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# University entrepreneurship: entrepreneurial orientation, networks, market orientation, and sustainable development

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## Abstract

**Purpose** – The literature identifies the need to understand better the role of universities' entrepreneurial orientation (EO), even while this remains an unexplored field. This study seeks to overcome this shortcoming and put forward empirical evidence on the EO of universities and it examines the moderating effects of networks, knowledge and trust, market orientation, and implementing sustainable development goals (SDGs) on the design and development of entrepreneurial universities.

**Design/methodology/approach** – To test the conceptual model, the authors used a sample of 125 questionnaires obtained from Portuguese higher education institutions, and it was deployed a structural equation model by a partial least squared as the estimation method.



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**Findings** – The results show that the different dimensions of EO significantly influence the design and development of entrepreneurial universities. Furthermore, our findings show how market orientation and SDGs have moderating effects on the development of university entrepreneurship.
**Practical implications** – As for practical implications, the results point to the influence EO holds over entrepreneurial universities, and this causal relationship undergoes moderation by networks, knowledge and trust, market orientation and SDGs. As such, HEI rectors, deans and directors need to leverage these moderating effects, fostering human capital and universities' active initiatives and policies to conceive and develop more entrepreneurial universities.
**Originality/value** – Our research model seeks to contribute to advancing studies on the EO of universities and assists in better understanding EO within the scope of influence of the third university mission as entrepreneurial institutions.

**Keywords** University entrepreneurship, Entrepreneurial orientation, Higher education institutions, Entrepreneurial university, Networks, Market orientation, Sustainable development goals, Moderating effects
**Paper type** Research paper

## Introduction

Following the first university revolution, which incorporated research into the scope of the core missions of universities, the sector underwent a second revolution that foresaw universities transitioning into entities specialising in education, research and economic development (Caputo *et al.*, 2022; Todorovic *et al.*, 2011). Subsequently, a third mission emerged: entrepreneurship, which underpins their involvement in transferring knowledge to the local community through entrepreneurial activities (Etzkowitz *et al.*, 2000; Feola *et al.*, 2021).

Ahmad *et al.* (2018) describe how the change towards research that is oriented towards entrepreneurship now ranks as one of the most important paradigm shifts in the education system. The complexity and turbulence of societies, as well as the global economic impact, affect most organisations, and universities represent no exception (Clark *et al.*, 2021; Rodrigues *et al.*, 2019).

Later, Etzkowitz *et al.* (2000) extended the concept by emphasising the financial advantages for the university and its faculty members that arise from internal pressures to become an entrepreneurial institution. Entrepreneurial universities are entities that strive to maximise the commercial potential of their knowledge while simultaneously creating value for society without compromising their academic values and traditional functions (Gibb and Hannon, 2006; Pacheco *et al.*, 2024; Sahoo and Panda, 2019). Similarly, Hannon (2013) emphasises the challenges universities may face in transitioning into entrepreneurial universities because they must be institutions capable of nurturing environments that have the capacity to deepen entrepreneurial mentalities and behaviours. Furthermore, this author argues that the competitive climate in which entrepreneurial universities operate continues to reflect more closely what is faced by the private sector in that it is global, changeable and difficult to predict.

Hence, the entrepreneurial university serves as a conduit of extensive knowledge and a source of entrepreneurial opportunities for the university community, in which academics and students may embark on new initiatives that integrate intellectual and commercial knowledge (Guerrero and Urbano, 2014; Retna and Cavana, 2013). According to Sidrat (2019), an entrepreneurial university is an institution that encourages innovation and is proactive, competitive, autonomous and assumes risks: the five dimensions of entrepreneurial orientation (EO). In this context, Montiel-Campos (2018) identifies how the entrepreneurial stances adopted within universities can be effectively explained through the EO construct.

The EO concept, which has been adapted and applied to the context of universities, was introduced into strategic management literature during the 1980s by Miller (1983), in which he presented the three dimensions of EO (innovativeness, proactiveness and risk-taking) to

model entrepreneurship at the firm level. Subsequently, other authors (Covin and Slevin, 1991; Lumpkin and Dess, 1996) developed investigations in which the concept of EO was applied, expanded and fundamentally correlated to the relationship with company performance (Wiklund, 1999; Wiklund and Shepherd, 2005).

