

# Gendered personality traits and entrepreneurial intentions: insights from Information Technology education

## Abstract

**Purpose:** Entrepreneurial intention of students is frequently used in entrepreneurship research as an indicator of creativity, innovativeness and entrepreneurial mindset. The entrepreneurship courses offered by engineering disciplines do not always have the expected outcomes, while differences are observed on students' entrepreneurial intention. These differences sometimes stem from the stereotypical beliefs about Entrepreneurship, in favor of masculinity. Although these anachronistic perceptions gradually fade in the society, personality traits attributed to 'traditional' gender schemas still have an impact on students' career choices, especially in academic fields considered 'masculine', such as Information Technology. The purpose of this paper is to examine the impact of gender-typed personality on students' entrepreneurial intentions and identify differences between genders.

**Methodology:** The impact of gender-typed personality traits on students' entrepreneurial intention is examined using Gender Schema Theory and the Theory of Planned Behavior based on a sample of 321 university students of Information Technology. Structural equation models are used for the investigation of causal effects and group differences.

**Findings:** The results indicate significant interaction of gender-typed personality traits on the entrepreneurial intentions for both male and female students. However, no significant differences were found in the perception of gender schemas between males and females, which clearly suggests that the attribution of these traits to a specific gender nowadays is false.

**Originality:** The results offer convincing explanation of the differences observed in entrepreneurial intentions between the two genders and have both theoretical and practical implications for entrepreneurship education.

**Keywords** Entrepreneurial intention, Entrepreneurship education and training, Gender schemas, Masculinity, Femininity, Personality

## Introduction

Entrepreneurial activity is beneficial for economic prosperity and employment and therefore, it attracts academic and governmental interest (O'Connor, 2013). The entrepreneurial mindset is considered a "must have" attitude for the engineers of the 21st century. Entrepreneurial aspirations complement abilities and attitudes, resulting into concentrated effort towards entrepreneurial startup (Ács and Szerb, 2007). The entrepreneurial mindset and entrepreneurial aspirations of students are mainly operationalized in the form of entrepreneurial intentions (EI) gaining considerable momentum in the last decades and great effort has been devoted, in the investigation of individual and environmental factors influencing ones' intentions towards entrepreneurship (Liñán and Fayolle, 2015). Social behaviors, such as entrepreneurship are successfully explained by the Theory of Planned Behavior (TPB) (Ajzen, 1991).

Many studies in the existent literature examine the impact of various personality factors on EI (Ferreira *et al.*, 2012; Mueller and Conway Dato-on, 2013), whereas others examine EI, using broader frameworks, such as the Big Five (Brandstätter, 2011; Zhao *et al.*, 2010). Personality traits faced some criticism, regarding their predictive ability on EI (Kautonen *et al.*, 2015), especially in different contexts. Nevertheless, they were brought back in the foreground by a number of meta-analyses suggesting that certain personality traits exert significant variance in the prediction of entrepreneurial behavior (Brandstätter, 2011; Zhao *et al.*, 2010). Although, gender differences are probably the most investigated topic of EI research (Liñán and Fayolle, 2015), and previous research has highlighted that gender moderates the effect of perceived barriers on EI, yet the effect is not consistent across different cultures (Shinnar *et al.*, 2012). On the other hand, although there is evidence that gender role stereotypes and gender identification are related to career choices and EI, studies examining the effect are still limited (Gupta *et al.*, 2009). Moreover, dimensions of personality mentally associated with biological gender, defining gender schemas (Bem, 1981), or psychological gender identities, are not included in the dominant Big Five model (Paunonen and Jackson, 2000) and several researchers call for further investigation on their impact on entrepreneurship (Karimi *et al.*, 2014; Sweida and Reichard, 2013). Disentangling the role of gender stereotypes, has become urgent, since certain personality traits

of the entrepreneur are stereotypically associated with masculinity, throughout the existent entrepreneurship literature (Aidis and Weeks, 2016; Mueller and Dato-On, 2013). Additionally, low work context gender identification is considered the main cause of psychological pressure perceived by individuals in male dominated work environments, which makes them feel uncomfortable (Wheadon and Duval-Couetil, 2019). Therefore, it is necessary to examine if personality traits, still follow the traditional stereotypically defined gender schemas, in fields considered 'masculine', such as IT and entrepreneurship (Beyer, 2014; Nowiński *et al.*, 2019). Although IT was the keystone of entrepreneurship and innovation in the last decades, IT entrepreneurship remains understudied (Chen, 2014; Kaltenecker *et al.*, 2015) and consequently EI research in IT is limited (Chen, 2013; Da Cruz and Alvaro, 2013; Kaltenecker *et al.*, 2015). Entrepreneurship courses recently included in the IT curriculum demonstrated some ambiguities regarding their efficiency, mainly due to personality differences among participants (Doboli *et al.*, 2010). The fact that IT is stereotypically considered a 'masculine' field of studies (Beyer, 2014; Marlow and Mcadam, 2012), may explain the underrepresentation of females in the field, as well as the reduced EI of female students (Beyer, 2014).

