages. Petti and Zhang (2011) argue that technology entrepreneurship is “*the transformation of promising technologies into value*”. Pathak *et al.* (2013) view technology entrepreneurship as the “*propensity to create potentially new and unfamiliar technological products or services*”. Colovic and Lamotte (2015) define technology entrepreneurship as “*the creation of new firms that develop or use new technologies*”. It was acknowledged that existing definitions of technology entrepreneurship do contribute sufficiently to the understanding of “*the ultimate outcome of technology entrepreneurship; the target of the ultimate outcomes; the mechanism used to deliver the ultimate outcomes; or the nature of the*

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*interdependence between technology entrepreneurship and scientific and technological advances”* (Bailetti, 2012).

Distinctive characteristics of technology entrepreneurship relative to economics, entrepreneurship and management include the interdependence between scientific and technological change; the application of technology entrepreneurship to firms with different size and age; the interdependence between technology entrepreneurship and the resource-based view of sustainable competitive advantage and the theory of the firm (Bailetti, 2012). Shane and Venkataraman (2003) suggest that in contrast to mainstream entrepreneurial activities, technology entrepreneurship *“has strong intellectual links to technology management”*. Barr *et al.* (2009) stress that technology entrepreneurship education creates specific challenges stemming from its greater reliance on existing and emerging technologies as a learning base. Hsu (2008) argues that the innovation-based nature of technology entrepreneurship may be a barrier to entry and this distinguishes technology entrepreneurship from other forms of entrepreneurial entry.

Bahrami and Evans (1995) suggest that universities and research institutes are a key component of environments conducive to technology entrepreneurship such as Silicon Valley. Universities and research institutes produce pre-commercialization stage technologies and train engineers who may become entrepreneurs and professionals in new technology ventures (Bahrami and Evans, 1995). Barr *et al.* (2009) emphasize that graduate education for scientists and engineers should provide skills in technology entrepreneurship and the commercialization of technology. They acknowledge that as a result of the gap between research and commercial application (referred to as the “valley of death”) entrepreneurial opportunities may remain unexploited. The technology entrepreneurship education may train students to bridge the “valley of death” by increasing students’ skills in technology entrepreneurship.

### **3. Desirability of Entrepreneurship**

Since founding a new business is associated with uncertainty and ambiguity, some authors have adopted cognitive models for understanding new venture formation (Forbes, 1999). Entrepreneurial cognition encompasses *“the knowledge structures that people use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth”* (Mitchell *et al.*, 2002). Cognition literature emphasizes the role of perceptions, intentions, attitudes, beliefs and other cognitive factors that precede or accompany the entrepreneurial decision. In circumstances of uncertainty and ambiguity, cognitive factors are suggested to be especially relevant for understanding human behaviour (Forbes, 1999). It was recognized that cognitive approach includes the strengths and overcomes the deficiencies of traits, demographic and behavioural approaches to researching entrepreneurship (Robinson *et al.*, 1991). Cognitive approach represents *“a theoretically rigorous and empirically testable approach”* (Mitchell *et al.*, 2002) that may contribute to greater understanding of the role entrepreneur particularly in

the early stages of entrepreneurial process. Forbes (1999) argue that cognitive factors have “*more direct and immediate*” impact in new ventures in comparison with large, established organizations because new ventures are usually created under condition of uncertainty and ambiguity (Forbes, 1999). Grégoire *et al.* (2011) found that the literature on entrepreneurial cognition investigates the representation and attributes of cognitive constructs, the origins and antecedents of cognitive constructs, and the use and consequences of these constructs.

