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Personality alchemy: The influence of personality traits on the circular entrepreneurial intentions of higher education students

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ABSTRACT

Objective: The study explores the influence of Portuguese higher education students' personality traits on their intentions to become circular entrepreneurs using their perceived circular behavioural control as a mediator. We considered internal locus control, proactive personality, perceived creativity and propensity to take risks as personality traits.

Research Design & Methods: We used an online questionnaire to collect data from 510 Portuguese university students. We performed the quantitative analysis through the partial least square method.

Findings: We found that the propensity to assume risk, creativity, internal locus of control, and proactivity were (by these order) personality traits with a positive influence on either respondents' circular behavioural control and, using this, their circular entrepreneurs' intention.

Implications & Recommendations: The results of this study allowed us to infer implications for higher education students, universities, and policymakers. Students demonstrated intentions to promote circular entrepreneurial activities, and these intentions can be worked on and learned at universities by encouraging creativity, innovation, and proactivity and inciting greater levels of confidence in students. These skills allow you to accelerate the implementation of circularity in new businesses. To achieve this, greater coordination with the business community is essential by proposing challenges and problems that universities can help resolve. Political decision-makers must formulate circular entrepreneurship policies and include them in the national development plan, encouraging the formulation of new sustainable businesses.

Contribution & Value Added: This study highlights the relationship between personality traits and the intention to become a circular entrepreneur, providing novel evidence in this field. Moreover, it introduces perceived circular behavioural control as a mediator between personality traits and entrepreneurial intentions, an innovative approach in empirical research models. These insights can contribute to the development of policies and strategies aimed at fostering circular entrepreneurship, helping to create environments more conducive to sustainable innovation and economic development based on resource reuse and regeneration.

Article type:	research article
Keywords:	circular entrepreneurship; circular entrepreneurial intention; personality traits; perceived circular behavioural control; higher education students
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INTRODUCTION

Circular entrepreneurship is a more particular and emerging form of sustainable entrepreneurship that aims to protect people and their environment (Geissdoerfer *et al.*, 2020). Although related, a circular entrepreneurial process is different from a sustainable one, as the entrepreneurs' environmental knowledge is crucial to successfully manage the complex circular processes of multi-stake-

holder management (Poblete *et al.*, 2021). Moreover, while sustainable entrepreneurs apply a common 'what' (*i.e.*, socially or environmentally beneficial innovations), circular entrepreneurs, besides the 'what,' also introduce the 'how' (*i.e.*, circular principles) in their business models (Henry *et al.*, 2022). Circular entrepreneurship is the process of evaluating and exploring opportunities within the field of circular economy (Wang *et al.*, 2013; Zucchella & Urban, 2019). Circular entrepreneurship is becoming a new, promising reality, in the manner of needed radical paradigmatic change (Urban, 2019). Since the concept of circular entrepreneurship is relatively recent, research remains scattered (Heshmati, 2017; Suchek *et al.*, 2022), especially with regard to the determinants or motivation of circular-oriented entrepreneurs' intentions. A few very recent studies have begun to explore these intentions (Al-Awlaqi & Aamer, 2022; Dantas *et al.*, 2022; Henry *et al.*, 2022). Dantas *et al.* (2022) examined the antecedents and consequences of circular entrepreneurship in emerging markets. As for the antecedents, the authors conclude that circular entrepreneurs can be either intrinsically or extrinsically motivated. Henry *et al.* (2022) explored the motivations and identities of circular founders. According to the authors, circular founders have an innovative mindset and ambitions of growing scale. Besides, the authors also found that social altruism and noneconomic motives drive their circular entrepreneurs' intentions. Al-Awlaqi and Aamer (2022) explored the individual entrepreneurial factors affecting the adoption of circular business models in small and medium-sized enterprises in the Republic of Yemen. The authors found that innovativeness and risk-taking propensity influenced entrepreneurs' intentions to adopt circular business models. However, the intentions of young students, seen as potential future circular entrepreneurs, still need to be investigated. There is evidence among university students of these intentions in the context of sustainable-oriented entrepreneurs (Fatoki, 2020; Qazi *et al.*, 2021). It seems widely accepted that sustainable and, therefore, circular entrepreneurs are people with high environmental values and are strongly motivated to protect the ecosystem. However, other personality traits may influence the intentions to be circular-oriented entrepreneurs, such as proactivity and risk propensity (Fatoki, 2020; Qazi *et al.*, 2021), need for achievement and self-efficacy (Qazi *et al.*, 2021), and perceived behavioural and locus of control (Fatoki, 2020). Thus, there is a need for more in-depth knowledge about the influence of personality traits in promoting sustainable entrepreneurial activities. This personality alchemy refers to the process of inner transformation, where the individual consciously works to refine and develop their characteristics, seeking a balance between different personality traits to achieve an ideal state of functioning and personal success, which is essential for the success of entrepreneurial activities.

In this context, we sought to extend these analyses to the context of circular entrepreneurship among young Portuguese university students, based on the theory of planned behaviour (TPB) and the entrepreneurial traits theory. Therefore, we intended to explore the influence of Portuguese college students' personality traits on their intention to become circular entrepreneurs moderated by perceived circular behavioural control. The trend towards community engagement and collaborative initiatives also supports circular entrepreneurship by encouraging resource efficiency and waste reduction. In economic terms, the Portuguese government is strengthening the viability of these models through policies such as the Circular Economy Action Plan, which is aligned with European guidelines to encourage the business transition to practices that minimise waste and maximise the use of resources (APA, 2021). The Circular Economy Action Plan has driven Portuguese companies to adopt circular approaches, contributing to the country's economic growth and resilience, since entrepreneurship increases investment, creates jobs and promotes competitiveness. In the educational field, educational institutions have been incorporating the circular economy into their curricula, while training programmes and workshops complement this training, equipping students with the necessary skills to foster a transition to a sustainable economy, as well as promoting a wider social shift towards circular practices (Alves *et al.*, 2024; Deda *et al.*, 2022).