Entrepreneurship also is stereotypically considered a 'masculine' field and entrepreneurial intentions of individuals exhibit a 'gender gap', in favor of males (Bosma, 2013). These perceptions gradually change over time, and many of the previously feminized or masculinized personality traits (e.g. 'warm', 'sensitive', 'dominant', 'willing', etc) tend to equally apply for both genders, lending support to the theory of gender equality (Hyde, 2005). Therefore, it is important to examine how these traits interact with students' EI and its antecedents, and if they still follow traditional schemas in the perceptions of male and female students? The aim of this study is to examine the differential effect of Gender-Typed Personality (GTP) traits with students' EI, building on Ajzen's (1991) Theory of Planned Behavior (TPB) in order to reveal possible interconnection with the primary motivational antecedents of the model. The findings will offer better understanding of the mechanisms through which individuals with different GTP schemas develop their EI. Moreover, possible differences in these traits between genders may shed light on the causes of underrepresentation of women, particularly in technology venturing related domains such as IT and STEM (Wheadon and Duval-Couetil, 2019), and help cover the high demand for high skilled personnel as well (Lemons and Parzinger, 2007).

The rest of the article continues with theoretical background followed by hypotheses development. Next the methodology is presented followed by discussion of the findings and conclusions for stakeholders.

## **Theoretical Background**

### *The Theory of Planned Behavior*

Intention is the mental processing taking place before exercising a specific behavior, and is considered the best predictor of the behavior compared to other psychological factors (Wu and Wu, 2008). EI is the willingness to get involved with entrepreneurship which transforms into entrepreneurial behavior given the right opportunity (Schar *et al.*, 2014). The TPB, offers a successful explanatory instrument of EI, based on three motivational antecedents (Ajzen, 1991). The first of these antecedents, personal attitude (PA), captures the beliefs of the individual regarding entrepreneurial activity, whereas, Perceived behavioral control (PBC) expresses the perception of the individual regarding the necessary capabilities in order to exercise the behavior. Finally, social norm (SN) expresses the approval or disapproval of the behavior from important others, such as family and friends (Kautonen *et al.*, 2015; Wu and Wu, 2008). Several internal or external factors may influence intentions through these three motivational constructs. The TPB is a widely used theory in psychology due to its increased predicting ability and as a consequence it receives increased recognition in EI research (Liñán and Fayolle, 2015). Several instruments developed for measuring students' EI, are based on the TPB, due to the effectiveness of the predictive model (Liñán and Chen, 2009). The TPB was used as a basis for the examination of the connection between EI and entrepreneurial behavior. The predictive ability of the TPB on subsequent startup behavior in the short term is confirmed (Kautonen *et al.*, 2015). Moreover, a Differential Item Functioning analysis on a group of Greek students concluded that the TPB constructs are almost equivalent measures at the item level for both males and females (Zampetakis *et al.*, 2017). However, (Hindle *et al.*, 2009) propose the inclusion of other influential social capital variables in existing theoretical models, for future studies to expand theoretical frontiers. The investigation of the relation between social factors, such as gender stereotyping, and TPB constructs, could offer explanation on EI differences between genders (Díaz-García and Jiménez-

Moreno, 2009). Previous use of the TPB in IT research, for the study of gender differences in technology adoption (Venkatesh *et al.*, 2000), has already highlighted that men's decisions are mostly based on PA, whereas decisions of women are mostly based on SN and PBC. Similarly, the differences observed between genders could possibly be explained with the gender schema theory (Bem, 1981) and TPB.

#### *Gender-typed personality and Entrepreneurial intention*

Personality traits are among the most investigated factors in entrepreneurship research (Brandstätter, 2011) and certain types of character are recognized to be more suitable for entrepreneurial career than others (Ferreira *et al.*, 2012; Mueller and Conway Dato-on, 2013). Although personality traits alone, are not capable of statistically predicting entrepreneurial intention (Kaltenecker *et al.*, 2015), they are predictors of entrepreneurial success (Leutner *et al.*, 2014). Entrepreneurial personality related traits reside into one or more dimensions of the Big Five. However, gender-typed (masculinized and feminized) traits constitute personality dimensions outside this palette (Pauunonen and Jackson, 2000). A number of recent studies on the effect of gender-typed personality traits, found significant impact on EI (Goktan and Gupta, 2013; Shneor *et al.*, 2013). According to gender schema theory, the individual tends to conform with gender roles, orientations or identities set by their social environment. The association of personality traits with gender, results from "the structure of social relations that centers on the reproductive arena, ... bringing reproductive distinctions between bodies into social processes" (Connel, 2002). Simply put, gender schemas are common mechanisms of cognitive processing shared among individuals with common background or experience, that define gender role stereotypes based on biological gender (Lemons and Parzinger, 2007). Although modern gender theories support the similarity of gender characteristics (Hyde, 2005), occupational preferences are frequently shaped according to gender stereotypes and therefore many occupations are considered either 'masculine' or 'feminine' (Sinclair and Carlsson, 2013), affecting occupational opportunities for females (Hyde, 2005). This kind of occupational designation is explained by androcentric causal attributions people make, based on the traditional male point of view, which often result in uncomfortable or hostile behaviors towards individuals deviating from the standard (Lemons and Parzinger, 2007). Engineering, and entrepreneurship, are traditionally associated with masculinity. Kelley and Bryan, (2016) provide evidence that female students who perceive engineering as a masculine field, seek study fields with more females in order to feel more comfortable. Those among engineering students, who consider Computer Science (CS) as 'masculine', are less likely to choose it as a field of studies. Similarly, although the relation between gender schemas and entrepreneurial self-efficacy varies by time, and the formation of EI is similar for males and females (Santos *et al.*, 2016), individuals with high masculine schemas seem to cope better with venture creation tasks (Mueller and Conway Dato-on, 2013). Accordingly, the underrepresentation of women in CS majors denotes a mismatch between personality traits and the masculinized orientation of the field (Beyer, 2014; Lemons and Parzinger, 2007).