Therefore, Sidrat and Boujelbene (2020) state that to become entrepreneurial, the university, as an institution, should adopt an EO and, thus, strive to become innovative, autonomous, proactive, risk-taking and display competitive aggressiveness. Hence, EO represents one of the most common concepts for research on entrepreneurship and management and their role in any organisation (Lu *et al.*, 2023; Wales *et al.*, 2021; Wales *et al.*, 2023). However, within the university context, the EO construct still needs to be explored. Thus far, some studies on university EO have attempted to determine what is known in this field of research (Balasubramanian *et al.*, 2020; Cruz *et al.*, 2021; Gaspar Pacheco *et al.*, 2024; Graf and Menter, 2022; Guerrero *et al.*, 2023; Hormiga *et al.*, 2017; Lehmann *et al.*, 2024; Todorovic *et al.*, 2011).

Todorovic *et al.* (2011) developed an EO measurement scale for university departments. In turn, Balasubramanian *et al.* (2020) explore the impact of EO on university performance to conclude that the key factor is leveraging the effects of the EO-performance relationships of universities that stem from their innate organisational characteristics. Furthermore, Sidrat and Boujelbene (2020) approach EO within the framework of founding and developing an entrepreneurial university in Tunisia. In turn, Hormiga *et al.* (2017) explore how EO explains academic research groups' performance through sharing knowledge.

Graf and Menter (2022) investigated entrepreneurial universities as a channel for overflowing knowledge, verifying that they act as central actors in innovation networks and stimulate network activities. The authors concluded that EO should be considered a means of enabling a transformation process of public research institutions, assuming a more central role in innovation networks rather than a means in itself.

EO and entrepreneurial universities share a symbiotic relationship, influencing each other in significant ways (Cai and Ahmad, 2023; Diánez-Gonzáles *et al.*, 2021). EO refers to an organisation's strategic mindset and behaviour that fosters innovation, risk-taking and proactiveness (Lu *et al.*, 2023). Entrepreneurial universities actively cultivate this mindset within their academic community: they encourage faculty, students and researchers to think entrepreneurially (Patrício and Ferreira, 2023). Similarly, EO drives knowledge commercialisation. Universities with an entrepreneurial bent actively seek ways to translate research findings into practical applications. As a result, entrepreneurial universities bridge the gap between academia and industry (Tunalioglu *et al.*, 2024). They facilitate technology transfer, spinoffs and startups and drive universities toward entrepreneurial actions while these universities, in turn, nurture and amplify EO. Together, they propel innovation, economic development and societal progress (Diánez-Gonzáles *et al.*, 2021).

Despite the growing academic interest in entrepreneurial universities and their contribution to local development (Leih and Teece, 2016; Schmitz *et al.*, 2017), a number of studies on the role of EO in the creation and development of entrepreneurial universities still need to be explored.

Furthermore, established literature mentions the complexity of the relationship between EO and entrepreneurial universities and some factors moderate this linkage—for instance, networks and knowledge (Abbate and Cesaroni, 2017), market orientation (Migliori *et al.*, 2019) and sustainable development goals (Gallardo-Vázquez *et al.*, 2024; Leal Filho *et al.*, 2021). These factors are crucial in translating knowledge into economic value (Abbate and Cesaroni, 2017). Similarly, in academic spinoffs, some studies suggest that market orientation plays a moderating role in the relationship between EO and subsequent performance levels (Migliori *et al.*, 2019). Additionally, the interaction between

entrepreneurial universities and their spinoffs, along with the unique capabilities embedded within the networks, leads to moderating effects (Walter *et al.*, 2006). In turn, and in response to the United Nations Sustainable Development Goals, entrepreneurial universities must realign their capabilities to foster sustainable social development (Klofsten *et al.*, 2019). Pacheco *et al.* (2024) suggest that further studies should focus on academic entrepreneurship by incorporating other moderating variables. In this sense, our study aims to address these gaps by examining how these factors, such as networks, market orientation, and sustainable development goals, moderate the relationship between EO and entrepreneurial universities. Thus, our study contributes to the current discussion on entrepreneurial universities and contributes to a greater understanding of EO by enabling the design and development of entrepreneurial universities.