The study presented in this article seeks to extend these analyses to the context of circular entrepreneurship among young Portuguese university students, based on the TPB and the entrepreneurial traits theory. Therefore, we intended to explore the influence of Portuguese college students' personality traits on their intention to become circular entrepreneurs moderated by perceived circular behavioural control.

After the introduction, the article is composed of four more sections. The next section contains the literature review and development of hypotheses, followed by a section with the research methodology with the description of the samples, variables and data analysis. Then comes the section on the results and discussion of the results with the presentation of the theoretical and practical implications as well as the limitations and future lines of research. Finally, the last section contains the conclusion.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Theoretical Framework

Circular entrepreneurship is a more specific and emerging form of sustainable or green entrepreneurship that aims to protect people and the environment simultaneously (Geissdoerfer *et al.*, 2020). It can be represented by young business initiatives oriented towards circularity to create value (solutions to emerging problems at the environmental level, creation of new products, processes, and pro-circular practices) and explore existing opportunities at the level of circularity. It can also be prosecuted by companies that have already implemented the transition from linear to circular business models (Zucchella & Urban, 2019).

The TPB offers a robust framework for understanding circular entrepreneurship by emphasizing the significance of attitude toward entrepreneurship as a predictor of entrepreneurial intention (Ajzen, 1991). In this context, perceived circular behaviour control plays a crucial role in shaping these intentions, highlighting the need for aspiring entrepreneurs to have a strong belief in their ability to implement circular practices effectively. Moreover, the TPB framework includes subjective norms and perceived behavioural control, both of which are critical in predicting business start-up intentions and subsequent behaviours, as evidenced by empirical studies (Kautonen *et al.*, 2013; Lopes *et al.*, 2024). These elements collectively underscore the importance of fostering a positive entrepreneurial attitude, supportive social norms, and a sense of control over circular business activities for successful circular entrepreneurship.

Entrepreneurial traits theory significantly influences the adoption and success of business models (Thai & Mai, 2023), with traits such as internal locus of control, proactive personality, perceived creativity, and propensity for risk-taking being particularly relevant. An internal locus of control encourages entrepreneurs to take responsibility for their actions and outcomes, fostering persistence in the face of challenges (Al Mamun *et al.*, 2021). A proactive personality drives individuals to anticipate and act on opportunities, essential for innovating within the circular economy. Furthermore, perceived creativity enables entrepreneurs to develop unique solutions that align with circular principles, while a propensity for risk-taking allows them to navigate the uncertainties inherent in circular business ventures (Lopes *et al.*, 2024). Collectively, these traits empower entrepreneurs to implement and sustain circular business models effectively.

The interplay between behavioural intentions and entrepreneurial traits is critical in circular ventures, as these components collectively shape the pathway to successful entrepreneurship. Entrepreneurial intentions, influenced by attitudes, subjective norms, and perceived behavioural control, are further strengthened by traits such as an internal locus of control and a proactive personality (Lopes *et al.*, 2024; Lopes *et al.*, 2023). This synergistic effect enables entrepreneurs to plan and execute circular business strategies with greater efficacy. For instance, a proactive entrepreneur with high perceived creativity is more likely to overcome barriers and innovate within the circular economy, driven by strong behavioural intentions (Kumar & Shukla, 2022). Understanding this dynamic interaction provides valuable insights for nurturing successful circular entrepreneurs capable of driving sustainable economic growth.

Circular Entrepreneurial Intention and Perceived Circular Behaviour Control

Circular-oriented entrepreneurial intention is an individual's intention to start a business based on circular principles. Intention is a mental state that explains individuals' thinking and behaviours (Arru, 2020). As for circular entrepreneurship, behaviours are influenced either by micro (individual) or macro (environmental) factors that will affect individuals' propensity to engage in specific business actions. Perceived behaviour control is similar to self-efficacy. Ajzen (1991) introduced it as a construct in his theory of planned behaviour. Perceived behaviour control refers to the person's

belief that their behaviour is under their control. Moreover, we may define it as the perceived ease or difficulty of performing a particular behaviour. According to Ajzen (2002), perceived behavioural control comprises self-efficacy and perceived controllability. Self-efficacy involves internal factors such as knowledge and skills, while perceived controllability consists of the perception of achievement, which depends on the individual (Vamvaka *et al.*, 2020). In the case of entrepreneurship, perceived behaviour control reflects the ability of individuals to start and achieve success with a new business involving feelings of capability and perceived controllability (Liñán & Chen, 2009).

Previous research has demonstrated a positive relationship between perceived behaviour control and overall entrepreneurial intention (Lortie & Castogiovanni, 2015). We found the same pattern for students (Munir *et al.*, 2019; Shi *et al.*, 2020). Moreover, several studies on sustainable entrepreneurship have confirmed a positive relationship between perceived sustainable behaviour control and sustainable entrepreneurial intention (Fatoki, 2020; Thelken & de Jong, 2020; Yasir *et al.*, 2021). In this way, we formulated the following hypothesis:

H1: Higher education students' perceived circular behaviour control positively affects their circular entrepreneurial intention.

Personality Traits, Perceived Circular Behaviour Control, and Circular Entrepreneurial Intention

The literature describes personality traits as consistent reactions of individuals to external or environmental factors (Cao *et al.*, 2022). Several studies positively relate personality traits with the entrepreneurial intention (*e.g.*, Karabulut (2016) analyzed the influence of internal locus of control, need for achievement, risk tolerance, and entrepreneurial alertness as dimensions of personality traits on the entrepreneurial intention of Turkish graduate students; Murugesan and Jayavelu (2017) analyzed the influence of the Big-Five personality traits and self-efficacy on the entrepreneurial intention of students in the Bachelor of Technology; Laouiti *et al.* (2022) conducted a gender-based approach to evaluate the influence of the Big-Five on the entrepreneurial intention of students in Bachelor of Technology in France; Ahmed *et al.* (2022) analyzed the influence of big-five personality traits on entrepreneurial intention when mediated by risk aversion) of Pakistani university students).