Although, stereotypical perceptions about entrepreneurship are fading over time, disparities observed on the occupational choices of male and female students (Gupta *et al.*, 2009; Perez-Quintana *et al.*, 2017), resulting in a 'gender gap' regarding the entrepreneurial career path (Mueller and Conway Dato-on, 2013). These disparities materialize in EI differences between the two genders, in favor of male students (Nowiński *et al.*, 2019; Westhead and Solesvik, 2016). Thus, it is hypothesized that:

H1: There is a considerable difference in EI between male and female IT students. Males demonstrate higher levels of EI than female students.

Previous studies examining the impact of gender-typed personality on business students' EI (Goktan and Gupta, 2013) claim that androgynous (high masculine / high feminine) GTP exerts the most influential effect for both males and females. Many studies conclude that an ideal combination of masculinized and feminized GTP traits can foster EIs of both males and females (Perez-Quintana *et al.*, 2017; Díaz-García and Jiménez-Moreno, 2009; Goktan and Gupta, 2013). For example, stereotypically feminized traits, related to creativity and imagination are essential for the entrepreneurial activity early in venture creation process, whereas masculinized traits are required later during implementation tasks (Mueller and Conway Dato-on, 2013). However, Gupta *et al.*, (2009), examining a sample of business students from three countries concluded that males and females engagement with entrepreneurship was moderated by their perceived identification with masculine personality traits, whereas feminine traits had no significant impact. Regarding technology sectors, the extremely low levels of EI among female engineering students reported by previous research, in contrast to other majors (Jin *et al.*, 2016), could

indicate a possible mismatch between students' actual GTP traits and those socially acceptable for the entrepreneurial career. In male dominated fields like STEM and IT, gendered stereotypes could possibly reproduce specific normative beliefs in favor of masculinity (Lemons and Parzinger, 2007; Nowiński *et al.*, 2019; Veelen *et al.*, 2019). As a consequence, the examination of the relations between GTP traits and students' EI could offer insights of underlying connections of technology entrepreneurship with stereotypical beliefs. Therefore, following Gupta *et al.*, (2009), it is hypothesized that:

H2a: Masculinized GTP traits are positively related to IT students' EI

H2b: Feminized GTP traits are negatively related to IT students' EI

Despite the interdisciplinary research interest in EI, (Liñán and Fayolle, 2015), the number of EI specific studies in the field of IT is limited (Kaltenecker *et al.*, 2015). A considerable part of the existing literature on IT entrepreneurship, examines specific Information Systems related to constructs and entrepreneurial intentions of students. For example, Chen, (2014) found significant effects of computer self-efficacy and personal innovativeness in IT on EI, whereas Dutta *et al.*, (2015) found significant relations of personal innovativeness in technology on EI. Although gender differences are evident in entrepreneurship literature, little attention is given to these differences in intentions to become entrepreneurs in the field of IT (Karimi *et al.*, 2014; Venkatapathy and Pretheeba, 2014). Recent studies among IT students, highlighted a 'gender gap' in their EI (Shneor *et al.*, 2013; Millman *et al.*, 2010), whereas personality and stereotypes, offer possible explanation for the underrepresentation of women in IT courses (Beyer, 2014). Stereotypical perceptions claiming that men are more pre-disposed towards entrepreneurship, raise implicit barriers in the form of social capital deficiency, especially for women in technology entrepreneurship (Sitaridis and Kitsios, 2019). These barriers prevent individuals and especially women from seeking occupation in male dominated contexts (Wheadon and Duval-Couetil, 2019). These barriers conceived as a form of psychological threat due to gender identification mismatch with the field, have proved to play an important role on career choices, especially in masculine work environments such as STEM and IT. Women in STEM, for example, experience high levels of gender identity threat (Veelen *et al.*, 2019). Contrary to theoretical gender equality (Hyde, 2005), research of Lortie *et al.*, (2017) on a sample of entrepreneurs, shows that males and females differ in terms of intentions due to preexisting differences in gender schemas-identities. However, previous research on IT students has found that female students share higher non-traditional gender schemas compared to males and both males and females from the general population, meaning they have high opinion on their abilities and privileges, (Lemons and Parzinger, 2007). Thus, it is hypothesized that males and females in IT share similar gender schemas:

H3: Gender schemas due to stereotypical perceptions of gender are not significantly different between male and female IT students

