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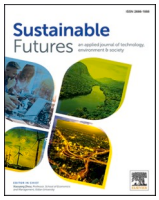

Entrepreneurial traits and sustainable entrepreneurial orientation in Peru: A PLS-SEM analysis of micro and small-sized enterprises

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ABSTRACT

Purpose: The study investigates how individual-level entrepreneurial traits influence the development of Sustainable Entrepreneurial Orientation (SEO) among decision-makers in micro and small-sized enterprises in Peru, highlighting SEO as a dynamic capability critical for advancing sustainability goals in emerging economies.
Design/methodology/approach: Rooted in a positivist paradigm, the analysis employed the PLS-SEM technique on a sample of 121 decision-makers from micro and small-sized enterprises operating across various sectors in Peru, a highly entrepreneurial country in Latin America.
Findings: The results indicate that SEO is fostered by a combination of entrepreneurial traits, including conscientiousness, resilience, self-efficacy, and cognitive reappraisal, an emotional regulation mechanism.
Implications: This study represents an initial effort to assess SEO at the individual level. In terms of managerial implications, the findings suggest that micro and small-sized enterprises, along with their decision-makers and members, should be oriented toward sustainable entrepreneurship to contribute to the 2030 Agenda. To achieve this, it is essential to foster entrepreneurial traits that promote SEO as a capability influencing the predisposition of individuals and organizations toward sustainable practices.
Originality: By applying a PLS-SEM model, the study identifies which entrepreneurial traits exert a stronger influence on SEO at the individual level in Peruvian micro and small-sized enterprises. By linking psychological traits to sustainability capabilities, the study offers new insights into fostering sustainable entrepreneurship in emerging economies. The findings also underscore the strategic role of universities and policy instruments in developing these traits to support progress toward the 2030 Agenda.

1. Introduction

Given the current global situation, characterized by a strong CO_2 rebound and insufficient progress toward achieving the Sustainable Development Goals (SDGs) by 2030 [1], it is necessary to adopt more responsible and conscious organizational behavior regarding environmental and social impacts. This approach calls for conducting business under a more sustainable model, considering the welfare of both society and the planet [2]. In the context of emerging countries, while entrepreneurial levels are high [3], there is a need for economic models that contribute to sustainable development, safeguarding the resources needed for well-being [4–6]. Small companies, characterized by their fewer resources, entrepreneurial leadership style, flexible organizational capabilities, and motivated personnel, exhibit advantages for manifesting sustainability that requires further study [7–9]. To align with the global agenda, ventures must generate not only economic value but also demonstrate a strong commitment to environmental and social responsibilities, in accordance with John Elkington's [10] Triple Bottom Line (TBL) framework, thereby promoting sustainable practices.

Research on sustainable entrepreneurship has been approached through various models and theories. Specifically, Dynamic Capability Theory considers the uncertainty of the environment in determining key resources, which must be reconfigured and developed into dynamic capabilities—particularly in emerging or developing countries [11]. The Upper Echelons Theory [12] posits that the characteristics of top decision-makers influence strategic outcomes—an especially relevant consideration in small firms, where leaders' psychological traits often have a direct impact on the company's direction. In parallel, the Resource-Based View [13] conceptualizes entrepreneurial traits as intangible resources that contribute to competitive advantage when effectively aligned with strategic capabilities. Thus, organizational capabilities and individual strengths can contribute to sustainability

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through a complex dynamic capability of emerging interest, which is called Sustainable Entrepreneurial Orientation (hereinafter SEO) [14,15]. In this context, sustainability-oriented entrepreneurs may serve as a driving force for sustainable development [16].

Recent empirical studies have reaffirmed the role of entrepreneurial competencies and sustainable orientation as key drivers of environmental and social performance in small firms. Aftab et al. [17] argue that entrepreneurial competencies significantly influence TBL outcomes in emerging markets and act as mediators between entrepreneurial orientation and sustainable performance. Likewise, Riaz et al. [18] highlight the importance of social networks and green entrepreneurial orientation in enhancing small firm success through knowledge acquisition and innovation. These findings align with broader frameworks suggesting that SEO is shaped not only by contextual factors such as knowledge dynamics and institutional support but also by individual traits [7,19]. Therefore, the phenomenon of sustainable entrepreneurship from an individual perspective has attracted increasing attention from researchers.

Research streams have emerged that examine beliefs, values, personality traits, and other generic entrepreneurial characteristics of decision-makers [20] to understand the process of environmental problem-solving [21]. From a dynamic perspective, these traits can develop and form to contribute to sustainable entrepreneurship [22], facilitating the pursuit of environmental, social, and economic goals by decision-makers [23]. In other words, specific traits can predispose sustainable entrepreneurs to think and feel certain ways. Eventually, these traits influence behavior thanks to their interconnections with other individual characteristics and unique motivational processes [24]. Empirical evidence confirms that individuals oriented toward entrepreneurship have different mental configurations than non-entrepreneurs and exhibit distinguishable psychological traits that influence their decision-making processes [25]. However, more research is needed to better understand the practices that entrepreneurial decision-makers adopt to ensure a desired level of SEO [26].

Although recent studies have advanced the understanding of the relationship between entrepreneurial traits and SEO significant gaps remain. Based on an extensive literature review, Lazarte-Aguirre [3] emphasizes the importance of traits such as resilience and self-efficacy in promoting sustainability among entrepreneurs in emerging economies but calls for empirical validation using robust analytical frameworks. Similarly, Valencia-Arias et al. [27] highlight the role of individual competencies in sustainability orientation; however, their work focuses primarily on higher education and does not address SEO as a complex, dynamic capability. Overall, the literature lacks empirical studies examining how specific entrepreneurial traits influence SEO at the individual level—particularly within micro and small-sized enterprises in Latin America, where institutional instability, informal economies, and limited resources make sustainable entrepreneurship both critical and underexplored.

As previously mentioned, although prior studies have confirmed the importance of SEO on performance, research on its antecedents, such as entrepreneurial traits, is limited [3]. Based on this issue, the research question guiding the present study was: How do generic entrepreneurial traits—conscientiousness, moral reflectiveness, entrepreneurial self-efficacy, cognitive reappraisal (emotional regulation), and entrepreneurial resilience—influence SEO? The present empirical study aimed to explore the influence of entrepreneurial traits on SEO. A model with PLS-SEM was used to identify the entrepreneurial traits that foster SEO at the individual level, using a sample of decision-makers from Peruvian micro and small-sized companies. Peru is an attractive context because it is considered one of the most entrepreneurial countries worldwide, according to the Global Entrepreneurship Monitor [28]. Peru has 2.3 million micro and small enterprises, representing 99.4 % of the country's total businesses [29]. Although recent studies have shown a positive trend in the implementation of sustainable projects, this trend is more evident in large companies (Perú [30]). Therefore, as in other Latin American countries, sustainable ventures are not yet the norm in Peru, despite a 25 % increase in sustainability reports in 2020 [2]. Thus, Peruvian micro and small enterprises were selected to study the SEO phenomenon, as a predisposition to behave sustainably, and the influence of traits.

This study contributes to the literature by empirically identifying which entrepreneurial traits—specifically conscientiousness, moral reflectiveness, entrepreneurial self-efficacy, cognitive reappraisal, and resilience—foster SEO among decision-makers in micro and small-sized enterprises in Peru. In contrast to prior studies that have examined sustainability orientation more broadly or at the organizational level, this research adopts an individual-level perspective, offering a nuanced understanding of SEO as a dynamic capability. By focusing on micro and small-sized enterprises in a highly entrepreneurial yet under-researched emerging economy, the study provides context-specific insights that advance both theory and practice, particularly regarding how entrepreneurial traits can be cultivated to promote sustainability in resource-constrained environments.

The remainder of the paper is as follows. Section one presents the theoretical framework and the proposed hypotheses. Section two explains the method, including the sample, data collection, and procedure. Section three presents the findings regarding the assessed model. Section four discusses the theoretical implications and proposes recommendations for managers to help organizations offer socially, and environmentally responsible products and services, positively impacting on value for society at large and environmental conditions.

2. Theoretical background

2.1. SEO and sustainability

Criado-Gomis et al. [14] first proposed SEO as the integration of Entrepreneurial Orientation (hereinafter EO) and Sustainability Orientation (hereinafter SO). This approach aims to respond effectively to current environmental demands and instabilities by combining the capabilities to adapt flexibly, discover emerging opportunities, and exploit them. This approach enables companies to incorporate sustainability into their business strategy, respond to environmental uncertainty, and adjust their strategic orientation. SEO is conceived at the enterprise level and is based on an integrated TBL [10]. At the individual level, SEO explains the tendency toward entrepreneurial behavior that contributes to sustainable development based on individuals' environmental concerns [14,31]. Thus, the higher an entrepreneur's SEO, the more likely he or she is to recognize a sustainable business opportunity. Although some empirical studies have addressed SEO as a relevant sustainability capability, current research has shown a tendency toward stagnation on this topic. This may be due to the fact that topics such as EO and Green Entrepreneurial Orientation (GEO) have a longer academic history and more empirical evidence to promote new research.