In this regard, an entrepreneurs' success depends, among other external factors, on his personality traits, determining the decision to start a business (Cao *et al.*, 2022). Entrepreneurs with more powerful personality traits for favourable decision-making tend to be more successful than entrepreneurs who crumble in the face of obstacles inherent in starting an entrepreneurial activity (Butz *et al.*, 2018; Şahin *et al.*, 2019). Thus far, the most studied personality traits that drive entrepreneurial intention are discipline and internal locus of control, the need for achievement, risk-taking propensity, tolerance, consistency, determination, and entrepreneurial alertness (Cao *et al.*, 2022; Espíritu-Olmos & Sastre-Castillo, 2015; Farrukh *et al.*, 2018; Karabulut, 2016). Other studies use the Big Five model (openness, conscientiousness, extraversion, agreeableness, and neuroticism) to explain entrepreneurial intention (Şahin *et al.*, 2019). Less studied are the personality traits of proactivity and perceived creativity (Fatoki, 2020; Lopes *et al.*, 2023). However, many studies still show inconsistent and insignificant results on the impact of personality traits on entrepreneurial intention (Farrukh *et al.*, 2018), requiring this relationship to be more substantiated.

Internal Locus of Control

Internal locus of control is the level at which people believe that they, as opposed to external factors, have control over the outcomes of their lives. A person's locus of control is conceptualized as internal or external. The external locus of control consists of beliefs that life outcomes result from extrinsic factors that people do not control like chance or faith. By contrast, internal locus control reflects an individual's degree of control over his life (Cao *et al.*, 2022). Individuals with greater internal locus control tend to be more successful, control their internal and external environment through actions, and take more risks. The internal locus of control has been positively related to pro-environmental behaviours (Chiang *et al.*, 2019; Derdowski *et al.*, 2020; Pavalache-Ilie & Unianu, 2012; Trivedi *et al.*, 2015). In this regard, Peyton and Miller (1980) show that individuals with greater internal locus control

tend to: i) positively control the environment; ii) seek positive information to solve environmental problems; iii) effectively use this information; iv) resist social pressures and discard biased or erroneous information; v) expect to obtain long-term benefits, *e.g.*, making additional efforts in the short term to obtain better results in the future; vi) be more responsible and more able to change their self-concept. This personality trait has been commonly used to explain higher education students' intention to start a traditional entrepreneurial business (Cao *et al.*, 2022; Farrukh *et al.*, 2018; Tentama & Abdussalam, 2020) and sustainable entrepreneurial intention (Fatoki, 2020; Hirschfeld & Wagner, 2022; Muñoz *et al.*, 2020). Thus, we formulated the following hypotheses:

H3: Higher education students' internal locus of control positively affects their perceived circular behaviour control.

H3a: Higher education students' internal locus of control positively affects their circular entrepreneurial intention when mediated by perceived circular behaviour control.

Proactive Personality

We may define proactive personality as the active attempts that an individual makes to change external or environmental factors. Individuals with pro-active personalities tend to more easily identify opportunities, exempt themselves from social pressures and make impactful decisions in their environment (Parker *et al.*, 2010). Consequently, more proactive individuals tend to be more successful at work and show more perceived behaviour control, leadership, awareness and self-confidence (Abid *et al.*, 2021). Previous research has demonstrated a relationship between proactive personality and conventional entrepreneurial intention (Delle & Amadu, 2016; Hu *et al.*, 2018; Luo *et al.*, 2022). Research on the entrepreneurial intention of higher education students has also shown that students with a more proactive personality tend to perceive a greater probability of starting a new business (Cai *et al.*, 2021; Nasaj, 2021; Paul & Shrivatava, 2016). Li *et al.* (2020) and Luo *et al.* (2022) demonstrated that proactive higher education students perceived entrepreneurial behaviour and demonstrated greater control over it. Fatoki (2020) showed a direct contribution of the proactive personality to sustainable entrepreneurial intention based on a greater propensity of these individuals to detect business opportunities. Lopes *et al.* (2023) demonstrated that a proactive personality influences sustainability-oriented entrepreneurial intention when mediated by subjective norms. As for younger students, research shows that high proactiveness boosts students' ability to think outside the box, influencing their choice to become an entrepreneur (Fragoso *et al.*, 2020; Neneh, 2019). We formulated the following hypotheses:

H3: A proactive personality of higher education students positively affects their perceived circular behaviour control.

H3a: A proactive personality of higher education students positively affects their circular entrepreneurial intention when mediated by perceived circular behaviour control.

Perceived Creativity

Creativity is intrinsically linked with new ideas, creating new products, and innovation. Thus, a creative mind is fundamental to entrepreneurship because the success of entrepreneurs depends on their capacity to innovate. The literature considers creativity as an essential requirement for an individual to become an entrepreneur (Laguía *et al.*, 2019) and is part of the stereotype of the entrepreneurial individual. However, perceived creativity is often overlooked in research about the motivations underlying the start of entrepreneurial activity (Shi *et al.*, 2020). In one of the few studies that address the relationship between perceived creativity and entrepreneurial intention, Nabi *et al.* (2018) concluded that there is a positive relationship between students' creativity and the intention to become entrepreneurs. Zampetakis and Moustakis (2006) related the perceived creativity of students with future entrepreneurial intentions.

Notwithstanding, several studies have concluded that perceived creativity alone does not directly contribute to entrepreneurial purpose (Nguyen *et al.*, 2021), and the relationship between perceived creativity and entrepreneurial intention may be mediated by the sense of entrepreneurial self-efficacy (Laguía *et al.*, 2019) and by controlling perceived behaviour (Tiwari *et al.*, 2017). Thus, more creative

students are more self-confident and therefore believe that they are more capable of starting their own business, inducing pro-entrepreneurial behaviours. At the level of sustainable entrepreneurship, perceived creativity can be important to recognize an opportunity and influence the start of sustainable entrepreneurial activity when mediated by the alert behaviour perceived by the entrepreneur (Yasir *et al.*, 2020) or by the green self-identity (Jiang *et al.*, 2020). Since circular business requires significant levels of innovation, we formulated the following hypotheses:

H4: Higher education students' perceived creativity positively affects their perceived circular behaviour control.