The attitudinal variable desirability of entrepreneurship is included in theoretical models of entrepreneurial intentions (Shapero and Sokol, 1982; Krueger *et al.*, 2000; Krueger and Brazeal, 1994; Schlaegel and Koenig, 2014). Desirability of entrepreneurship is defined as the perceived attractiveness of starting a business (Krueger *et al.*, 2000). According to the Shapero and Sokol’s (1982) model desirability of entrepreneurship is a key determinant of entrepreneurial intentions. The higher level of desirability of entrepreneurship is associated with higher likelihood of starting a new venture. Drawing on meta analytic test of competing models of entrepreneurial intentions, Schlaegel and Koenig (2014) demonstrate that other determinants are transformed into entrepreneurial intentions through an individual’s desirability of entrepreneurship. The understanding of the antecedents of perceived desirability of entrepreneurship may contribute to predict entrepreneurial intentions and behaviour (Noja and Cristea, 2018).

Several empirical studies explore the antecedent of desirability of entrepreneurship. Empirical evidence suggests that antecedents of desirability of entrepreneurship include gender (Veciana *et al.*, 2005; Dabic *et al.*, 2012), entrepreneurship education, positiveness of prior entrepreneurial experience (Peterman and Kennedy, 2003), and perceived family support (Shen *et al.*, 2017). These studies focus on desirability of entrepreneurship in general and there is a lack of understanding particularly about antecedents of desirability of technology entrepreneurship.

#### **4. Entrepreneurship Education**

A large number of factors in industrialized countries in Europe and USA contribute to increasing interest in entrepreneurship among policy makers including high unemployment rates, economic recession and fluctuations in international trade cycles (Garavan and O’Cinneide, 1994). Gibb and Cotton (1998), cited in Henry *et al.* (2005), stress that increasing uncertainty and complexity at various levels requires entrepreneurial response by individuals. Entrepreneurship education “*represents a fundamental change in ways of thinking about business, life, and the environments in which people and ventures operate*” (Morris *et al.*, 2001). Traditional business educational programs are focused on established organizations and quantitative and corporate techniques, while entrepreneurship education is focused on small or new ventures and the acquisition of creative skills, imagination, and risk-taking (Jones, 2007; Son *et al.*, 2013; Son and Noja, 2013).

Various definitions have been proposed in the literature. Béchard and Toulouse's (1998) definition of entrepreneurship education emphasizes that it encompasses formalized teachings aimed at promoting entrepreneurship awareness, new venture creation, small business development, or training for trainers. The definition provided by Jones and English (2004) stresses the role of entrepreneurship education for development of the ability for recognition of entrepreneurial opportunities and the necessary mindset, knowledge and skills to pursue them. Hindle's (2007) definition suggests that entrepreneurship education is "*the transfer of knowledge about how, by whom and with what effects opportunities to create future goods and services are discovered, evaluated and exploited*". The objectives of entrepreneurship education reflected in the existing definitions may include creating or increasing entrepreneurial attitudes, spirit and culture among individuals and in the general community, new venture creation and job creation, contribution to the community by helping local entrepreneurs to form and grow, imparting of entrepreneurial skills among individuals (Mwasalwiba, 2010).

Although the impact of entrepreneurship education is an important issue for various stakeholders such as donors, educators and policy makers (Mwasalwiba, 2010), the existing scientific knowledge about the impact of entrepreneurship education is very limited (Fayolle and Gailly, 2009). The scientific research on the impact of entrepreneurship education is significantly complicated by the large heterogeneity of entrepreneurship education programs at university level, the challenges related to the choice of adequate measurement indicators, and the appropriate timing of the measurement (Fayolle and Gailly, 2009). In addition, various factors such as the institutional context, the nature of the audience, the local culture, etc. might have moderating effects on the impact of entrepreneurship education (Fayolle and Gailly, 2009). Positive effects from entrepreneurship education may include self-employment and ability to act as an independent operator of a venture, personal and career satisfaction, knowledge and understanding acquisition, skills acquisition, identification of individual potential, changed attitudes, economic objectives (Falkäng and Alberti, 2000). Mwasalwiba (2010) identify attitudes as a key indicator for impact assessment of entrepreneurship education. Falkäng and Alberti (2000) stress that entrepreneurship education should be conducive for the development of students and their own identities in the light of their learning experiences.