GEO is a strategic construct that encompasses dimensions such as green innovation, proactivity, and risk-taking. It enables the transformation of existing organizational capabilities [32] and influences firm performance through the support of dynamic capabilities [33] and innovation [34]. GEO plays a fundamental role in navigating highly uncertain environments and aims to generate economic and environmental benefits [35]. However, a systematic literature review by Ameer and Khan [21] proposed a model of individual, organizational, and contextual drivers that could foster the emergence of GEO. This model suggests that sustainable performance can be explained by either SEO or GEO. Despite these terminological overlaps, Ameer and Khan [21] state that the main objective of GEO is to seek the best business opportunities strategically by judiciously combining resources and capabilities. Essentially, GEO serves as a strategic resource enabling entrepreneurs to develop innovative green products and services. Those with a higher level of GEO demonstrate a greater ability to leverage available resources, mitigate negative environmental impacts, and generate

innovative ideas [36].

Furthermore, Verma and Kumar [37] argue that green entrepreneurship, which is associated with sustainability, can be applied to various industries and sectors. This makes it difficult to discern the difference between GEO and SEO. Thus, the issue of divergence between GEO and SEO persists. Regarding paths to achieving sustainability, Dasgupta et al. [38] confirm that innovation plays an important role in promoting sustainable practices. Therefore, investment in research and development is crucial for achieving efficient solutions in the use of resources and clean technologies. In this sense, GEO needs additional drivers [39], e.g., green innovation or social aspects such as Corporate Social Responsibility or CSR [35,36,40], to achieve sustainability. In contrast, SEO intrinsically incorporates the SO component, which leads to technological innovation and improved operational efficiency, subsequently reducing costs, and increasing productivity [41]. Thus, SEO is emerging as a powerful predictor of sustainability, despite the absence of empirical research.

2.2. Entrepreneurial traits as individual drivers of SEO

In the 1970s, researchers first studied entrepreneurial traits as drivers to explain the need for entrepreneurs. The focus was primarily on personality characteristics and their relevance in predicting individual behavior [42]. Moreover, although there are different classifications of entrepreneurs' characteristics, within the entrepreneurial competencies, there have been highlighted skills, knowledge, motivations (extrinsic and intrinsic), personality traits, and specific traits that would lead a business to competitiveness, development, or growth, and success [43, 44]. Indeed, a significant body of research considers entrepreneurial traits to be psychological elements, highlighting that entrepreneurial activities are driven by individuals' psychological behavior [45]. Sustainable entrepreneurs manage the TBL; therefore, they pursue opportunities that generate sustainable benefits with limited profitability [9]. In addition, they have distinctive features compared to traditional entrepreneurs [46].

Kraus et al. [26] and Ameer and Khan [21] defined the terms SEO and GEO, respectively, conceptualizing them based on personality traits, and suggesting the need to expand further research including the role of motivation, abilities, and skills, along with the perceptions, ethical orientation, values, morals, and attitudes that the sustainable entrepreneur demonstrates to promote SEO. Under a strong stream of studies [21], individual factors focus on the importance of personality traits and other generic entrepreneurial traits of the decision-maker to face environmental issues. While the literature extensively studies personality traits [47], it does not extensively study other generic traits despite their known influence on the predisposition to undertake sustainable projects. Given that the role of decision-makers in the emergence of SEO has not been widely addressed in the literature [15], this study focuses on generic entrepreneurial traits (e.g., conscientiousness, moral reflectiveness, entrepreneurial self-efficacy, emotional regulation, and entrepreneurial resilience) in emerging countries, where there is a need for sustainable initiatives.

2.3. Theoretical foundation

This study is underpinned by the following complementary theoretical lenses: the Upper Echelons Theory (UET) [12], the Resource-Based View (RBV) of the firm [13], and the Dynamic Capability Theory (DCT) [48]. Together, these frameworks provide a robust foundation for understanding how individual-level characteristics of decision-makers influence organizational orientations and capabilities such as SEO.

The Upper Echelons Theory posits that strategic choices and organizational outcomes are significantly shaped by the experiences, values, and personality traits of top executives or decision-makers. According to Hambrick [49], individual attributes function as cognitive filters through which managers perceive and interpret their environment. In the context of micro and small-sized enterprises—where founders or managers often exert direct influence over strategic direction—the role of individual traits becomes particularly salient. Entrepreneurial traits such as resilience, self-efficacy, moral reflectiveness, conscientiousness, and cognitive reappraisal shape the decision-maker's capacity to identify and respond to sustainability-related opportunities and risks, thereby fostering a proactive SEO.

The RBV conceptualizes firm-specific resources and capabilities as the foundation for sustained competitive advantage [13]. Within this framework, entrepreneurial traits are viewed as intangible, rare, and inimitable resources embedded in a firm's leadership. Accordingly, traits that foster SEO contribute to long-term value creation not only for the firm but also for society and the environment, aligning with the principles of the TBL [10]. The DCT complements this perspective by extending the scope of the RBV to consider an uncertain environment when determining the most important resources. These resources must be reconfigured as dynamic capabilities, especially in emerging countries [11]. From this standpoint, EO, as a component of SEO, is considered a dynamic capability that predicts others such as absorptive capacity, which in turn affects organizational performance [50]. Alternatively, absorptive capacity and other contextual factors may also serve as antecedents that influence the development of EO at the organizational level [51,52].

Together, UET and RBV/DCT provide a robust theoretical framework to support the hypothesized relationships in this study. While UET explains the psychological and behavioral mechanisms through which individual decision-makers shape sustainability-oriented strategies, RBV and DCT emphasize how these traits function as strategic assets. These assets differentiate firms and contribute to sustainable impact through SEO and its components, which are recognized as dynamic capabilities.

2.4. Hypothesis development

Sustainable entrepreneurs should seek business opportunities that can improve economic, social, and environmental performance [40]. SEO is a high-level strategic construct that explains entrepreneurial behavior's tendency to achieve sustainable development based on individuals' environmental concerns [14,31]. Therefore, this study proposes the general hypothesis that the level of SEO at the individual level could help explain the nature of the sustainable practices that decision-makers promote within their organizations to achieve sustainable development and environmental protection.

Fig. 1 shows the nomogram of the proposed SEO structural model. This model is based on the conceptual model of Ameer and Khan [21], who invited researchers to empirically test their framework using quantitative methods. Their model identified psychological factors as key to addressing environmental issues and included generic traits such as conscientiousness, moral reflectiveness, and power motives [53,24]. The model also includes entrepreneurial self-efficacy and emotional regulation [54,55]. Entrepreneurial and employee-level resilience [56] was also included as an important ability. These self-beliefs can help entrepreneurs confront the environmental impacts of their businesses and encourage sustainable behavior by influencing sustainable entrepreneurial orientation [21].

First, at the individual level, conscientiousness about unsustainable practices rooted in the local context, as well as a moral imperative to address social inequalities, primarily motivates people to develop sustainable entrepreneurship [57]. This aligns with the work of Patzelt and Shepherd [58] and Belz and Binder [59], who indicate that recognizing opportunities for sustainable entrepreneurship depends on awareness of social or environmental problems entrepreneurs aim to solve. Thus, individuals with high conscientiousness are committed to the long term and believe in entrepreneurship [22]. Furthermore, conscientiousness positively influences entrepreneurial intention, a consequence of EO, through entrepreneurial self-efficacy [60]. This, in turn, leads an