H4a: Higher education students' perceived creativity positively affects their circular entrepreneurial intention when mediated by perceived circular behaviour control.

Risk-taking Propensity

Risk propensity refers to an individual's attitude towards risk aversion or acceptance (Hoogendoorn *et al.*, 2019). Some individuals are more risk-tolerant, others naturally avoid risks, and entrepreneurs belong to the most risk-averse group. Research on traditional entrepreneurial intention shows that individuals' propensity to tolerate risk is an important personality trait to explain the intention to start an entrepreneurial business since risks and uncertainties are inherent to business (Deng *et al.*, 2018). Direct relationships have been established between entrepreneurial intention and risk acceptance (Schlaegel *et al.*, 2021). However, this relationship is still controversial and even inconclusive since the way risk is perceived can be influenced by the socio-cultural environment of individuals (Farrukh *et al.*, 2018). Furthermore, when considering sustainable entrepreneurial intention, scholars did not find any direct effects of risk propensity (Fatoki, 2020), which can be explained by the fact that, so far, no significant differences have been identified in terms of risk propensity for entrepreneurs oriented for sustainability and mainstream entrepreneurs (Hoogendoorn *et al.*, 2019). However, according to Hoogendoorn *et al.* (2019), risk propensity is not irrelevant to sustainability since ecological entrepreneurs are more likely to tolerate risk. The study of circular entrepreneurship is still very recent and is surrounded by uncertainties motivated by opportunities and needs related to solutions for solving environmental and individual problems. By analogy with the results related to sustainable entrepreneurship, we hypothesised:

H5: Higher education students' propensity to accept risk positively affects their perceived circular behaviour control.

H5a: Higher education students' propensity to tolerate risk positively affects their circular entrepreneurial intention when mediated by perceived circular behaviour control.

Figure 1 describes the structural research model.

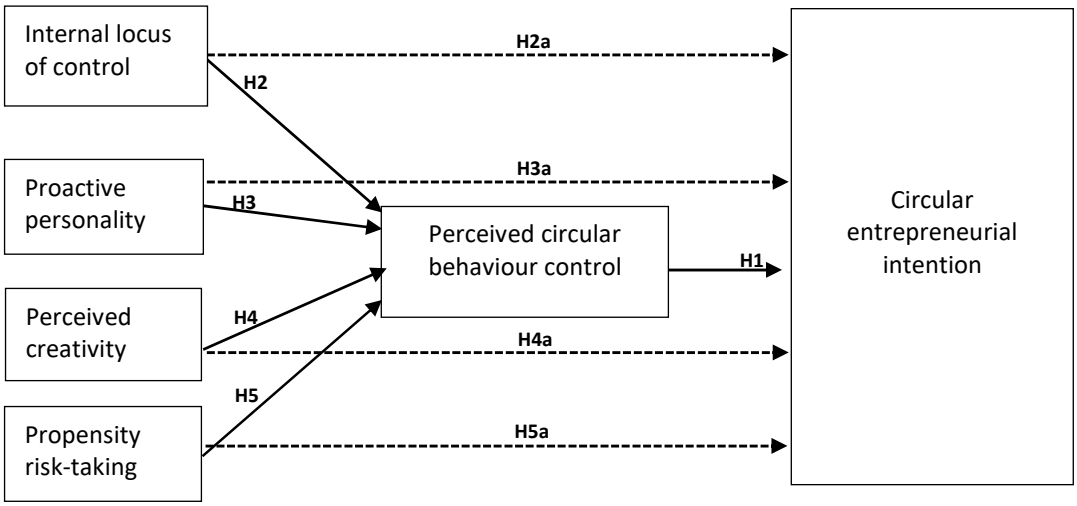

Figure 1. Research model
Source: own elaboration.

RESEARCH METHODOLOGY

Data Collection

The data for this study were collected through an online questionnaire distributed by email to Portuguese higher education students from five Universities and published on social networks (Facebook and Linkedin). Thus, it is a non-probabilistic sample. It was guaranteed that only higher education students answered the questionnaire through the following initial question: 'Are you currently attending a higher education establishment in Portugal?' If the respondents chose 'yes,' they proceeded to the remaining questions; if they answered 'no,' the questionnaire ended. In total, we obtained 510 valid responses. In 2022, according to Pordata (2022), around 433 thousand students were enrolled in Portuguese higher education. Considering an error margin of 5%, 385 responses would be needed. Although the number of participants in our sample was higher, considering that we collected the sample using a non-probabilistic technique for convenience, the sample was not representative of students who attend Portuguese education. All participants were aware of the study's purpose and their participation was voluntary and anonymous. We obtained informed knowledge from all participants. We conducted a pre-test with 10 participants to assess their understanding of the questions and the response time.

The questionnaire (link in the Appendix) consisted of six sections adapted from Fatoki (2020): Section 1 evaluated circular entrepreneurial intention with three items. Section 2 assessed the perceived circular behaviour control with three items. Section 3 assessed the internal locus of control with six statements. Section 4 considered proactive personality with six items. Section 5 assessed perceived creativity with three statements, and section 6 evaluated risk-taking propensities with seven items. Respondents answered all the statements on a 5-point Likert scale with 1 – strongly disagree, 2 – disagree, 3 – neither disagree nor agree, 4 – agree and 5 – strongly agree.

Moreover, we also collected socio-demographic indicators such as gender, age, residence, and the level of education. We also evaluated the professional situation.