A few of the limited number of studies examining gender differences report insignificant differences in EI between the genders (Mohd *et al.*, 2015; Yaghoubi Farani *et al.*, 2017), and only a number of studies found significant differences using the theoretical framework of the TPB (Kaltenecker *et al.*, 2015; Sitaridis and Kitsios, 2017). Shneor *et al.*, (2013), using the TPB framework identified significant differences in the effect of gendering students' perceptions (in terms of sex-culture interaction) with EI between masculine and feminine cultures, however they did not find any impact on the TPB antecedents. In this study we follow the suggestion of Hindle *et al.*, (2009) that more 'informed' models of entrepreneurial intentions are needed in future research to highlight the paths through which social influences act and justify EI differences. Since the decisions of individuals are based on informed inputs from the micro and macro social environments, and social capital related variables such as GTP schemas transfer the social valuations regarding entrepreneurship (Santos *et al.*, 2016), they potentially shape students' EI through their impact on the motivational TPB variables. Then, it is hypothesized that:

H4: GTP traits act as informed inputs from the social environment on IT students' EI. As such, they have an influence on the three antecedents of EI, namely SN, PA, PBC (H4a). The effect of GTP on EI is mediated through these three constructs (H4b).

## Research Methodology

### Method and measures

An invitation to participate was sent by email to 957 University students of Information Technology using convenience sampling. The invitation email included a cover letter about the nature and significance of the research, anonymity and privacy protection precautions, as well as a link to the survey. A total of 326 anonymous responses were received, resulting in 321 usable questionnaires.

The short version of Bem's Sex-Role Inventory (BSRI) was used for measuring the GTP constructs (Colley *et al.*, 2009; Zampetakis *et al.*, 2016). The instrument was originally developed for the study of gender schemas using a list of personality items stereotypically compiled as masculine or feminine (Bem, 1974). The participants were asked to rate themselves on each item associated with masculinity, as well as on items associated with femininity. For the measurement of the TPB constructs, the Entrepreneurial Intention Questionnaire scales were utilized by Liñán and Chen, (2009). For the measurement of the social pressure towards entrepreneurship from the close social environment, 3 items were used from SN scale, whereas, for the measurement of the desire to get involved with entrepreneurship and the perceived personal capability of exercising the behavior 4 items from PA scale and 5 items from PBC scale were used respectively. For the measurement of EI, a 5 items scale was used. All questionnaire items, shown on Table V in the Appendix, were rated on a 5 point Likert scale between (1) "Fully disagree" and (5) "Fully agree". Control variables included age, year and level of studies, since students develop stronger entrepreneurial intention at end of their studies (Parker, 2009), and parental role models as entrepreneurs. A factor analysis was conducted to ascertain that the latent factor structure meets the theoretical basis, and structural equation models (SEM) were used for hypotheses testing, using EI as the dependent variable. SEM offers the ability to examine the relations between measured variables and latent factors, the structural properties of the empirical model, and indirect effects (Hair *et al.*, 2009).

### Results

Genders were almost equally represented in the sample, with 51.7% male and 48.3% female students. Most of the respondents were undergraduates (74.1%), between 18 and 24 years old (73.8%).

In order to examine the hypotheses put, a six factor analysis solution was chosen a priori (Hair *et al.*, 2009), including the four TPB constructs and two GTP factors, namely MGTP for masculinized personality traits and FGTP for feminized personality traits, with acceptable amount of cumulative variance (58.1%) produced. The rest of the items loaded, as expected, on the corresponding TPB constructs. Item GTP12 was removed due to low communality. The reliability of the all factors shown on Table I, exceeds the minimum required Cronbach's  $\alpha > 0.7$  (Hair *et al.*, 2009).

**Table I.** Factor analysis

Factor	Item	Loadings	Cronbach's $\alpha$ /AVE	Eigenvalues	Cumulative Variance
PBC	PBC4	0.864	0.84/0.51	7.743	30.9
	PBC2	0.744			
	PBC5	0.733			
	PBC3	0.604			
INT	PBC1	0.558	0.92/0.70	2.875	42.0
	INT4	0.965			
	INT1	0.872			
	INT3	0.831			
SN	INT2	0.657	0.88/0.64	2.160	51.1
	SN2	0.895			
	SN4	0.842			
	SN3	0.748			
MGTP	SN1	0.701	0.82/0.47	1.917	58.7
	GTP3	0.817			
	GTP4	0.764			
	GTP9	0.688			
PA	GTP5	0.643	0.86/0.55	1.676	65.5
	GTP10	0.507			
	PA4	0.920			
	PA2	0.847			
	PA3	0.676			

	PA1	0.435			
	GTP8	0.956			
	GTP6	0.734			
FGTP	GTP11	0.506	0.77/0.42	0.986	69.2
	GTP7	0.502			
	GTP2	0.402			

Notes: ML estimation., Promax (KMO=0.872, Bartlett's  $p < 0.001$ )

The sample exceeded the minimum size requirements and the assumption for normality was met on the basis of moderate data skewness and kurtosis within the recommended  $\pm 1.5$  value range (Schumacker and Lomax, 2010). A Harman's common factor test conducted indicated that only 30.97% of variance was explained by the common factor, ensuring that the variance extracted by the model was not attenuated by common method variance (Podsakoff *et al.*, 2003).