Research on entrepreneurship education demonstrates that entrepreneurial intentions among students are positively associated with entrepreneurship education (Martin, McNally and Kay, 2013; Dickson, Solomon and Weaver, 2008; Pittaway and Cope, 2007). In contrast to other measures of the impact of entrepreneurship education commented in the literature, entrepreneurial intentions have been continually tested in the empirical research (Maritz and Brown, 2013). Due to the large volume of empirical research on entrepreneurship education - entrepreneurial intentions link and the generated ambiguous findings, several authors have undertaken qualitative and quantitative reviews of the research on this topic (Bae *et al.*, 2014; Dickson *et al.*, 2008; Martin *et al.*, 2013). Bae *et al.* (2014) perform a meta-analysis of 73

studies with a total sample size of 37285 individuals and demonstrate a small significant correlation between entrepreneurship education and entrepreneurial intentions ( $r = 0.143$ ), which is greater than the correlation between business education and entrepreneurial intentions ( $r = 0.51$ ). The correlation coefficient between entrepreneurship education and entrepreneurial intentions is not significant after controlling for pre-education intentions, which indicates the presence of a selection effect. Individual student differences and attributes of entrepreneurship education (duration of entrepreneurship education and specificity of entrepreneurship education) have no significant impact on the relationship between entrepreneurship education and entrepreneurial intentions.

Dickson *et al.* (2008) analyze peer-reviewed research published between 1995 and 2006 in scientific journals and proceedings in order to explore the relationship between general education and specific forms of entrepreneurship education and various entrepreneurial activities. They identify 6 studies that demonstrate a positive correlation between entrepreneurship education and entrepreneurial intentions. Drawing upon human capital theory, Martin *et al.* (2013) conduct a quantitative review of the literature on entrepreneurship education and training and human capital assets and entrepreneurship outcomes based on 42 independent samples ( $N=16657$ ). They find a statistically significant correlation between entrepreneurship education and entrepreneurial intentions ( $r = 0.137$ ). Empirical research also demonstrates that entrepreneurship education is associated with entrepreneurship-related human capital and entrepreneurial behaviour. The quantitative review performed by Martin *et al.* (2013) reports a significant positive relationship between entrepreneurship education and training and entrepreneurship-related human capital assets such as entrepreneurship-related knowledge and skills and positive perceptions of entrepreneurship, entrepreneurship outcomes in general, start-up and entrepreneurial performance. Rideout and Gray (2013) review the empirical research on the outcomes of university-based entrepreneurship education taking explicitly into account the methodological rigor of the included empirical studies by applying the Storey's (2000) six steps to entrepreneurship education evaluation validity.

Several rigorous empirical studies confirm the link between entrepreneurship education and entrepreneurial behaviour (Kolvereid and Moen, 1997; Charney *et al.*, 2000; Menzies and Paradi, 2002), entrepreneurial capabilities (Thursby *et al.*, 2009), entrepreneurial competencies (Sanchez, 2011), and opportunity identification (DeTienne and Chandler, 2004). Although significant research attention has been devoted to the impact of the participation in entrepreneurship education on entrepreneurial intentions, its impact on desirability for technology entrepreneurship and technopreneurial intentions is less clear.

## **5. Research Methodology**

STEM students are selected for the empirical analysis because they exhibit the potential to start technology ventures (Souitaris *et al.*, 2007). A survey was

administrated to students in science or engineering majors in 15 Bulgarian universities in 2015 and 2016. A quota sampling technique was adopted for data collection. The students in the database are enrolled in various study fields such as communication and computer equipment, informatics and computer sciences, biotechnologies, electrical engineering, electronics and automation, power engineering, transport, navigation and aviation, general engineering, biological sciences, chemical sciences, chemical technologies, architecture, construction and geodesy, earth sciences, minerals prospecting, extraction and processing, mechanics, energetics, food technologies. Students enrolled in the study fields of social sciences, humanities, medicine, national security and military science were excluded from the survey.