Data Analysis

We performed a statistical analysis of the constructs contained in the research model and the items that measure the constructs using the SPSS (v.25) software. Then, we used the partial method least square (PLS) of smart PLS (V.3.0) to test the hypotheses formulated in the research model. The PLS method is the second generation of multivariate techniques combining statistical analysis with regressions. As we collected the data and did not have a normal distribution, confirmed by obtaining the kurtosis and skewness statistics, we fine-tuned the PLS method since it does not require data normality. Moreover, it allows for optimizing the relationships established between latent variables (or constructs) and between these and the indicators (or items) that measure them (Ringle *et al.*, 2020). In this way, we analysed the data in four steps. The first step was to analyse the statistics of the model constructs and the items. In the second step, we tested measurement validity and reliability. The third step tested the research model and hypotheses via bootstrap analysis with the estimation of multiple linear regression. Bootstrapping is a non-parametric procedure for testing the significance of path coefficients estimated in PLS-SEM. In bootstrapping, subsamples are created with observations randomly drawn from the original data set (with replacement). The subsample is then used to estimate the PLS path model. This process is repeated until a large number of random subsamples are created, which in this study were 10 000. Parameter estimates obtained from the subsamples served to derive 95% confidence intervals for significance tests (Ringle *et al.*, 2020).

RESULTS AND DISCUSSION

Statistical Description of Latent Variables and Items

The sample comprises 510 student participants, of whom 304 were women (59.6%). The average student age was 22.70 years, with a minimum age of 17 and a maximum age of 57. Regarding occupation, 79.2% were students, and 20.8% were working students. Most respondents (83.1%) were undergraduates, while

the remaining were masters or doctoral students. Regarding the geographical location of universities, 44.7% of respondents studied in the central region of Portugal, 31.7% in the Lisbon metropolitan area, and 18.5% in the northern region. Table 1 contains a description of the six latent variables of the model.

Table 1. Statistical description of the variables and items of the research model

Variables and indicators	Mean	Std deviation
Circular entrepreneurial intentions (CEI)	**3.24**	**1,160**
CEI1.	3.33	1.155
CEI2.	3.16	1.145
CEI3.	3.22	1.179
Perceived circular behaviour control (PCBC)	**2.95**	**1,083**
PCBC1.	3.08	1.164
PCBC2.	3.07	1.038
PCBC3.	2.69	1.048
Internal locus of control (ILC)	**3.94**	**0.852**
ILC1.	3.76	0.989
ILC2.	3.59	0.930
ILC3.	4.31	0.750
ILC4.	4.22	0.809
ILC5.	3.83	0.800
ILC5.	3.95	0.833
Perceived creativity (PC)	**3.77**	**0.9093**
PC1.	3.63	0.916
PC2.	3.93	0.880
PC3.	3.76	0.932
Proactive personality (PP)	**3.93**	**0.8352**
PP1.	4.07	0.898
PP2.	3.61	0.885
PP3.	3.72	0.808
PP4.	4.04	0.827
PP5.	4.18	0.766
PP6.	3.98	0.827
Risk-taking propensity (RTP)	**3.76**	**0.9016**
RTP1.	3.85	0.920
RTP2.	3.69	0.903
RTP3.	3.36	0.944
RTP4.	4.48	0.681
RTP5.	4.11	0.791
RTP6.	3.55	1.021
RTP7.	3.27	1.051

Source: own study.

The results reveal that Portuguese higher education students intend to start an entrepreneurial activity oriented towards circularity (M = 3.24). Despite the high perceived circular behaviours control (M = 2.95), higher education students found it challenging to start a circular business (M = 2.63). Concerning personality traits, internal locus of control (M = 3.94) and proactivity (M = 3.93) were those that characterized the respondents, followed by perceived creativity (M = 3.77) and risk-taking propensity (M = 3.76).

Measures of Reliability and Validity of the Model

We performed a confirmatory factor analysis (CFA) to specify the reflective nature of the research design. The latent variables are the common cause of the items that measure them, and the observed variables do not have causal effects on the corresponding constructs (Hair *et al.*, 2019). All indicators show high confirmatory factor loads (> 0.70), except items ILC3, RTP4, and RTP5 which we removed

from the analysis. Thus, six items will measure the latent variable of internal locus control, and five will measure the latent variable risk-taking propensity.

The model presents a great model fit according to the reference values of Hair *et al.* (2019): GFI = 0.964 (reference value > 0.90); CFI = 0.953 (reference value > 0.90); IFI = 0.978 (reference value > 0.90); RMSEA = 0.063 (reference value < 0.08).

We evaluated the sample reliability from three measures based on the reference values proposed by Hair *et al.* (2019): Cronbach's alpha (Cα> 0.70), composite reliability (CR > 0.70), and average variance extracted (AVE > 0.50). We also used the Fornell-Larcker criterion (Fornell & Larcker, 1981) to assess the discriminant validity of the variables. Table 2 also shows the results of these measures. The CR and AVE results were higher than the reference values and the model was then reliable and convergent. There as also discriminant validity according to the results obtained through the application of the Fornell-Larcker criterion since the square root of the AVE of each variable (in bold on the diagonal) is greater than the correlation of each latent variable (off the diagonal). Table 2 synthesizes the results.

Table 2. Evaluation of the model reliability and validity

Variables	Confirmation factor loads	Cα	CR	AVE	CEI	PCBC	ILC	PC	PP	RTP
CEI		0.950	0.968	0.909	**0.953**					
CEI1.	0.940									
CEI2.	0.969									
CEI3.	0.951									
PCBC		0.853	0.911	0.773	0.654	**0.879**				
PCBC1.	0.886									
PCBC2.	0.878									
PCBC3.	0.874									
ILC		0.703	0.792	0.535	0.251	0.324	**0.731**			
ILC1.	0.785									
ILC2.	0.810									
ILC3.	0.345									
ILC4	0.783									
ILC5.	0.865									
ILC6.	0.819									
PC		0.756	0.860	0.341	0.309	0.400	0.387	**0.821**		
PC1.	0.843									
PC2.	0.744									
PC3.	0.871									
PP		0.827	0.872	0.535	0.309	0.329	0.539	0.617	**0.731**	
PP1.	0.718									
PP2.	0.809									
PP3.	0.541									
PP4.	0.775									
PP5.	0.794									
PP6.	0.816									
RTP		0.840	0.886	0.609	0.365	0.413	0.382	0.499	0.550	**0.781**
RTP1.	0.765									
RTP2.	0.836									
RTP3.	0.762									
RTP4.	0.366									
RTP5.	0.182									
RTP6.	0.756									
RTP7.	0.779									

Note: AVE Square Root in bold. CEI – circular entrepreneurial intentions; PCBC – perceived circular behaviour control; ILC – internal locus of control; PC – perceived creativity; PP – proactive personality; RTP – risk-taking propensity; Cα – Cronbach's alpha; CR – composite reliability; AVE – average variance extracted.
Source: own study.