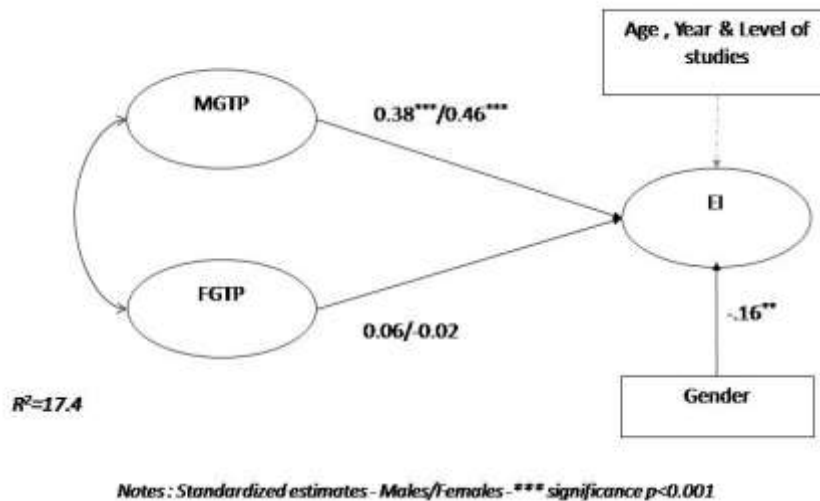


Figure 1. Model 1 - The partial model

SEM requires a minimum number of fit indices to be reported by researchers in order to evaluate measurement and structural model fit. Fit indices should include at least  $\chi^2/df$  as an absolute fit measure, CFI or TLI for incremental fit, and RMSEA/SRMR in order to compensate for  $\chi^2$  tendency to reject models with a large number of observations. Parsimony fit measures such as PNFI should be also reported (Hair *et al.*, 2009).

Table II. Fit indices

Model		$\chi^2(df)$	$p$	CFI	RMSEA	PNFI	SRMR
Model 1.a	Measurement	415.28 (219)	<0.01	0.95	0.04	0.74	
Model 1.b	Structural.	604.15 (318)	<0.01	0.96	0.03	0.71	0.064
Model 2.a	Measurement	481.78 (306)	<0.01	0.96	0.04	0.79	
Model 1.a	Structural	1311.1 (918)	<0.01	0.96	0.03	0.70	0.056
<b>Rules of thumb</b>		$\chi^2/df < 3$	<i>n.s</i>	$>0.92$	$<0.07$	$>0.5$	$<0.08$

A base model was implemented first, including EI, MGTP and FGTP constructs. In Fig. 1, the standardized regression coefficients of the hypothesized paths between main variables are shown. The measurement model (Model 1.a) exhibited substantial fit to the data, therefore a structural model was next implemented, including control variables (Model 1.b), which not only maintained but increased fit based on the fit measures shown on Table II (Hair *et al.*, 2009).

Based on the estimates on Table III, Gender has a negative effect ( $b=-0.16^{**}$ ) on students' EI, lending support to hypothesis H1, meaning that female students show significantly reduced levels of EI compared to male students. Hypothesis H2a is also supported by the positive path coefficient ( $b=0.42^{***}$ ) on the effect of MGTP on EI. Contrary though, hypothesis H2b is not supported, due to the statistically insignificant effect of FGTP on EI ( $b=0.01, n.s.$ ).

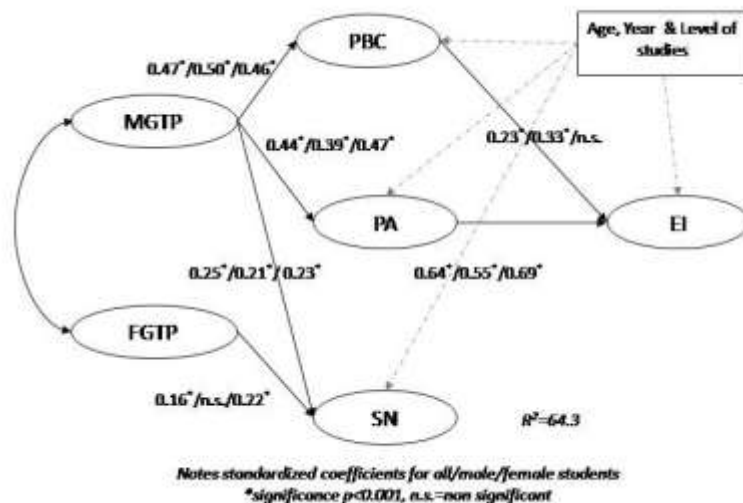
**Table III.** Model 1-Estimates

		B	SE	CR	b
Male	MGTP	.48 <sup>***</sup>	.11	4.14	.38 <sup>***</sup>
	FGTP	.08	.11	.72	.06
Female	MGTP	.56 <sup>***</sup>	.11	5.41	.46 <sup>***</sup>
	FGTP	-.03	.11	-.24	-.02
All	MGTP	.52 <sup>***</sup>	.08	6.63	.42 <sup>***</sup>
	FGTP	.02	.08	.25	.01
	Gender	-.35 <sup>**</sup>	.13	-2.83	-.16 <sup>**</sup>

Notes: Outcome variable = EI  
b= standardized coefficient, \*\*\* p<0.001, \*\* p<0.01

The configural invariance  $\chi^2$  difference test of Model 1 between gender groups, did not result in statistically significant difference ( $\Delta\chi^2=0.16, df=2, p=0.923$ ). The path coefficients difference between males ( $b=0.38^{***}$ ) and females ( $b=0.46^{***}$ ), which was not statistically significant ( $\Delta\chi^2=0.29, df=1, p=0.59$ ), indicated that the impact of MGTP on students' EI, was equally strong for female and male students. This finding shows that hypothesis H3 is probably valid, which will be further examined using difference of GTP means in the full model.