The questionnaire used in the study includes questions, which requested a broad array of information related to demographic characteristics of respondents, entrepreneurial intentions, attitudes toward entrepreneurship, entrepreneurial behavior, and entrepreneurship education. In a short introduction about the aims of the survey in the questionnaire technology entrepreneurship is defined as the creation of a new technology-based business while technology-based business is described as a business whose products or services depend largely on the application of scientific or technological knowledge (Allen, 1992). The collected database includes 1061 students and has the same proportions of STEM students from the different universities as the entire population of STEM students enrolled in the selected 15 universities in the respective year, in which the survey was conducted. The sample for this study is composed of 879 STEM students, who are not nascent entrepreneurs or nascent intrapreneurs (in a process of starting a business) or established business owners or intrapreneurs (have already started a business).

Table 1 presents the characteristics of the sample. More than 76% of the respondents are undergraduate students. Female students represent less than 37% of the sample. The great majority of the respondents are full-time students. Only 23.5% of the sample consists of part-time students. Less than 29% of the respondents report that they have been / are enrolled in an entrepreneurship course within their university. Only 6.3% of the respondents participate(ed) in entrepreneurship course outside their current academic program, but within the university, while 27.1% of the respondents participate(ed) in entrepreneurship course within their bachelor or master program. About 9% of the respondents received entrepreneurship education or training outside the university. A pilot study was conducted among 15 students (8 males and 7 females) in order to pre-test the initial version of the questionnaire. Due to comments from some students, minor changes were introduced in some questions. With the approval and cooperation of rectors, deans, department heads and lecturers in 15 Bulgarian universities, a questionnaire was distributed during class sessions. Students were informed that the participation in the survey was voluntary and questionnaires were only for research purposes. In the instructions to respondents with regard to filling procedure they were advised that the instrument should be completed anonymously and that it was important to answer all questions.

**Table 1.** *Characteristics of the sample.*

Characteristics	%
Bachelor	76.7
Master	23.3
Female	36.9
Male	63.1
Full-time	76.5
Part-time	23.5
Participants in entrepreneurship course within their university	28.6
- participants in entrepreneurship course within their current academic program	27.1
- participants in entrepreneurship course outside their current academic program but within the university	6.3
Participants in entrepreneurship education or training outside the university	9.1

**Source:** *Own study.*

In order to secure a high response rate, to monitor respondents while they were answering the questionnaire, and to be able to answer further questions from respondents, one of the authors was present during the data collection in most occasions. If missing information was identified when the respondents were submitting the filled questionnaires, the respondents were politely asked to complete it. Questionnaires with missing answers were removed from the database and data collection from each university continued until the required quota fixed by the researcher was fulfilled.

The dependent variable perceived desirability for technology entrepreneurship (DESIRABILITY\_TE) reveals how desirable technology entrepreneurship is for respondents. It is measured with an index composed by 4 items measured on a 7-point Likert scale (Drennan *et al.*, 2005; Krueger, 1993; Krueger *et al.*, 2000) and takes values between 4 and 28. The scale exhibits high reliability. The Cronbach's alpha of the scale is 0.739, which exceeds significantly the minimum acceptable level of 0.6 (Hair *et al.*, 1998). Respondents, who report that the variable Perceived\_desirability\_TE takes values greater than 16, exhibit high perceived desirability of technology entrepreneurship. The rest of the respondents exhibit low perceived desirability of technology entrepreneurship. The independent variable entrepreneurship education (ENTR\_EDU) takes value 1 if the respondent participated/participates in an elective or compulsory entrepreneurship course within the university and value 0 if not.