We also conducted the common method bias (CMB) through the Harman one-factor test. The research model contains six constructs with an accumulated variance of 62.75%, with the largest factor explaining only the variation of 30.27%. In this way, as no factor had a variance greater than 50%, it was unlikely that our data would be affected by the CMB. Results revealed that the model had predictive relevance for predicting perceived circular behaviour and circular entrepreneurial intention once Q^2 was greater than zero (Q^2 = 0.175 and Q^2 = 0.385, respectively). The latent variables related to personality traits explain 23.8% of the variance of perceived circular behaviour, and this explained 42.8% of the variance of circular entrepreneurial intention.

Research Model Testing

We tested the relationships presented in our model through bootstrapping. Figure 2 presents the results.

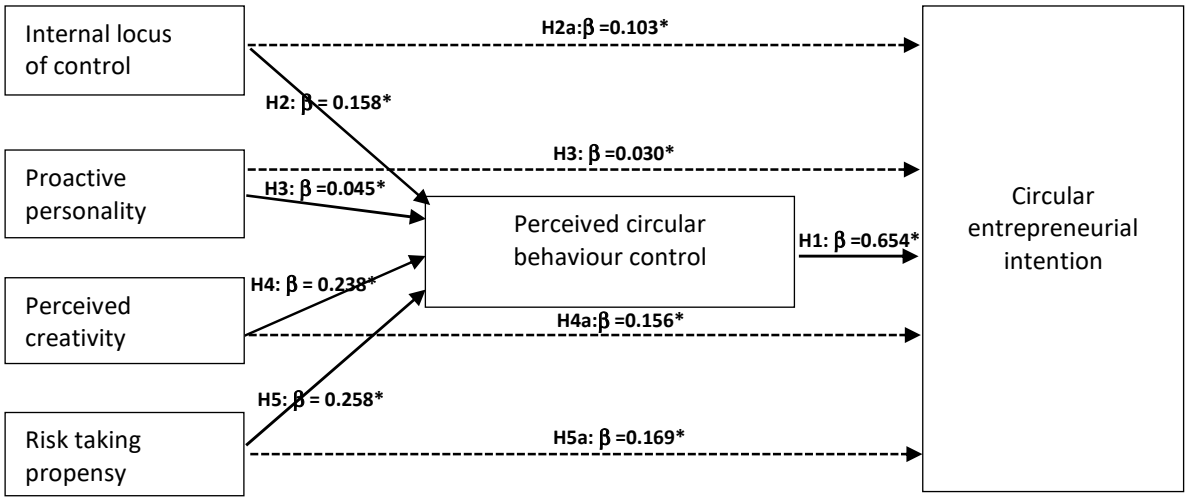

Figure 2. Results of the research model and hypothesis testing via bootstrapping
Note: *p < 0.001. N = 510. Coefficient estimates generated with 10.000 bootstrap iterations.
Source: own elaboration.

The results confirmed the first hypothesis that perceived circular behaviour control positively and expressively influenced respondents' circular entrepreneurial intention (β= 0.654). We also noted that the four personality traits positively influenced the perceived circular behaviour control, ensuring hypotheses H2 to H5. Specifically, the propensity to assume risks was the personality trait that most contributed to the perceived circular behaviour control (β= 0.258), followed by respondents' perceived creativity (β= 0.238) and internal locus of control (β= 0.158). A proactive personality was the trait that least contributed to the perceived circular behaviour control (β= 0.045).

Finally, we confirmed the influence of personality traits on circular entrepreneurial intention, mediated by the respondents' perceived circular behaviour control. Thus, we accepted hypotheses H2a to H5a. The range of contributions of personality traits to circular entrepreneurial intention was also uneven (by decreasing order): risk-taking propensity (β= 0.169), perceived creativity (β= 0.156), internal locus control (β= 0.103), and proactive personality (β= 0.030).

Discussion

Circular entrepreneurship understood as a process of exploration and exploitation of opportunities in the circular economy domain (Zucchella & Urban, 2019) is, to date, a subject underexplored in the empirical literature (Veleva & Bodkin, 2018). The present article contributes to the literature by analysing how certain individual characteristics and personality traits can stimulate a circular entrepreneurial attitude. Therefore, the study extends the TPB and the entrepreneurial traits theory by investigating which personality traits of younger university students have the potential to affect their circular behavioural control and, through this, their intention to become circular entrepreneurs. Since there are no studies (at least that the authors are aware of) that have investigated the relationship between person-

ality traits and the intention to become a circular entrepreneur, the comparison of our results with empirical evidence is compromised. Nevertheless, this comparison will be made whenever possible

Our findings suggest that respondents have demonstrated a circular-oriented entrepreneurial intention. Since most participants belonged to Generation Z, the results corroborate the greatest concerns younger people have shown about the environment and sustainability (Krasulja *et al.*, 2020). Evidence confirms that Generation Z members believe reducing resource consumption, waste management, recycling, and reusing products can benefit the environment (Lakatos *et al.*, 2018).