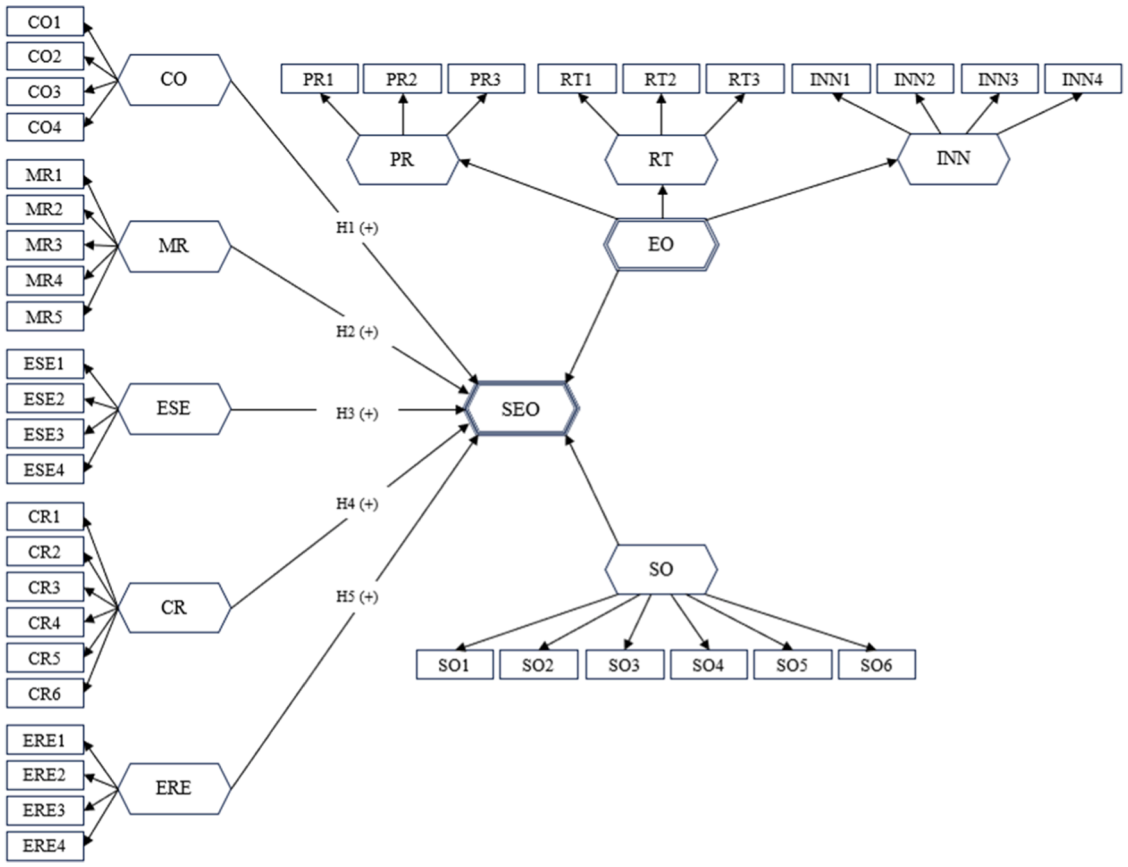

Fig. 1. Nomogram of the SEO structural model proposed. Notes (1) Tripled-line hexagon refers to a third-order construct. Doubled-line hexagon refers to a second-order construct. (2) CO = Conscientiousness; MR = Moral Reflectiveness; ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; CR = Cognitive Reappraisal (Emotional Regulation); INN = Innovativeness; PR = Proactivity; RT = Risk-taking; SO = Sustainability Orientation; EO = Entrepreneurial Orientation; SEO = Sustainable Entrepreneurial Orientation. Source: Author's own work.

organization toward successful performance through conscientiousness and openness to experience [61]. Similarly, Tze San et al. [62] found that Asian employees with high environmental conscientiousness strengthen their GEO commitment to sustainable performance due to their deep self-perception of the environment. Lastly, Zabelina et al.'s [63] mixed-scope study concluded that green or sustainable entrepreneurs are more conscientious and concerned about their context than non-sustainable ones, who focus more on negative aspects. Thus, this study developed the following hypothesis:

Hypothesis 1. Conscientiousness facilitates the adoption of SEO in micro and small-sized companies.

Second, conscientious individuals exhibit moral reflectiveness, which is a self-controlled process that enables them to regulate their behavior [24]. However, it is also considered a motivational trait that influences pro-environmental behavior [64,65]. This trait distinguishes individuals because it is associated with intrinsic motivation and encourages people, even without benefit or pressure, to act ethically and morally for a sense of meaning [66]. Entrepreneurs with stronger ethical orientations and moral reflective capacities are more likely to adopt sustainable practices and contribute positively to society. This is consistent with the "reflective moral leader" model, which posits that entrepreneurs must develop a deep understanding of their own morality to lead ethically and responsibly, especially in an increasingly sustainability-conscious business environment [67]. Consequently, this trait helps individuals care about morality. Thus, it is considered an individual factor that differentiates them based on the amount of morally guided reflection they engage in regarding their experiences and the extent to which they contemplate moral issues in their daily lives. Regarding sustainable entrepreneurship, conscientiousness and moral reflectiveness directly impact green behavior by encouraging entrepreneurs to overcome difficulties despite lacking confidence or external support [66]. Thus, this study developed the following hypothesis:

Hypothesis 2. Moral reflectiveness facilitates the adoption of SEO in micro and small-sized companies.

Third, personality traits influence individuals' beliefs in their capabilities and abilities, contributing to entrepreneurial self-efficacy. This trait system supposes a sustainable process that affects not only individual self-efficacy, but also the overall sustainability of the individual [22]. However, it also works in the opposite direction; entrepreneurial self-efficacy supports positive beliefs, feelings, and intentions toward entrepreneurial actions [68]. Thus, entrepreneurial self-efficacy enables individuals to believe in their ability to make necessary business decisions in challenging contexts [69]. In addition, self-efficacy involves the capacity to manage and utilize emotions [70], which is closely associated with emotion regulation mechanisms. Consequently, the higher the entrepreneurial self-efficacy, the greater the confidence, ability, strength, and trust in meeting customers' continuous changes and requirements [36]. This personal trait predicts entrepreneurial intention directly [68,71–73] or indirectly as a mediator [22,74]. Furthermore, entrepreneurial self-efficacy has been found to positively influence green entrepreneurial intention [75], which is an antecedent of GEO/SEO and a predictor of green entrepreneurial behavior [66]. On the other hand, controlling for self-efficacy would reveal a direct effect of EO on small business performance [76]. Given this background and the definition of entrepreneurial self-efficacy as a trait or mechanism

that generates interest in entrepreneurship and connects interpersonal skills with entrepreneurial actions [77], as well as its role in determining organizational performance through EO, it is clear that further attention is warranted, particularly in view of its relationship with SEO. This discussion suggested the following:

Hypothesis 3. Entrepreneurial self-efficacy facilitates the adoption of SEO in micro and small-sized companies.

Fourth, emotions are closely related to entrepreneurship. When pursuing opportunities associated with goals and desires, emotions emerge as moods related to the identified cause or objective. In other words, emotions are experienced as a function of what is important—a reflection of goals and concerns. Hence, emotional regulation allows individuals to deal with their emotions to achieve a goal [78]. This definition sheds light on how entrepreneurs' psychological attributes influence emotional management in entrepreneurial endeavors [70]. Entrepreneurs who effectively regulate their emotions over time are more likely to maintain well-being and make sustained progress in their ventures [79]. There are five emotional regulation strategies, of which cognitive reappraisal is one of the most researched and used [80]. Cognitive reappraisal efficiently reduces fear, especially the one related to entrepreneurial activities [81], resulting in lower levels of emotion-related biases in the decision-making process [82]. Moreover, cognitive reappraisal reduces negative affective states and increases positive ones [83]. At the same time, it anticipates extreme emotions, contributing to good entrepreneurial performance [54]. One way to decrease negative emotions, such as fear, is through emotional regulation using cognitive strategies to change appraisals of the relevance of events to goals. In this sense, reevaluating the importance of emotion-provoking events in the entrepreneurial process (e.g., viewing a negative future event as unimportant) and reevaluating its outcome (e.g., considering how things could improve) depends on anticipatory emotions regarding entrepreneurship. These emotions are evaluated using behavioral measures [81]. These findings suggest that cognitive reappraisal deserves more attention, especially about SEO. Therefore, the following hypothesis was proposed:

Hypothesis 4. Cognitive reappraisal (i.e., emotional regulation) facilitates the adoption of SEO in small- and micro-sized companies.

Fifth, entrepreneurial resilience enables individuals to anticipate potential threats, face dangerous business circumstances, and adapt to changes. This strengthens them further. In other words, those who are more resilient are the most likely to start over when identifying a business opportunity or facing difficulties [56,69]. Studies such as those by Ignat and Constantin [84], Schepers et al. [85], and Pascucci et al. [86] state that entrepreneurial resilience has become more relevant due to economic and health crises around the world. Organizations could collapse and lose their resilience if they do not have a functional long-term strategy. Therefore, the most resilient individuals are the most likely to start over [56]. Thus, entrepreneurial resilience positively correlates with success at the individual and organizational levels. Those with high entrepreneurial resilience identify with and embrace sustainable development, which motivates them to develop sustainable entrepreneurship [87,88]. However, in an entrepreneurial context, psychological resilience refers to the ability to overcome significant challenges and persist in the entrepreneurial process despite adverse situations and unexpected outcomes [31]. Although it is difficult for decision makers to transition from a traditional economy to a sustainable one, demonstrating sufficient resilience can help them recognize the value of creative ideas and optimize environmental opportunities [69]. Nasser [88], on the one hand, tests the impact of entrepreneurial resilience on SEO; that is, resilience directly affects entrepreneurship, so resilient individuals are more likely to propose sustainable entrepreneurship. Conversely, Wu et al. [31] proposed that resilience moderates the relationship between personality traits and SEO. This confirms that resilience is positively correlated with SEO, as evidenced by individuals who successfully manage change, adversity, and risk. However, Soo Sung and Park [89] recommend that future research collect data from different countries to better understand the effects of individual traits, such as personality and resilience, on SEO. Therefore, resilient individuals would be more likely to propose sustainable entrepreneurship:

Hypothesis 5. Entrepreneurial resilience facilitates the adoption of SEO in micro and small-sized companies.