The study employs several control variables. The variable role models (ROLE\_MODELS) takes value 1 if the respondent has at least one entrepreneur among parents, relatives, friends or acquaintances whose success gave her/him a positive impression of entrepreneurship (Walter *et al.*, 2013) and value 0 otherwise. The variable social network support (SOC\_NET\_SUP) takes value 1 if the respondent can count on support from family, partner, friends and acquaintances if s/he becomes entrepreneurs after his/her studies (Walter *et al.*, 2013) and 0 otherwise. The variable gender (GENDER) takes value 1 if the respondent is male

and value 0 if is female. The variable previous experience in a technology company (TECH\_EXP) takes value 1 if the respondent has previous professional experience in a technology company. The variable age (AGE) measures the age of the respondents in number of years. The variable perceptions of environment (PERC\_ENV) indicates whether the respondent perceives the environment as favorable for operating a business. Taking into account the objectives of this study and the properties of the data, we apply a linear regression for data analysis (Greene, 1997). The data analysis is performed with the statistical package SPSS, version 25.

## 6. Empirical Results

More than 65% of the students in the present study exhibit high desirability of technology entrepreneurship, which is in sharp contrast with the low level of desirability of entrepreneurship (34%) among the general population in Bulgaria (Amway Global Entrepreneurship Report, 2016). The share of respondents reporting high perceived feasibility is 21.6%, which is similar to the share of the general population exhibiting feasibility of entrepreneurship in Bulgaria as indicated in the Amway Global Entrepreneurship Report (2016).

Table 2 contains the results of a linear regression with DESIRABILITY\_TE as a dependent variable. As a check on multicollinearity, the variance of inflation factor (VIF) is used. The VIF indicates that there are no serious multicollinearity problems, as they are all well within the acceptable limits (less than 2). The variable ENTR\_EDU has a significant positive effect on the dependent variable after controlling for other individual characteristics. Students who participated/participate in an elective or compulsory entrepreneurship course within the university exhibit higher desirability of technology entrepreneurship. The control variables ROLE\_MODELS and SOC\_NET\_SUP have positive and significant coefficient, while the variable AGE exhibit negative and significant coefficient. Respondents who report that there is least one entrepreneur among parents, relatives, friends or acquaintances whose success gave her/him a positive impression of entrepreneurship also exhibit higher desirability of technology entrepreneurship. Respondents, who can count on support from family, partner, friends and acquaintances if she/he becomes entrepreneur after her/his studies demonstrate higher desirability of technology entrepreneurship. The variables TECH\_EXP, PERC\_ENV, and GENDER have no significant effect on the dependent variable.

**Table 2.** Linear Regression Analysis

Variable	Coefficient (Standard error) <sup>a</sup>
Constant	19.13 (0.79)***
TECH_EXP	-0.07 (0.17)
ROLE_MODELS	0.94 (0.33)***
SOC_NET_SUP	0.78 (0.34)**
PERC_ENV	0.21 (0.48)
GENDER	0.26 (0.33)

Variable	Coefficient (Standard error) <sup>a</sup>
AGE	-0.08 (0.03)***
ENTR_EDU	0.58 (0.35)*
Adjusted R-squared	0.024
F-statistics	4.019

<sup>a</sup> \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Source:* Own study.

## 7. Discussion and Conclusions

It was acknowledged that knowledge-based entrepreneurship is an engine for economic growth, employment generation and competitiveness in an entrepreneurial society (Audtersch, 2009). Increasing interest by academics and policy makers is devoted particularly to technology entrepreneurship for its significant contribution to economic progress (Mosey *et al.*, 2017). Students are an important source of entrepreneurs in the knowledge society (Veciana, 1998, cited in Veciana *et al.*, 2005), while universities are seen as “*natural incubators*” of entrepreneurs (Etzkowitz, 2003) and an ideal setting for research on technology entrepreneurship, which involves different levels of analysis (Mosey, 2016; Mosey *et al.*, 2017). Universities need to operate more entrepreneurially and to create favourable conditions for entrepreneurship among students and academics (Kirby, 2006). The provision of entrepreneurship education at university level is an important factor for stimulating and preparing future entrepreneurs.