Moreover, our findings support all the hypotheses. First, respondents' circular entrepreneurial intention was explained by their perceived circular behaviour control and personality traits. The results demonstrate that controlling perceived circular behaviour is a strong antecedent that positively influences circular entrepreneurial intention. Although no study has tested this relationship at the level of circular entrepreneurship, a positive contribution of perceived behavioural control over sustainable entrepreneurial intention has yet to be confirmed (Fatoki, 2020; Thelken & de Jong, 2020; Yasir *et al.*, 2021). Furthermore, evidence from emerging markets shows that circular entrepreneurs are motivated both intrinsically and extrinsically (Dantas *et al.*, 2022).

Secondly, the findings revealed that respondents' risk profile and creativity were the main determinants of their circular behavioural control and intention to become circular entrepreneurs. Empirical evidence denotes that the more creative young people consider themselves to be, the higher their entrepreneurial intentions (Zampetakis *et al.*, 2011) and more creative students tend to be more capable and competent in recognizing entrepreneurial business opportunities and more effective in controlling their behaviour (Yasir *et al.*, 2020). The relation between risk-taking propensity and sustainable entrepreneurial intention is not consensual in the empirical literature. While some studies undertaken with students' found no statistically significant association between risk-taking propensity and the choice to become a green entrepreneur (Fatoki, 2020; Qazi *et al.*, 2021), other researchers found a positive effect between them (Hoogendoorn *et al.*, 2019). Regarding creativity, our results align with empirical literature concerning sustainable entrepreneurs (Fatoki, 2020).

Thirdly, our findings show that respondents' locus of internal control and proactiveness were the two personality traits with the most negligible influence on their perceived circular behaviour control and, indirectly, on their circular entrepreneurial intention. The finding for proactivity is a little odd since it is well-known that people with a proactive personality are likely to become entrepreneurs (Mustafa *et al.*, 2016). In the context of sustainable entrepreneurship, we confirmed the positive effect of the internal locus of control on students' intention to become a sustainable entrepreneur (Arkorful & Hilton, 2022; Fatoki, 2020) although the external locus of control has more influence on entrepreneurial intention compared to an internal locus of control (Arkorful & Hilton, 2022). We found a significant and high effect of proactivity on students' green entrepreneurial intentions elsewhere, where this personality trait was the most effective (Qazi *et al.*, 2021). Empirical evidence also corroborated the positive effect of the internal locus of control on perceived behaviour control (Chiang *et al.*, 2019; Derdowski *et al.*, 2020).

The results provide important insights into how both the TPB and entrepreneurial traits theory can be adapted or refined in the context of circular entrepreneurship, where sustainability and innovation are central. The strong influence of perceived circular behaviour control on circular entrepreneurial intention supports TPB's assertion that perceived behavioural control is critical for shaping intentions. However, it also challenges the theory by suggesting that the type of behaviour control (specifically, control over circular practices) may need to be distinct in models of sustainable entrepreneurship. The role of creativity and risk propensity as primary traits influencing circular behavioural control and intention reinforces the entrepreneurial traits theory's emphasis on cognitive and risk-oriented traits in entrepreneurial success. However, the minimal impact of internal locus of control and proactiveness on circular entrepreneurship intention challenges the theory's universality, implying that traits essential to traditional entrepreneurship may hold less weight in the context of circular entrepreneurship. These findings suggest that both theories could be improved by accounting for context-specific traits and perceived controls, allowing for greater predictive accuracy in fields where creativity and sustainable practices are key. This nuanced understanding not only refines each theory but also highlights the

importance of adapting models of entrepreneurship to align with emerging values and sectors, like those prioritizing circular and sustainable business approaches.

Theoretical Implications

Although this study is exploratory and serves as a starting point for future comparative studies, it contributes to the theoretical deepening of circular entrepreneurship literature. The present research has five main theoretical implications. Firstly, the results demonstrate that circular entrepreneurship presents distinct challenges, opportunities and skills that interact significantly with the personality traits of future entrepreneurs, differentiating it from other types of entrepreneurship. In terms of challenges, since circular entrepreneurship is based on the circular economy, a change in consumers' mentality is necessary to reduce resistance to recycled or reused products and increase their acceptance (Grafström & Aasma, 2021), with the entrepreneur proactivity is essential in this transformation. Furthermore, this type of entrepreneurship is based on innovation and differentiation, looking for circular products and services, innovation in materials, processes and business models (Grafström & Aasma, 2021) and as such, creativity is essential. Circular businesses require investments in innovation that may have a slow return and acceptance, leading to a moderate-high risk propensity. In this way, the results demonstrate that circular entrepreneurship stands out due to the need to close production cycles, requiring a high level of systemic thinking and collaboration with different actors in the value chain (Iacovidou *et al.*, 2021), this type of entrepreneurship requires high perceived creativity to develop regenerative models and strong internal locus of control to deal with regulatory and market challenges. However, it distinguishes itself from other types of entrepreneurship, such as sustainable entrepreneurship, which shares the traits of innovation and purpose with circular entrepreneurship but with a broader focus than just circularity, seeking a balance between profit and impact on society and traditional entrepreneurship that prioritizes profit and efficiency without an explicit focus on sustainability or social impact, having a high propensity for risk. Secondly, it contributes to the development of knowledge on the TPB and Entrepreneurial Traits Theory. Thirdly, it highlights the intentions of Portuguese high students to become socially responsible entrepreneurs. Fourthly, through a unique multidimensional model, it demonstrates that personality traits are antecedents of both perceived circular behaviour control and circular entrepreneurial intention. Finally, it shows that being risk-prone and creative are two important determinants of the intention to be a sustainable entrepreneur. We theoretically show that personal characteristics such as personality traits play a significant role in the development of circular enterprise culture.