When PBC, ATT and SN entered the equation, the measurement model (Model 2.a) exhibited adequate fit to the data (Hair *et al.*, 2009), therefore a structural model with control variables was implemented, (Model 2.b), for hypotheses testing. However, items PA1, INT3 and GTP2 were removed to improve metric invariance due to  $\chi^2$  difference between unconstrained and fully constrained factor loadings model ( $\Delta\chi^2=42, df=27, p=0.033$ ).



**Figure 2.** Model 2 - The full model

The structural model (Model 2b) illustrated in Fig. 2, including only the statistically significant paths for clarity, had excellent fit based on the measures shown on Table II (Hair *et al.*, 2009) and increased produced variance ( $\Delta R^2=46\%$ ). Although minor differences were observed in structural weights between male and female students, no statistically significant  $\chi^2$  difference was found between the

unconstrained and the constrained structural weight models ( $\Delta\chi^2=29,798$ ,  $df\ 24$ ,  $p=0.192$ ). No direct causal relation was detected between the GTP constructs and EI, in the presence of PBC, PA and SN, as both path coefficients became statistically insignificant based on the estimates shown on Table IV.

**Table IV.** Model2-Estimates

		B	SE	CR	b
Male	MGTP → EI	.028	.100	.280	.023
	FGTP → EI	.016	.075	.216	.014
	PBC → EI	.401	.136	2.956	.334***
	SN → EI	-.096	.104	-.920	-.062
	PA → EI	.611	.102	5.994	.554***
	MGTP → SN	.159	.069	2.300	.204**
	MGTP → PBC	.489	.091	5.379	.489***
	MGTP → PA	.412	.099	4.158	.378***
	FGTP → SN	.066	.076	.869	.067
	FGTP → PBC	.101	.063	1.612	.132
	FGTP → PA	.097	.088	1.101	.090
	Female	MGTP → EI	.072	.091	.795
FGTP → EI		-.154	.086	-1.796	-.115
PBC → EI		.163	.113	1.441	.122
SN → EI		.034	.072	.479	.031
PA → EI		.787	.102	7.693	.690***
MGTP → SN		.252	.091	2.783	.226***
MGTP → PBC		.410	.081	5.072	.453***
MGTP → PA		.502	.093	5.383	.472***
FGTP → PBC		.067	.085	.796	.068
FGTP → SN		.244	.100	2.436	.201**
FGTP → PA		.124	.098	1.266	.107
All		MGTP → EI	.046	.066	.691
	FGTP → EI	-.074	.057	-1.315	-.059
	PBC → EI	.279	.083	3.362	.226***
	SN → EI	-.022	.060	-.371	-.017
	PA → EI	.720	0.71	10.076	.638***
	MGTP → SN	.232	.059	3.957	.245***
	MGTP → PBC	.448	.062	7.190	.456***
	MGTP → PA	.464	.069	6.765	.435***
	FGTP → PBC	.047	.059	.793	.046
	FGTP → SN	.157	.058	2.686	.159***
	FGTP → PA	.106	.066	1.608	.095

Notes: Outcome variable = EI  
b= standardized coefficient, \*\*\*significance  $p<0.001$

Two TPB constructs, namely PA ( $b=0.638^{***}$ ) and PBC ( $b=0.226^{***}$ ) demonstrated high predicting ability on students' EI, whereas SN had an insignificant effect for all groups. More specifically, male students' EI is driven by PBC ( $b=0.334^{***}$ ) and PA ( $b=0.554^{***}$ ), whereas female students' EI are driven by PA ( $b=0.690^{***}$ ). GTP constructs lose their predictive ability, in the presence of the TPB constructs. However, significant effects between MGTP and PBC ( $b=0.456^{***}$ ), PA ( $b=0.435^{***}$ ) and SN ( $b=0.245^{***}$ ) were observed. Significant effect was also found between FGTP and SN ( $b=0.159^{***}$ ). As a result, hypothesis H4a is supported. The effects of GTP on the antecedents of EI and the elimination of direct effects, indicated possible mediation effect through the TPB constructs.

A mediation analysis conducted resulted in significant mediation effects between MGTP and EI, through PA ( $b=0.335^{***}$ ), and PBC ( $b=0.124^{***}$ ), lending support to hypothesis H4b. These complementary effects prove the positive influence of MGTP on students' EI through PA and PBC (Baron and Kenny, 1986; Kline, 2011).