This study examines the role of entrepreneurship education for the development of desirability of technology entrepreneurship among STEM students in 15 Bulgarian universities. The present study attempts to fill several research gaps identified in the literature on technology entrepreneurship and entrepreneurship education. The focus on pre-venture processes in technology entrepreneurship such as the formation of technopreneurial attitudes addresses the need for more research explaining why some people create new technology ventures (Shane and Venkataraman, 2003). In terms of research methodology, this study is based on a large sample of university students in STEM majors and utilizes statistical methods to examine the effects of entrepreneurship education on technopreneurial attitudes and intentions addressing the need for more comparative studies on technology entrepreneurship employing statistical methods (Zhang *et al.*, 2008). The study responds also to the calls for more research exploring the role of entrepreneurship education particularly in the field of technology entrepreneurship (Mosey *et al.*, 2017).

The results of the present study reveal that STEM students included in the sample are an important source of potential entrepreneurs. They are more likely to exhibit high desirability of technology entrepreneurship and technopreneurial intentions than the general population as indicated in the Amway Global Entrepreneurship Report (2016) and the Global Entrepreneurship Monitor. Only about 29% of the surveyed STEM students have been / are enrolled in an entrepreneurship course at

their university, but the present study does not provide insight if the low participation in entrepreneurship education is due to a low demand of entrepreneurship education by students or a low supply of entrepreneurship courses by the universities. This study demonstrates that entrepreneurship education is positively associated with desirability of technology entrepreneurship among Bulgarian STEM students after controlling for age, gender, entrepreneurial role models, social network support, previous experience in a technology company, perceptions of environment. These findings support previous empirical evidence about the positive effect of entrepreneurship education on perceived desirability of entrepreneurship among students (Peterman and Kennedy, 2003). Other factors with positive effect on the desirability of technology entrepreneurship include role models and support from family and friends.

Before discussing the implications of the findings, some limitations of the study should be noted. First, this study uses a convenient sample of STEM students enrolled in 15 Bulgarian universities accredited to provide undergraduate and postgraduate education in the field of STEM, while students from other accredited universities providing such education are not included in the sample. Therefore, the findings should be interpreted with caution. Second, data was collected through a self-reported survey and thus may be subjected to cognitive biases and errors. Third, the findings may be influenced by specific features of the Bulgarian cultural and institutional environment and therefore may not be applicable to other contexts and economies. Next, individual factors such as entrepreneurial role models among family and friends, previous experience, willingness to take risks, support from social network, etc., which may influence technopreneurial attitudes and intentions are not included in the analyses. Finally, due to the cross-sectional design of the research causal relationships cannot be deduced.

In order to enhance the understanding of the impact of entrepreneurship education on technopreneurial attitudes and intentions, future research needs to examine the following aspects. Future research should provide greater insights about effects of the participation in entrepreneurship education and the educational variables such as the content, pedagogical methods and learning from entrepreneurship education on technopreneurial intentions and attitudes of STEM students controlling for individual differences related to presence of entrepreneurial role models, previous experience, gender, support from social network, etc. Future research should also examine to what extent the findings of this study can be generalized to students in other fields of study and to students in other contexts and countries. It is important to identify the most important barriers to starting a technology venture perceived by STEM students in order to be able to devise appropriate support measures. A longitudinal analysis should complement the findings in this research in order to confirm causal relationships.

The empirical results presented in the study have several practical implications for higher education institutions and policy makers. Greater emphasis should be placed

on entrepreneurship education for STEM students in Bulgarian universities. Entrepreneurship education has a significant positive impact on technopreneurial attitudes and intentions and therefore should be offered to all graduate and undergraduate STEM students in Bulgarian universities. Entrepreneurship courses should be included at least as elective courses in STEM graduate and undergraduate programs. In addition, following Davidsson (1995), we recommend an entrepreneurial perspective to be introduced in other courses as well. The content and pedagogical methods of entrepreneurship education at university level should be oriented to enhancing students' desirability and feasibility for technology entrepreneurship and their technopreneurial intentions. Business faculties should provide doctoral programs in entrepreneurship in order to train a future generation entrepreneurship academics who will be capable of using up-to-date methods in entrepreneurship education.

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