Practical Implications

The results of this study serve as a reference for establishing policy guidelines to encourage the adoption of circular businesses. A set of practical implications for students, universities, companies, and policymakers emerged from the present study. Firstly, although we found that students express their intention to become circular entrepreneurs, we know that what is said is not always what is done. Therefore, the educational systems must promote an emphasis on entrepreneurship in line with what is recommended in the circular economy (Pizzi *et al.*, 2022). Besides, as a place of reflection and innovation, the university should encourage students' creativity by fostering freedom of thought and by stimulating them to think outside the box. Secondly, the university is a preparation for the job market and should instil in students greater levels of confidence (internal locus of control). Thirdly, throughout their university education, young people should be imbued with self-confidence, self-esteem, and positive attitudes to become circular entrepreneurs (Khan *et al.*, 2021). Fourthly, universities should develop new entrepreneurship course units at the level of circular entrepreneurship since conventional business models are becoming increasingly outdated. In this regard, it is of the utmost importance to provide students with a broader knowledge of other scientific areas, such as chemistry, since circular business opportunities require profound background knowledge. Fifth, initiatives should be promoted to change the organizational culture of teaching establishments so that a solid corporate culture oriented towards circularity is created. Implementing recycling practices, saving energy and water, waste

management, and saving plastics in bars and cafeterias can induce and improve students' pro-circular behaviours and increase their interest in circularity.

Finally, as for policymakers, circular entrepreneurship policies must be formulated and included in the national development plan. Specific funding must be promoted for universities and companies to adopt circular practices (Yasir *et al.*, 2022). Moreover, effective support policies for circular business initiatives should be encouraged, such as funding vouchers for opening new circular businesses, subsidized bank financing rates, and tax benefits through the reduction of the tax burden on the acquisition of assets oriented towards circularity (*e.g.*, the possibility to amortize assets acquired second-hand, deductibility of taxes on the consumption of second-hand goods, decrease taxes on the consumption of water and electricity in companies with systems to optimize the consumption of these resources and increase the period of deductibility of losses). By decreasing entrepreneurs' risk, these initiatives improve entrepreneurs' pro-circular behaviour and increase circular entrepreneurial intention. Moreover, since young people are increasingly digital, encouraging interaction between the circular economy and emerging technologies such as the internet of things or digitalisation can reduce the risk involved in adopting circular business by increasing transparency and the availability of real-time data.

Limitations and Future Research

This study is not exempt from limitations. We collected data through an online questionnaire and social networks. Even though these drawbacks are recognized in the literature (Andrade, 2020), in this study, specifically in the case of university students, where everyone has access to the internet and social networks, the risk of sampling bias was lower. Furthermore, we collected data only in five higher education institutions, with the sample being collected using a non-probabilistic technique for convenience, making it impossible to generalize the results. We believe that the strengths of the study offset these limitations. The present study is the first to investigate the circular entrepreneurial intention of Portuguese university students. Moreover, this is the first study that uses a multidimensional model to predict the influence of younger personal traits on their circular entrepreneurial intentions employing a circular behaviour control variable. In future research, it would be interesting to extend the study to students of all the Portuguese high education institutions. It would also be interesting to conduct the same study design with college students from other countries to conduct a comparative analysis and test for cultural differences. Future research should include individuals' circular habits in their daily lives to see whether individuals with more circular daily routines are more prone to start a circular business. Finally, future studies should test the influence of individuals' Big Five personality traits in predicting their circular entrepreneurs' intentions.

CONCLUSIONS

The world is changing, and humanity runs severe risks of suffering irreparable damage. Human ambition has depleted natural resources, and the time has come to act to remedy the ecological and environmental disasters. We must learn to live in tune with nature and one another. The circular economy is a critical concept for driving sustainability transformations. By working with circular movements, nature creates a viable environment through interconnected ecological relationships. The concretization of a circular economy requires the intervention of civil society as consumers and entrepreneurs as producers. Concerning the production side, it is essential to know what drives producers to replace economic systems based on linear 'take-make-consume-dispose' models with circular models. To this end, the present study explored the drivers of Portuguese college students' intention to become circular entrepreneurs. Our findings are optimistic since respondents revealed a great interest in being circular entrepreneurs. Thus, they followed in the footsteps of their predecessors when, in the late 90s, a young generation began a cultural change culminating with an entrepreneurship boom. Moreover, respondents' risk-taking propensity, creativity, internal locus of control, and proactivity were determinants in defining both their circular behaviour control and intention to become circular entrepreneurs. The study's empirical findings contribute to the literature on the determinants of the circular entrepreneurial intention of future entrepreneurs.

This study provides five key contributions to understanding circular entrepreneurship among young students. Firstly, it advances knowledge on the TPB and entrepreneurial traits theory by applying these frameworks to the context of circular entrepreneurship, expanding theoretical insights into how perceived behaviour control, internal locus of control, proactive personality, perceived creativity, propensity, and risk-taking influence entrepreneurial intentions. Secondly, it highlights the intentions of Portuguese high school students to become socially responsible entrepreneurs, shedding light on a growing inclination among youth towards sustainable and community-oriented business practices. Thirdly, the study employs a unique multidimensional model to demonstrate that personality traits act as precursors to both perceived circular behaviour control and circular entrepreneurial intention, offering empirical evidence of a complex relationship between individual characteristics and sustainable entrepreneurship. Fourth, the finding that perceived circular behavioural control mediates the relationship between personality traits and circular entrepreneurial intentions introduces a novel perspective, suggesting that young individuals' confidence in their sustainable actions bridges the influence of traits like creativity and risk propensity on their entrepreneurial goals. Ultimately, the study emphasizes the theoretical importance of personality traits in fostering a culture of circular enterprise, positioning characteristics like creativity and risk tolerance as crucial determinants in the drive toward circular entrepreneurship.

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Appendix A:

Questionnaire available at:
https://drive.google.com/file/d/1l3yrM4sy0auxvWGxEHLLtL7gHGZROm78/view?usp=drive_link

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The contribution share of authors is equal for each of them. SG, MP, JLM – conceptualisation, literature writing, SG, MP, JLM – methodology, calculations, discussion.

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Use of Artificial Intelligence

The authors declare that they used grammarly for proofreading.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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