In order to determine the role of FGTP and MGTP, on the differences observed on students' EI between the two genders, the equality of factor means was examined (Schmitt and Kuljanin, 2008). The overall fit of the constrained model demonstrated negligible decrement ( $RMSEA=0.038$ ;  $CFI=0.942$ ;  $CMIN/df=1.466$ ;  $SRMR=0.054$ ;  $PCLOSE=0.99$ ). A  $\Delta CFI \leq 0.01$  in comparison to the unconstrained model indicated equivalence of factor means (Kline, 2011). Additionally, two independent sample T-tests were conducted to examine the significance of these differences between gender groups, comparing the mean factor scores for MGTP and FGTP. No statistically significant difference was evidenced, in FGTP mean ( $t_{319} = 0.533$ ,  $p = 0.595$ ), except for a possible difference in MGTP mean ( $t_{319} = -1.667$ ,  $p = 0.097$ ), which however, was not statistically significant in the specific



sample ( $p > 0.05$ ). As a result hypothesis H3 claiming that males and females in IT share similar gender schemas is supported.

## Discussion

This research has examined the impact of GTP traits on the entrepreneurial career choices of IT students, as well as, the differences of the perceived gender schemas between males and females. The factor analysis has resulted in two distinct GTP factors, one for MGTP and one for FGTP, in line with previous research (Goktan and Gupta, 2013). Based on the findings (Model 1), Gender has a significant negative impact on students' EI, lending support to hypothesis H1, suggesting that male students demonstrate higher levels of EI than females. This finding is consistent with the works of Shneor *et al.*, (2013) and Karimi *et al.*, (2014) who found significant EI differences in a samples of IT students, Millman *et al.*, (2010), who found significant Internet-EI differences in a cross country sample of students, and Westhead and Solesvik, (2016), as well as Nowiński *et al.*, (2019), who found significant gender moderation on the effect of entrepreneurial education on EI. Based on the same model, the direct positive effect of MGTP on EI, lends support to hypothesis H2a. On the other hand, the effect of FGTP on EI is non-significant and therefore hypothesis H2b, is not supported. These results are similar to those of Gupta *et al.*, (2009) and Perez-Quintana *et al.*, (2017), who also found significant effect of masculine and insignificant effect of feminine gender role orientation on EI, among business school students. Consequently, students with increased MGTP are expected to show self-motivation towards entrepreneurship, whereas, students with increased FGTP are expected to be indifferent or hesitant towards entrepreneurship. Increased levels of MGTP seem to give IT students' EI a positive push, making MGTP a strong precursor of EI in the field of IT, since the entrepreneurial career path seems to be related with increased levels of MGTP among IT students. Based on the results of Model 2, including the TPB constructs, PA, PBC and SN, the direct effect of the GTP is eliminated. This finding was somewhat expected, firstly because the predictive ability of these constructs is undeniable (Kautonen *et al.*, 2015), and secondly because these constructs foster EI by concentrating informed input from the social environment (Hindle *et al.*, 2009). The statistically significant effects of MGTP on all three antecedents of EI, as well as, the significant effect of FGTP on SN provide proof of the informed input theory. Moreover, the effects of MGTP on PBC and PA, and the effect of FGTP on SN, lend support to hypothesis H4a. These findings are similar to those of Venkatesh *et al.*, (2000), regarding technology adoption intentions, which act through different TPB constructs for males and females. The different interrelation of GTP with the TPB constructs opens new possibilities about explaining EI differences beyond the traditional biological gender approach. Students with increased MGTP levels seem to develop more positive attitudes towards entrepreneurship and they rely more on their increased entrepreneurial capabilities compared to students with lower MGTP. On the other hand, students with increased FGTP levels, seem to rely mostly on their social environment for support in order to decide whether to follow an entrepreneurial career.

Furthermore, the absence of significant differences in MGTP and FGTP effects between the two genders, has confirmed that males and females in the field of IT, do not significantly differ in gender schemas, since they share common GTP traits such as, leadership ability, sympathy, willingness to take a stand and sensitivity to the needs of others, to name a few. Male and female IT students exhibit an almost unique mixture of GTP traits, supporting hypothesis H3. This is consistent with previous research claiming that women in IT are not following traditional gender schemas, and that gendered stereotypes can reproduce masculine normative beliefs in male dominated fields such as IT (Lemons and Parzinger, 2007).

Finally, the mediation of PA and PBC in the relation between MGTP and EI, lend partial support to hypothesis H4b. This finding is very important, because it explains the different interaction of MGTP between genders. Since MGTP acts on PBC and PA, which are the main EI drivers for male students, whereas, for female students it acts only through PA, it can be concluded that MGTP fosters EI by cultivating positive attitude and belief in ones capabilities in the case of males. Contrary though, females with increased MGTP also exhibit increased positive attitude towards entrepreneurship, but they do not seem affected regarding their entrepreneurial capabilities, maybe because they are more realistic on their self-capability perceptions.

These findings, following the rationale of previous research (Karimi *et al.*, 2014; Millman *et al.*, 2010; Shneor *et al.*, 2013), suggest that the 'gender gap' in IT students' EI, is not a matter of gender, but rather results from different interactions of GTP traits with students' personal attitude and behavioral control. Therefore, GTP traits have serious implications for the design of entrepreneurial courses offered by IT engineering departments, as well as the educational approaches used, in order to take

advantage of the unique combination of GTP traits of every individual, in order to offer asset based support and therefore promote the entrepreneurial mindset of IT students.