3. Methods

3.1. Sample and data collection

Peru has a vibrant entrepreneurial scene, with high levels of entrepreneurship and a growing number of startups [28]; however, sustainable practices are not widely expanded as the number of sustainability reports of the Global Reporting Initiative (GRI) corroborate. This dynamic environment offers a relevant case for examining entrepreneurial traits and SEO. Moreover, challenges such as political instability, social inequality, and infrastructural deficits [90] test and shape entrepreneurial resilience and adaptability, making the focus on traits particularly pertinent.

In Peru, micro and small-sized enterprises are a vital part of the economy. As of 2023, together with medium-sized firms, they accounted for approximately 2.3 million businesses—99.4 % of all formal enterprises—employing 89.4 % of the private-sector workforce and contributing 12.6 % of corporate income tax revenues and 5.8 % of total exports [29]. Despite their economic importance, Peruvian firms face structural challenges such as informality, limited financial access, and constrained capacity for innovation and sustainability [91,92]. These conditions make them a relevant focus for research on entrepreneurial capabilities and sustainable practices. In addition, there is no record of the size of the enterprise population with sustainability reports. However, the GRI provided this information using a 2021 database. Thus, the sample framework was constructed using nonpublic GRI information. The study was reviewed and approved by the Ethics Committee for Social, Humanistic, and Artistic Sciences of the Pontificia Universidad Católica del Perú (PUCP) under approval number 100–2023-CEI-CCSSHHyAA/PUCP on September 28, 2023. All participants gave informed consent for inclusion before participating in the study. Data were collected over a six-week period, from October to mid-November 2023, providing sufficient time to reach decision-makers and maximize the response rate while maintaining the relevance and timeliness of the data.

The final sample of 121 responses exceeds the minimum requirement established by an a priori power analysis ($n = 92$), confirming that the study has adequate statistical power (0.91) to detect medium effect sizes, ensuring robustness for model testing using PLS-SEM. First, a statistical power analysis was conducted a priori to determine the sample size [93]. Using the G*Power 3.1.9.7 software, the study calculated an F-statistic for linear multiple regression with statistical power of 0.80, an error probability of 0.05, five predictors, and a minimum effect size of 0.15 [94]. This determined a minimum sample size of 92 micro- and small-sized companies. The post hoc statistical power analysis of the evaluated model resulted in a statistical power of 0.91. To corroborate this sample size, the inverse root square method was used with a retrospective approach [95], considering a significance level of 5 % and minimum path coefficients ranging from 0.11 to 0.32 (accepted hypothesis). This established a minimum sample size ranging from 39 to 155 observations.

Second, the minimum sample size was used to determine the number of invitations for the study. To this end, the sustainability reports were reviewed to obtain data from decision-makers. Of the complete database of 303 micro- and small-sized enterprises, data could not be obtained from 23 of them. Seventeen of these enterprises did not have registered sustainability reports, and there was no contact information for the companies or their decision-makers in public sources. Six of the

enterprises had the same decision-maker and could not be duplicated. Third, since the expected response rate for surveys is very low [96], it was decided to invite as many companies as possible. Given the absence of a complete public directory of sustainable micro and small-sized enterprises, a purposive sampling strategy was initially used to identify the accessible population (303 enterprises). A census-like approach followed, with the questionnaire sent to all 280 eligible firms with valid contact information. This approach ensured broad coverage and enhanced the generalizability of the findings within this niche population. Thus, by sending the survey to the 280 micro and small-sized enterprises with valid contacts, a probabilistic sampling was ensured. A total of 126 responses were received, resulting in a response rate of 45 %.

The questionnaire was prepared for data collection, considering the validated instruments in the literature for all constructs. The questionnaire included closed, single-choice questions (dichotomous or polytomous) to measure nominal and ordinal variables. Polytomous questions used a 5-point Likert scale to collect data. All items underwent double translation (English to Spanish and Spanish to English) to ensure they were adequate, clear, and easy to understand. An in-depth content validity process was conducted through the judgment of a panel of experts [97]. Then, a panel of three academics with backgrounds in entrepreneurship, sustainability, and methodology revised the complete survey to validate the content. Each expert examined the relevance, wording, and meaning of each question to ensure content validity. The expert panel made minor modifications to adapt the instrument to the Peruvian context and address potential issues of comprehension and ambiguity. No reflective variables were removed as they were deemed appropriate and non-repetitive. Appendix 1 provides the survey items and corresponding validated instruments.

For assessing the instrument's validity using criterion and construct validity before applying PLS-SEM, a pilot study was conducted on 30 micro and small-sized companies that reported their sustainability through the GRI in 2021, which were selected at random by personally contacting the decision maker, to empirically contrast the measurement models. The questionnaire was distributed online via Google Forms and selected randomly through personal contact with decision-makers. The pilot study demonstrated that the internal consistency reliability, evaluated using Jöreskog's rho (ρC) and Dijkstra-Henseler's rho (ρA), yielded values between 0.720 and 0.931, falling within the expected range of 0.6 to 0.9. Convergent validity, assessed through the Average Variance Extracted (AVE), was confirmed with values exceeding 0.5 in all cases. Discriminant validity was measured using Fornell and Larcker's criteria and the Heterotrait-Monotrait (HTMT) ratio, with results confirming discriminant validity [98]. Some items were initially removed to achieve the reported consistency and reliability results; however, they were retained for further data collection because the consistency and reliability may improve with a complete sample. Lastly, after validating the instrument and confirming the estimated survey duration, it was sent via email to the complete filtered database.

3.2. Procedure

There are several reasons why PLS-SEM was chosen for this study. First, the exact number of Peruvian companies that publish sustainability reports remains uncertain, which poses a challenge for methods that demand large sample sizes to attain sufficient statistical power, for example, CB-SEM [99]. Second, as proven through the univariate (Shapiro-Wilks's test) normality check, data of the analyzed variables are not normal, so the application of PLS-SEM is suitable for testing the proposed theoretical model since it is strong for treating non-parametric data [100,101]. Third, the SEO is a third-order construct with a reflective first order, a reflective second order, and a formative third order. Thus, PLS-SEM is suitable for assessing the model of this study as it combines indicators of different latent variables [102]. In addition, PLS-SEM is appropriate for evaluating the model's predictive capability [103,104].

The steps in the analysis followed the guidelines outlined by Hair et al. [105]. The statistical procedure began with data exploration to identify inconsistencies, missing values, excessive skewness or kurtosis, and outliers, resulting in the removal of five cases and yielding a final usable sample of 121 observations. To assess common method bias (CMB), Harman's single-factor test was conducted, with one factor accounting for 20.41 % of the variance—well below the 50 % threshold [106]. The process continued with the application of reliability tests, the assessment of the structural model, and the analysis of the results provided by the SmartPLS 4 program and related to the proposed research hypotheses. As a consequence of this last step, it was indicated whether the hypotheses were accepted or refuted, as well as suggesting why the results are or are not considered significant, when considering the literature, or whether they can be generalized to a certain population, context, or time. In short, the implications of the results for the studied population for future research were given [107].

4. Results

4.1. Evaluation of measurement models

Following Sarstedt et al. [108], the evaluation of reflective and formative measurement models implies several criteria. As for the first-order reflective constructs, as evidenced in Table 1, internal consistency is proven [109,110]. The loadings of all the remaining items were greater than the threshold of 0.7 [109,110]. In addition, Cronbach's α and composite reliability were greater than 0.6 [111], determining the instrument is reliable. Convergent validity was evaluated by assessing the criterion of Average Variance Extracted (AVE) values above 0.5 [109,110]. Although a few constructs (ERE, INN) showed AVE values marginally below the 0.50 threshold (i.e., 0.498 and 0.483, respectively), their composite reliability values (ρC = 0.796 and 0.788) and Cronbach's alpha values remain within acceptable bounds, indicating sufficient internal consistency. According to Fornell and Larcker [98], an AVE value slightly below 0.50 may be acceptable if the composite reliability value exceeds 0.60 because it still reflects convergent validity. Hair et al. [112] also support this position, recommending prioritizing construct reliability and item loadings when AVE is borderline. Furthermore, the indicator loadings for these constructs were all greater than 0.60, which supports their inclusion in the measurement model.