### Research implications

The results of this research provide evidence that stereotypically masculinized personality traits have a significant positive effect on students' EI, whereas stereotypically feminized traits do not. The informed input approach (Hindle *et al.*, 2009) used in the proposed model shows that although the effect of GTP traits diminishes in the presence of the TPB constructs, an indirect effect takes place through these constructs. The different interactions observed between males and females, imply that entrepreneurial intention was problematically gendered until now, and opens new opportunities for theory development and practice. Stereotypically gendered personality traits, which significantly affect students' EI, cannot be further associated with a specific gender, since no statistically significant differences were found. Fine differences in these traits between individuals may offer explanation on the underrepresentation of women (Wheadon and Duval-Couetil, 2019), and suspend the reproduction of gendered stereotypes in favor of masculinity in male dominated fields, such as IT and technology venturing (Lemons and Parzinger, 2007; Nowiński *et al.*, 2019; Veelen *et al.*, 2019). Furthermore, the emerging relation of GTP with IT entrepreneurship could help the IT discipline become more attractive to female students (Beyer, 2014) and cover the demand for skilled personnel in IT. Through the lenses of GTP, entrepreneurship educators can better understand the mechanisms through which students develop attitudes, as well as fears towards entrepreneurship, and use novel educational approaches beyond the traditional gendered views of entrepreneurship. Incorporating new educational paradigms with appropriate examples and role models could help students develop stronger personality, leadership ability, willingness to take a stand and defend their beliefs. Students' participation in realistic entrepreneurial problem solving projects, requiring project management and team collaboration abilities in combination with counseling offered by experienced mentors from the industry and academia, could stimulate particularly students in need of social support develop an entrepreneurial mindset. On the other hand, introducing alternative forms of entrepreneurship to students with increased feminized GTP, e.g. affectionate, sensitive to the needs of others etc., could help them become aware of the opportunities offered by social entrepreneurship (Kakouris, 2016). Students with increased masculinized GTP, e.g. dominant, assertive etc., mostly driven by increased personal attitudes should be warned about the dangers arising from overconfidence and misunderstood leadership (Brandstätter, 2011). These interventions could alter anachronistic beliefs considering entrepreneurship a masculine career choice (Czeglédi *et al.*, 2017; van Ewijk and Belghiti-Mahut, 2019).

Finally, the adoption of asset based educational approaches in IT disciplines, taking in account GTP effect could help IT students, consider technology entrepreneurship as an option, regardless of gender. Finally, the incorporation of GTP personality in the existing theoretical frameworks of EI, can offer entrepreneurship research the means to address the 'gender gap' more efficiently, beyond the unconvincing traditional gender approaches.

### Limitations and Future research

This research is not without limitations. Since gender could be experienced differently in different cultures the findings should be treated with caution (Shields, 2008; Shinnar *et al.*, 2012). Future research should use larger datasets and multiple data sources, in order to figure out those differences, and avoid possible sources of endogeneity due to sample selection and non-response bias. More studies are needed to examine the effect of GTP in the context of entrepreneurship education, especially in male dominated disciplines as IT and engineering. For example, it would be interesting to identify which types of courses and other offerings provided by universities are more efficient, in terms of EI, for students following certain GTP schemas. The effect of GTP could be analyzed comparing different social contexts and units of analysis, individuals or groups. Furthermore, different educational approaches could be examined to highlight those that might help educators identify GTP based groups and design proper support interventions. For example differences might occur depending on country, university, or close social environment. Finally, possible interaction of GTP on the effect of entrepreneurship education on EI should be investigated, since considerable negative moderation of gender for female students has been reported by previous research (Westhead and Solesvik, 2016), but on the other hand, females students have gained the most out of entrepreneurship courses in terms of entrepreneurial self efficacy, according to other works (Nowiński *et al.*, 2019).

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#### APPENDIX

**Table V.** Questionnaire items

Construct	Measurement items
Entrepreneurial Intention	INT Rate yourself on the following items: 1. I am determined to create a firm in the future 2. My professional goal is to become an entrepreneur 3. I have very seriously thought of starting a firm 4. I will make every effort to start and run my own firm 5. I am ready to do anything to be an entrepreneur
Perceived Behavioral Control	PBC Rate yourself on the following items: 1. It would be easy for me to start a firm and keep it working 2. I am prepared to start a viable firm 3. I believe I can control the creation process of a new firm 4. I know the necessary practical details to start a firm 5. I know how to develop a business plan
Personal Attitude	PA Rate yourself on the following items: 1. Being an entrepreneur implies more advantages than disadvantages to me 2. Being an entrepreneur would entail great satisfactions for me 3. If I had the opportunity and resources, I'd like to start a firm 4. A career as entrepreneur would be attractive for me

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Social Norm	SN	Would the following people agree with your decision to start a firm? 1. Your close family members 2. Your relatives 3. Your friends
Gender-Typed Personality	GTP	Rate yourself on the following attributes: 1. Gentle (F) 2. Sympathetic (F) 3. Leadership ability (M) 4. Willing to take a stand (M) 5. Dominant (M) 6. Affectionate (F) 7. Warm (F) 8. Tender (F) 9. Strong personality (M) 10. Defends own beliefs (M) 11. Sensitive to needs of others (F) 12. Assertive (M) Note: <i>F= Feminine, M=Masculine</i>

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