Table 2 shows the factor loadings for the first-order reflective items. Although some indicators (e.g., CO2, ERE4, SO2, SO3) exhibited outer loadings between 0.50 and 0.70, they were retained to maintain the constructs' content validity. According to Hair et al. [112] and Fornell and Larcker [98], items within this range are acceptable in exploratory

Table 1
Evaluation of first-order reflective measurement model.

Construct	αC	ρC	AVE
CO	0.683	0.799	0.502
CR	0.855	0.892	0.579
ERE	0.656	0.796	0.498
ESE	0.870	0.911	0.720
INN	0.644	0.788	0.483
MR	0.852	0.893	0.627
PR	0.557	0.773	0.535
RT	0.812	0.865	0.519
SO	0.683	0.799	0.502

Notes (1) CO = Conscientiousness; MR = Moral Reflectiveness; ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; CR = Cognitive Reappraisal (Emotional Regulation); INN = Innovativeness; PR = Proactivity; RT = Risk-taking; SO = Sustainability Orientation. (2) SEO and EO are not reported because they are higher-order constructs. (2) αC = Cronbach's α; ρC = Jöreskog's Rho coefficient.
Source: Author's own work.

Table 2
Factor loadings of the first-order reflective measurement model.

	CO	CR	ERE	ESE	INN	MR	PR	RT	SO
CO1	0.807								
CO2	0.596								
CO3	0.720								
CO4	0.694								
CR1		0.701							
CR2		0.814							
CR3		0.716							
CR4		0.729							
CR5		0.803							
CR6		0.794							
ERE1			0.680						
ERE2			0.777						
ERE3			0.781						
ERE4			0.562						
ESE1				0.872					
ESE2				0.868					
ESE3				0.874					
ESE4				0.776					
INN1					0.672				
INN2					0.632				
INN3					0.712				
INN4					0.756				
MR1						0.675			
MR2						0.822			
MR3						0.843			
MR4						0.805			
MR5						0.804			
PR1							0.803		
PR2							0.772		
PR3							0.788		
RT1								0.779	
RT2								0.616	
RT3								0.787	
SO1									0.747
SO2									0.590
SO3									0.632
SO4									0.728
SO5									0.791
SO6									0.807

Notes (1) CO = Conscientiousness; MR = Moral Reflectiveness; ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; CR = Cognitive Reappraisal (Emotional Regulation); INN = Innovativeness; PR = Proactivity; RT = Risk-taking; SO = Sustainability Orientation. (2) SEO and EO are not reported because they are higher-order constructs.
Source: Author's own work.

research provided that the composite reliability exceeds 0.70 and the average variance extracted (AVE) approaches or exceeds 0.50. In this study, all constructs met these conditions, justifying the retention of items with moderate loadings to ensure theoretical completeness and robust measurement.

Regarding discriminant validity, according to the Fornell and Larcker criterion (Table 3), the values below the diagonal were lesser than above the diagonal, and values of the first-order values in the HTMT matrix (Table 4) were below 0.85 [113]. For the evaluation of the second-order reflective variable, a two-stage embedded approach was applied. Loadings from the second-order variable to the first-order variables must be significant and greater than 0.7. According to Table 5, this requirement is fulfilled. With these loadings, Cronbach's α, composite reliability, and AVE were calculated manually. The respective values were 0.661, 0.819, and 0.601, meeting the validation criteria.

In the case of formative variables, multicollinearity among

Table 3
Fornell-Larcker results of the first-order reflective measurement model.

	CO	CR	ERE	ESE	INN	MR	PR	RT	SO
CO	0.708								
CR	0.016	0.761							
EO	0.389	0.350							
ERE	0.487	0.330	0.706						
ESE	0.306	0.176	0.540	0.849					
INN	0.175	0.269	0.376	0.340	0.695				
MR	0.140	0.275	0.207	0.221	0.076	0.792			
PR	0.495	0.184	0.574	0.343	0.358	0.216	0.788		
RT	0.196	0.377	0.277	0.311	0.464	0.296	0.359	0.731	
SO	0.313	0.199	0.396	0.311	0.101	0.213	0.376	0.205	0.720

Notes (1) CO = Conscientiousness; MR = Moral Reflectiveness; ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; CR = Cognitive Reappraisal (Emotional Regulation); INN = Innovativeness; PR = Proactivity; RT = Risk-taking; SO = Sustainability Orientation. (2) SEO and EO are not reported because they are higher-order constructs.
Source: Author's own work.

Table 4
HTMT matrix of the first-order reflective measurement model.

	CO	CR	ERE	ESE	INN	MR	PR	RT	SO
CO									
CR	0.120								
ERE	0.700	0.436							
ESE	0.356	0.204	0.709						
INN	0.264	0.359	0.579	0.451					
MR	0.171	0.353	0.258	0.241	0.144				
PR	0.695	0.233	0.844	0.440	0.524	0.274			
RT	0.398	0.551	0.484	0.433	0.753	0.411	0.598		
SO	0.390	0.247	0.526	0.364	0.195	0.260	0.484	0.349	

Notes (1) CO = Conscientiousness; MR = Moral Reflectiveness; ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; CR = Cognitive Reappraisal (Emotional Regulation); INN = Innovativeness; PR = Proactivity; RT = Risk-taking; SO = Sustainability Orientation. (2) SEO and EO are not reported because they are higher-order constructs.
Source: Author's own work.

Table 5
Evaluation of second-order reflective measurement model.

Construct	Score	*p*-value	CI 97.5 %	αC	ρC	AVE
INN ← EO	0.796	0.000	[0.688; 0.870]	0.661	0.819	0.601
PR ← EO	0.767	0.000	[0.641; 0.853]			
RT ← EO	0.762	0.000	[0.652; 0.840]			

Notes (1) EO = Entrepreneurial Orientation; INN = Innovativeness; PR = Proactivity; RT = Risk-taking. (2) αC = Cronbach's α; ρC = Jöreskog's Rho coefficient.
Source: Author's own work.

components was assessed using the variance inflation factor (VIF). Table 6 shows that VIF for both EO and SO were under 3.3, the maximum acceptable threshold [114]. The significance of the weights and loadings of the components were evaluated, resulting in the retention of the components that had significant weights (p-value < 0.05) and loadings greater than 0.5 [111]. In addition, bootstrapping was used as a resampling method [115,116]. Furthermore, analyzing the weights and loadings of the indicator variables ensured their relevance and significance [117], meaning that none of them need to be excluded.

4.2. Evaluation of the structural model

The guiding principles of non-collinearity [118] were satisfied concerning the structural model. To evaluate the statistical significance of the path coefficients, bootstrapping with 10,000 resamples was conducted [109,110,115]. Based on the five hypotheses, four of them went in the expected direction with statistically significant relationships, supporting H1 (the impact of conscientiousness on SEO), H3 (the impact of entrepreneurial self-efficacy on SEO), H4 (the impact of cognitive reappraisal on SEO), and H5 (the impact of entrepreneurial resilience). Therefore, the effects of these relationships are relevant as they are highly significant (p-value < 0.05), as seen in Table 7.

After assessing the significance and relevance of the path coefficients, the predictive accuracy and relevance parameters were obtained [105], which helped define the explanatory power of the model [104]. The main parameter to demonstrate predictive accuracy is the level of variance explained (R^2) with levels of 0.67 described as important, 0.33 as moderate, and 0.19 as weak [102]. This parameter

Table 6
Evaluation of the formative measurement model.

Construct	Collinearity (VIF)	Score	*p*-value	Score (>0.5)	*p*-value
EO → SEO	1.100	0.788	0.000	0.910	0.000
SO → SEO	1.100	0.416	0.000	0.651	0.000

Notes EO = Entrepreneurial Orientation; SO = Sustainability Orientation; SEO = Sustainable Entrepreneurial Orientation.
Source: Author's own work.

Table 7
Evaluation of the structural model.

Endogenous variable	Exogenous variables	Path coefficients	*p*-value	R^2	f^2
SEO	CO	0.221	0.007	0.461	0.064
	CR(ER)	0.197	0.006		0.058
	ERE	0.316	0.003		0.093
	ESE	0.173	0.025		0.042
	MR	0.097	0.176		0.015

Notes (1) CO = Conscientiousness; CR = Cognitive Reappraisal (Emotional Regulation); ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; MR = Moral Reflectiveness; SEO = Sustainable Entrepreneurial Orientation. (2) p-values consider a statistical significance level of 5 %.
Source: Author's own work.

helps to identify which variables have the greatest contribution to explaining the variance [105]. Complementarily, the effect size f^2 is evaluated following Cohen's [93] criteria, considering that effect sizes of 0.02 are small, 0.15 are moderate, and 0.35 are large [119].

First, the R^2 coefficient, as a parameter of the explanatory power, for SEO (0.461) was found to be moderate, which is acceptable for exploratory research [120]. On the other hand, the model's predictive ability results were validated using PLSpredict, a procedure that identifies variables with high predictive power [121]. Following Shmueli et al. [104] evaluation guidelines, it was found that the prediction errors are symmetric for most indicators (when the skewness value is less than 1, the use of root mean square error (RMSE) is recommended), and the rest are not symmetric (when the skewness value is greater than 1, the use of the mean absolute error (MAE) is recommended). Table 8 shows that for all indicators, using the RMSE for comparison is more accurate than using the MAE. Moreover, all $Q^2_{predict}$ values are above 0 and all the indicators have predictive ability because they have RMSE values for PLS below their values with multiple linear regression model (MLR). Given that all indicators have lower RMSE values in the case of PLS than in MLR, the model has strong predictive power.

Therefore, based on the parameters of precision and predictive relevance, the model supports the initial hypothesis that entrepreneurial traits influence SEO in emerging economies, such as Peru. This finding supports the acceptance of hypotheses H1, H3, H4, and H5.

Finally, choosing a goodness-of-fit parameter in PLS-SEM is not a decision based on explicit criteria, since methodologists' recommendations have not yet reached a consensus [112]. Some argue that demonstrating the model's predictive capacity is sufficient, as the focus in an explanatory analysis is on the "R^2 of the endogenous variables, the statistical inference of the path coefficients and the sizes of the effects" ([122], p. 4).

Nevertheless, favorable results have been obtained using parameters applied in the CB-SEM with some corrections to be applied in PLS-SEM. In this context, the standardized root mean square residual (SRMR)

Table 8
Predictive performance assessment (PLS-Predict).

Construct	Indicator	MAE PLS	MAE MLR	RMSE PLS	RMSE MLR	$Q^2_{predict}$
EO	INN1	0.687	0.759	0.836	0.964	0.055
	INN2	0.859	1.018	1.063	1.294	0.067
	INN3	0.776	0.894	0.988	1.141	0.023
	INN4	0.661	0.811	0.844	1.008	0.033
	PR1	0.573	0.650	0.711	0.827	0.180
	PR2	0.640	0.707	0.776	0.864	0.204
	PR3	0.467	0.451	0.561	0.590	0.150
	RT1	0.833	0.952	1.038	1.173	0.045
	RT2	0.600	0.667	0.738	0.832	0.126
	RT3	0.835	0.868	1.048	1.086	0.040
SO	SO1	0.433	0.478	0.578	0.667	0.134
	SO2	0.807	0.983	1.055	1.316	0.025
	SO3	0.751	0.900	1.013	1.217	0.026
	SO4	0.394	0.417	0.499	0.543	0.042
	SO5	0.467	0.519	0.589	0.674	0.054
	SO6	0.418	0.469	0.543	0.601	0.079

Notes (1) CO = Conscientiousness; CR = Cognitive Reappraisal (Emotional Regulation); ESE = Entrepreneurial Self-Efficacy; ERE = Entrepreneurial Resilience; MR = Moral Reflectiveness; SEO = Sustainable Entrepreneurial Orientation. (2) MLR = Multiple linear regression model; MAE = Mean absolute error; RMSE = Root mean square error.
Source: Author's own work.

should be less than 0.08, and the normed fit index (NFI) should range from 0 to 1. A value greater than 0.90 and close to 1 indicates an acceptable model fit [121]. Likewise, Dijkstra and Henseler [123] proposed a procedure based on resampling techniques to validate the statistical significance of the geodesic distance (d-G) and squared Euclidean distance (d-ULS) parameters. Values of d-G and d-ULS less than 0.10 are considered an acceptable model fit. Table 9 shows the results of the goodness-of-fit indices for the present research, which are satisfactory for the saturated model according to the SRMR (0.011), NFI (0.996), d-ULS (0.003), and d-G (0.001).

In this way, exact fit tests were more widely accepted, based on the bootstrapping application, on the d-G measurement, the NFI, as well as through the SRMR [120,123]. However, the use of any parameter to evaluate the overall goodness of fit of the model requires being treated with caution, as "a much better understanding of its applicability and performance in PLS-SEM is needed" ([124], p. 573). For this reason, goodness-of-fit will not be used to define model quality, which has been determined by evaluating the measurement and structural models. Instead, goodness-of-fit parameters will be used as additional criteria for evaluating the model.

In summary, the proposed model has moderate explanatory precision, since the adjusted R^2 of the main endogenous variable is moderate with favorable results of the goodness-of-fit measures.

5. Discussion and implications

5.1. Discussion

Based on the literature review, different indicator variables were identified at the individual level and grouped into factors or traits that promote the emergence of SEO. The large number of indicator variables stems from the variety of approaches and perspectives in studying the SEO construct. However, the literature revealed a gap in that generic entrepreneurial traits are not widely studied, unlike personality traits. Thus, this research proposes a theoretical model that explains SEO from an individual perspective, considering generic entrepreneurial traits that are rarely addressed in the literature. The study aimed to identify the generic entrepreneurial traits—conscientiousness, moral reflectiveness, entrepreneurial self-efficacy, cognitive reappraisal (emotional regulation), and entrepreneurial resilience—that influence SEO.

Table 9
Goodness of fit assessment.

Index	Saturated model	Estimated model
SRMR	0.011	0.011
NFI	0.996	0.996
d-ULS	0.003	0.003
d-G	0.001	0.001

Notes SRMR = Standardized Root Mean Square Residual; NFI = Normed Fit Index; d-G: Geodesic distance; d-ULS: Squared Euclidean distance.
Source: Author's own creation.

For this reason, the model was evaluated using PLS-SEM with empirical data from 121 Peruvian micro and small companies' decision-makers who had sustainability reports. Outliers were evaluated first. These companies represent the economic base of most Latin American countries (Confederación Española de Organizaciones Empresariales [125], 2018) and constitute the majority of the Peruvian business group [126]. However, like other Latin American countries, Peru does not yet have a majority of sustainable ventures [2]. By focusing on Peru's unique entrepreneurial environment, this study contributes to a more comprehensive understanding of SEO and its entrepreneurial traits as antecedents. It offers lessons that can be adapted and tested in other settings. Although the generalizability of the findings is limited to this specific setting, the identified traits may be relevant in other cultural contexts. Entrepreneurial traits often transcend cultural boundaries, suggesting that findings related to traits such as resilience and self-efficacy could be applicable globally. However, the extent to which these traits influence SEO may vary depending on cultural, economic, and social factors.

The model's evaluation revealed support for most of the proposed structural relationships. Thus, the contrasted theoretical model considers five entrepreneurial traits as latent variables, four of which—conscientiousness, entrepreneurial self-efficacy, cognitive reappraisal (emotional regulation), and entrepreneurial resilience—have a significant effect on SEO as a third-order construct. These findings were supported by the empirical data and enabled us to present a series of findings, which are discussed in relation to the consulted literature and described below.

First, based on their relationship that evidences a relevant path coefficient, entrepreneurial resilience is one of the strongest exogenous variables that influence SEO. Therefore, Hypothesis 5 was corroborated. Thus, the proposed model confirms the findings of Ignat and Constantin [84], Nasser [88], Pascucci et al. [86], and Ameer and Khan [21]. These authors emphasize the importance of resilience as a strategy that enables entrepreneurs to adapt to changes and encourage organizations to align their activities with environmental sustainability. Regarding sustainable entrepreneurship, the present study provides evidence that resilience is an important antecedent of SEO. This means that micro and small entrepreneurs are driven by this trait to orient their companies toward sustainable practices, as evidenced by their sustainability reports. Furthermore, since resilience is a trait that builds over time based on previous experiences [69], it can be concluded that it has contributed to Peru's overall ranking as a highly entrepreneurial country.

Second, the proposed model confirmed the effect of entrepreneurial self-efficacy on SEO. Therefore, Hypothesis 3 was corroborated. The self-efficacy can motivate entrepreneurs to respond to external pressures and take environmental action, thus corroborating the findings of prior studies (e.g., [68,71–73]). Furthermore, it expands on the positive, direct relationship between entrepreneurial self-efficacy and EO in small businesses, as confirmed by Imran et al. [76], Palmer et al. [127], and McGee et al. [128]. Thus, the present study contributes to the literature by confirming the relationship between self-efficacy and SEO, moving ahead from the studies only regarding EO.

Third, the results confirm the link between cognitive reappraisal — an important emotional regulation mechanism [129] — and SEO. This mechanism reduces negative emotional states and enhances positive ones. This can lead to a reduction in fear and bias during the

decision-making process regarding entrepreneurial activities [81,82]. Thus, the results highlight an exciting finding: While cognitive reappraisal can encourage entrepreneurs to consider how emotions influence the entrepreneurial process, the study provides an initial understanding of the positive effects of SEO as a construct that fosters sustainable entrepreneurship within organizations. Furthermore, this corroborates the findings of Mortan et al. [70], who found that the regulation of emotions, as part of emotional intelligence, has a positive effect on the intention of becoming an entrepreneur (i.e., entrepreneurial intention), which is a consequence of EO. Therefore, the discoveries of this study widen the literature regarding EO, and confirm that SEO can be fostered by entrepreneurs with emotional regulation, especially the cognitive reappraisal mechanism.

Fourth, the proposed model did not support the relationship between moral reflectiveness and SEO but confirmed the relationship between conscientiousness and SEO. Therefore, while Hypothesis 1 was supported, Hypothesis 2 was not. These results align with Jiang et al. [32], who found that conscientiousness contributes to GEO commitment, as well as with previous studies [22,60] confirming that this trait is associated with entrepreneurial intention through entrepreneurial self-efficacy, which is particularly relevant due to its connection with EO. Although the present study did not address the specific relationship between conscientiousness and self-efficacy, given the positive relationship of both traits with SEO, future research could include entrepreneurial self-efficacy as a mediating variable. Furthermore, conscientiousness is considered a determinant of morality; thus, conscientious individuals tend to show greater interest in challenging environments [22] and are more likely to pursue moral and social values [24]. Moral reflectiveness is often present in conscientious entrepreneurs [24], and higher levels are associated with green behavior [66]. Surprisingly, in the studied context, conscientiousness may not be proof of high levels of moral reflectiveness; consequently, while the former is an antecedent of SEO, the latter is not. Therefore, Peruvian entrepreneurs would be sufficiently conscientious for this trait to have a positive impact on SEO, but not as a determining process of moral reflectiveness. Despite these results, it is suggested that this relationship be validated according to other contexts and populations, to verify the non-significant relationship.

Moving forward, another contribution of the study is the validation of SEO at the individual level. Various authors, such as Bolton and Lane [130], have identified that EO consists of risk-taking, proactivity, and innovativeness. This concept is supported by numerous published studies [131]. However, the literature has also revealed discrepancies in evaluating how entrepreneurial an individual can be. For this reason, Bolton and Lane's [130] work is valuable because they validated that an individual's EO is a direct result of the measures of traits and attitudes inherent to the original EO scale. This corroborates the measurement of EO through a consistent, validated scale. In contrast, the present study adopted the authors' recommendations and validated the IEO instrument beyond the scope of university students in the United States [130], instead focusing on micro and small entrepreneurs in an emerging country like Peru. By proving that the instrument works with non-university student populations, its use as a tool to evaluate the entrepreneurial potential of decision-makers was explored.

Understanding the dimensions of IEO provides an opportunity to explore the relationship between its three dimensions and other relevant factors, such as SO, to obtain SEO. Consequently, the present study not only analyzed the behavior of the scale and its measurement in a context different from the original work of Bolton and Lane but also validated that, combined with SO, it measures the degree of SEO at the individual level—an area not previously explored in the literature, including the pioneering study by Criado-Gomis et al. [15]. This is particularly relevant to the literature on entrepreneurship and the measurement of sustainable orientation, as it represents the first study to evaluate and confirm, through the validation of a scale based on instruments accepted in previous research, the existence of a strong strategic orientation that promotes sustainable entrepreneurship at the individual level.

5.2. Theoretical implications

The study presents several theoretical implications based on two identified gaps in the literature on SEO. First, the findings validate that SEO is a complex dynamic capability that, as shown by the structural model results, can be fostered through multiple individual traits, as theoretically proposed by scholars such as Ameer and Khan [21] and Nayak and Pillai [20]. The study also supports the work of Kraus et al. [26], which confirmed that sustainable entrepreneurs tend to act more sustainably due to their values and personal traits. Nevertheless, as stated in the discussion, these relationships are highly context-dependent, and the combination of entrepreneurial traits as antecedents of SEO appears unique to the Peruvian setting. The composition of these antecedents may vary when the model is tested in other contexts. The results demonstrate that, while conscientiousness, entrepreneurial resilience, entrepreneurial self-efficacy, and emotional regulation through cognitive reappraisal characterize the entrepreneurial traits of decision-makers in micro and small-sized companies, moral reflectiveness did not receive empirical support as an antecedent of SEO. However, considering the demonstrated relationships, the structural model's performance is expected to remain stable. By focusing on entrepreneurial traits as individual-level antecedents of SEO, the study expands knowledge regarding the role of the decision-maker.

Second, a novel approach to assessing SEO at the individual level is presented. The findings confirm that SEO can be evaluated by approximating EO at the individual level, which is called IEO [130] or SO [8]. Following the recommendations of Miles et al. [132], SEO has traditionally been evaluated using instruments for EO [133,134] and SO [8,135]. However, this study validates using the individual scale, IEO, as an SEO component at the individual level. Therefore, this study contributes an accurate way of measuring entrepreneurs' SEO that considers EO, a dynamic capability, as a main contributor [14]. Administering the instrument at the beginning of entrepreneurial training and coaching programs would enable entrepreneurship mentors and advisors to position program material more effectively and foster the entrepreneurial spirit efficiently. Educators teaching entrepreneurship could use this scale to measure individual SEO as well as trainers in seminars for companies of different sizes and types of organizations. Finally, understanding how SEO works at the individual level could be valuable for future entrepreneurs, business incubators, and potential investors considering supporting business proposals.

These findings offer theoretical contributions by refining and expanding UET and RBV/DCT in the context of sustainability. First, the study reinforces UET by empirically demonstrating that decision-makers' personal traits significantly shape SEO, a strategic orientation linked to sustainability outcomes. Second, the study contributes to RBV/DCT by conceptualizing entrepreneurial traits as internal resources that, when developed collectively, foster SEO as a dynamic capability for sustainability in micro and small-sized enterprises. The trait-specific results also indicate that not all traits contribute equally, providing a nuanced understanding of which individual characteristics are most strategically valuable for firms in emerging markets.

5.3. Managerial implications

In terms of managerial implications, the study's findings suggest that decision-makers should have experience and knowledge in their field, as well as technical capabilities. Additionally, it is evident that they should be oriented towards sustainable entrepreneurship to contribute to the 2030 Agenda in their respective countries. This research recognizes the vital importance of entrepreneurial traits that promote SEO, a dynamic capacity that explains the predisposition of organizations and their decision-makers towards sustainable practices. For these reasons, decision-makers should seek to develop these traits, which are

considered acquirable skills, or surround themselves with advisors or professionals who can help them enhance their orientation toward entrepreneurship and sustainability.

To operationalize the findings, managers of micro and small enterprises can adopt concrete tools such as self-assessment instruments for entrepreneurial traits (e.g., resilience scales, emotional regulation assessments) and incorporate sustainability KPIs into performance evaluations. Practical initiatives may include coaching sessions to strengthen entrepreneurial self-efficacy or workshops that integrate sustainability goals into daily decision-making. In addition, firms can benefit from partnerships with local universities to co-develop training modules that link SDGs with business operations, fostering a mindset shift toward long-term sustainability.

Specifically, universities could play an active role in strengthening the creation and consolidation of sustainable enterprises. For instance, they should embrace their role as generators of entrepreneurship and disseminators of the importance of sustainability. They must also focus on transferring entrepreneurial, management, and sustainable capabilities as an integrated package. Thus, they can contribute to the creation of sustainable businesses. The diversity of knowledge, motivations, and profiles that students and professionals possess represents valuable human resources for creating sustainable ventures. Although extensive programs exist for carrying out sustainability reports, this corresponds to a second stage of awareness. First, organizations must prioritize promoting sustainable ventures. To this end, more structured programs are needed, supported by private networks of specialized advisors and public policy instruments. These programs should combine knowledge of basic sciences and management and entrepreneurship practices. They should also be complemented by the experience of mentors of the GRI Standards or similar programs. This may be a significant way to encourage companies to contribute to the sustainability of countries.

Lastly, although the study focuses on Peruvian micro and small-sized enterprises, the findings may be transferable to other emerging economies with similar characteristics, such as high levels of entrepreneurship, weak institutional support, and resource constraints. The emphasis on individual entrepreneurial traits as drivers of sustainable behavior offers a valuable perspective for countries in Latin America, Africa, and Southeast Asia seeking to promote bottom-up sustainability transitions through capacity-building within their entrepreneurial ecosystems.

6. Conclusion

In the emerging Peruvian sustainable entrepreneurial ecosystem, SEO is fostered by specific traits that act as antecedents and help explain the practices adopted by decision-makers or founders of sustainable organizations. This is based on the fact sustainable entrepreneurship is a complex phenomenon and that not all entrepreneurs concern in the same degree for the environmental and social problems. Through this research, the general hypothesis regarding entrepreneurial traits and SEO has been proven. SEO can be observed as a result of the influence of multiple generic entrepreneurial traits. Regarding the evaluation of the proposed model, it is confirmed that it has a moderate explanatory precision since the adjusted R2 of the SEO is moderate with favorable results of the goodness of fit indexes.

6.1. Limitations and future research

As with any scientific study, this research presents certain limitations, which also provide opportunities for future research. The primary limitation is the focus on Peruvian micro and small-sized enterprises, which operate within a specific economic, social, and cultural environment. While some insights may be relevant to similar enterprises in other emerging economies, caution is advised when applying these results to significantly different contexts, such as developed economies with distinct regulatory frameworks. The unique characteristics of Peru, including its market conditions, cultural influences, and regulatory environment, may differ from those in other regions, potentially affecting the applicability of the findings. Furthermore, the focus on enterprises with sustainability reports aligned with GRI standards may not reflect the practices and challenges of micro and small-sized enterprises that do not engage in formal sustainability reporting. Although this focus provides valuable insights, it may limit the generalizability of the results to a broader range of micro and small-sized enterprises.

Another limitation is the reliance on self-reported information [136]. Since sustainability and the publication of such reports are recent phenomena in Peru, the data collected from participants, especially regarding performance, could be subject to recall bias. Furthermore, the sample was taken from the GRI's non-public database of reports from 2021. However, due to limited access to recent databases, some of the organizations contacted for this study may no longer have sustainable practices in place, or they may no longer exist, as has been documented. In other words, it was not possible to determine during data collection whether organizations involved in the study would continue their sustainable practices in the same manner or adopt different approaches compared to the year of the report. Future research might extend beyond the incipient Peruvian sustainable entrepreneurial ecosystem to consider other contexts in which to contrast the SEO model. This would encourage scholars to conduct new studies in relatively stable political, social, and economic contexts where companies have better incentives to make their practices more sustainable.

The third limitation relates to the empirical testing of part of the proposed model by Ameer and Khan [21]. The study examined the generic entrepreneurial traits of the model. Therefore, of the multiple traits defined by the authors, only four proved to influence SEO. Further research could explore how other traits influence the adoption of SEO in organizations; alternative models could be proposed to test the influence among specific traits as well, such as conscientiousness and self-efficacy [60,61,128], and their influence on the SEO. Possibly this would support the design of a more appropriate and suitable model for the Peruvian context, considering the characteristics of micro and small-sized companies and their struggle to survive in a turbulent economic environment such as the Peruvian one. Regarding future research, a wider approach to entrepreneurs' role in SEO could be of interest, analyzing different traits or motivational factors such as leadership [3,137] or creativity [138], as well as other measures of performance related to environmental and social outputs. Another opportunity arising from the previous limitation is the need to understand what motivates entrepreneurs to implement sustainable practices in their organizations and report them in sustainability reports. These reports publish information about CSR to inform stakeholders and society about organizations' actions in economic, social, and environmental spheres [139]. The model identified the impact of traits on individual SEO, however, as it has not evaluated SEO at the organizational level, it may need further analysis on whether this could be an indicator of sustainable practices or even CSR practices among the entire organization, as Hernández-Perlines and Rung-Hoch [40] state.

The last limitation relates to the use of SEO at the individual level. Due to the relatively new concept of SEO, measuring its relationship with different variables has certain analytical limitations. Following the recommendations in the literature [15], the limitations derived from the selection of theoretical alternatives were considered by selecting the individual scale of the construct, IEO. Future research should address the validated individual SEO scale and test it with different populations and in different contexts. Thus, there are considerable possibilities for future research development.

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CRediT authorship contribution statement

Andrea Lazarte-Aguirre: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1

Variables linked to the model

N°	Construct	Variable	Type	Items	Scales
1	Conscientiousness Measured by the Mini International Personality Item Pool of Donnellan et al. [140]	Conscientiousness	Ordinal	I get chores done right away.	1. Not at all accurate
2				I often forget to put things back in their proper place. (*reverse coded item*)	2. Rarely accurate
3				I like order.	3. Neutral
4				I mess things up. (*reverse coded item*)	4. Some accurate
					5. Very accurate
5	Moral reflectiveness measured by the scale of Reynolds [141]	Moral reflectiveness	Ordinal	I regularly think about the ethical implications (rational and universal fundaments of what's morally correct or incorrect) of my decisions.	1. Strongly disagree
6				I think about the morality (group of believes, norms, values and principles that are a guide) of my actions almost every day.	2. Sometimes disagree
					3. Nor agree or disagree
7				I often find myself pondering about ethical issues.	4. Sometimes agree
8				I often reflect on the moral aspects of my decisions.	
9				I like to think about ethics.	5. Strongly agree
10	Entrepreneurial self-efficacy measured by the scale of Zhao et al. [60]	Entrepreneurial self-efficacy	Ordinal	How confident are you in successfully identifying new business opportunities?	1. No confidence
11				How confident are you in creating new products?	2. Little confidence
12				How confident are you in thinking creatively?	3. Neutral
13				How confident are you in commercializing a new idea or development?	4. Some confidence
					5. Complete confidence
14	Entrepreneurial resilience measured by the Brief Resilient Coping Scale (BRCS) of Sinclair and Wallston [142]	Entrepreneurial resilience	Ordinal	I look for creative ways to alter difficult situations.	1. Does not describe me
15				No matter what happens to me, I believe that I can control how I react to it.	2. Somehow describes me
16				I believe that I can grow in positive ways by overcoming difficult situations.	3. Does not describe well or bad
17				I actively look for ways to replace the losses I encounter in life.	3. Describes me well
					5. Describes me very well
18	Emotional regulation measured by the scale of Gross and John [80]	Cognitive reappraisal	Ordinal	When I want to feel more positive emotions, such as joy, I change my thoughts.	1. Strongly disagree
20				When I want to feel less negative emotion, such as sadness or anger, I change what I'm thinking about.	2. Sometimes disagree
22				When I'm in a stressful situation, I think about it in a way that helps me stay calm.	3. Nor agree or disagree
24				When I want to feel more positive emotions, I change the way I think about the situation.	4. Sometimes agree
25				I control my emotions by changing how I think about my situation.	5. Strongly agree
27				When I want to feel less negative emotion, I change the way I'm thinking about the situation.	
28	Individual entrepreneurial orientation measured by the scale of Bolton and Lane [130]	Risk taking	Ordinal	I like to take uncommon actions without fearing the difficulties or risks they imply by venturing into the unknown.	1. Strongly disagree
29				I am willing to invest significant time and/or money in something that could generate a high return.	2. Sometimes disagree
30				I often act "boldly" without fearing the difficulties involved in situations where risk is present.	3. Nor agree or disagree
31		Proactivity	Ordinal	I usually act in anticipation of future problems, needs or changes.	4. Sometimes agree
32				I tend to plan ahead on projects.	5. Strongly agree
33				I prefer to "step up" and get things going on projects rather than sit and wait for someone else to do it.	
34		Innovativeness	Ordinal	I often like to try new and unusual activities that are different from the norm, but not necessarily risky.	

(*continued on next page*)

(*continued*)

N°	Construct	Variable	Type	Items	Scales
35				In general, I prefer a strong emphasis in projects on unique, one-of-a-kind approaches. I prefer this over revisiting tried and true approaches used before.	
36				I prefer to try my own unique way when learning new things rather than doing it like everyone else does.	
37				I prefer to solve problems through experimentation and original approaches rather than using the methods that others generally use.	
38	Sustainability orientation measured by the scale of Bos-Brouwers [8]	Sustainability orientation	Ordinal	Peruvian firms should take a leading role internationally in environmental protection.	1. Not at all accurate
39				Firms that are environmentally oriented have advantages in recruiting and retaining qualified employees.	2. Rarely accurate
40				The environmental performance of a company will in future be considered more and more by financial institutions.	3. Neutral 4. Some accurate
41				Corporate social responsibility should be part of the principles of each company.	5. Very accurate
42				I believe environmental issues are one of the greatest challenges facing our society.	
43				I believe entrepreneurs should take on more social responsibility.	

Source: Author's own creation.

Data availability

The authors do not have permission to share data.

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