We tested our research hypotheses based on a sample of 125 higher education institutions, and a quantitative methodology was applied using Partial Least Squares (PLS) techniques. We identified the support received for the theoretical arguments and evidence that suggests the EO of universities significantly influences the design and development of entrepreneurial universities. We specifically state that (1) autonomy, (2) innovation, (3) proactiveness, (4) risk-taking and (5) competitive aggressiveness positively influence the creation and development of entrepreneurial universities. We also encountered theoretical support and evidence that underpin the moderating effects of the market orientation and the implementation of sustainable development goals, which positively influence the design and development of entrepreneurial universities.

In terms of theoretical implications, our study contributes to the current discussion on entrepreneurial orientations by providing empirical evidence concerning the relevance of EO in the design and development of entrepreneurial universities. Furthermore, this study also contributes to the literature on the moderating effects that networks, knowledge and trust, market orientation and the objective of sustainable development play in the relationship between EO and the development of entrepreneurial universities. Our study also provides a new perspective and methodology to identify elements that promote university EO, which can be an important starting point for researchers and professionals who wish to evaluate this topic.

As for practical implications, our results show that EO influences the design and development of entrepreneurial universities. The results show that the knowledge and trust network, market orientation and sustainable development objectives moderate the relationship between EO and entrepreneurial universities. That is, implementing an entrepreneurial culture, entrepreneurship content in curricular structures, and projects with practical implications leads to the stimulation of an EO to become more dominant in entrepreneurial universities. Similarly, market orientation enables the innovative capacity of universities to design solutions that consider the needs of stakeholders and proactive orientation to anticipate the actions of competing institutions. This study thus identifies and recognises the best practices for creating and developing entrepreneurial universities.

## Theoretical background and hypotheses

### *Entrepreneurial universities*

The concept of an entrepreneurial university has been extensively debated by scholars, policymakers and practitioners, who have analysed its essence, implications and driving forces (Guerrero *et al.*, 2023).

According to Guerrero and Urbano (2014), an entrepreneurial university represents an extensive means of knowledge and a strong source of entrepreneurship for the university community, within which academics and students may embark on new ventures that combine intellectual and commercial facets. The importance and the definition of an

entrepreneurial university, in conjunction with the factors leading to its existence, have already received widespread discussion in the literature (Cerver Romero *et al.*, 2021), which affirms that any entrepreneurial university's activities are the function of individual, organisational and institutional factors and that the latter two influence the former (Perkmann *et al.*, 2013).

In the last 2 decades, the literature has legitimated the significance of the contributions made by entrepreneurial universities through means of generating human capital, graduate entrepreneurs as well as the dissemination/commercialisation of their knowledge that helps deepen social, economic and technological development (Guerrero and Urbano, 2017; Klofsten *et al.*, 2019; Siqueira *et al.*, 2023).

Thus, according to Rodrigues *et al.* (2019), the professor's and researcher's perception of university policies plays a role in encouraging EO at universities and academic entrepreneurship. On the other hand, entrepreneurial universities also contribute directly and indirectly to supporting every stage in entrepreneurship; the challenge for entrepreneurial universities stems from how best to support academic entrepreneurs through entrepreneurship internships: latent, emerging, launch and growth (Cunningham *et al.*, 2021). Entrepreneurial universities need to consider the best means of structuring their formal support for entrepreneurship and innovation (Dooley and Kirk, 2007) and dealing with the changes that directly target these means of support at every stage of entrepreneurship (Miller *et al.*, 2021). According to Efrata *et al.* (2021), the entrepreneurship education program in HEI is confirmed to increase individual innovation, proactivity and risk-taking. Thus, an EO at the university enables entrepreneurship in its students and workforce. Moreover, according to Siddiqui *et al.* (2023), universities affect the way students think and act in terms of entrepreneurship. The results of their study show that promoting entrepreneurship guidance and training programs are among the best ways to encourage entrepreneurial intentions in university students. Therefore, entrepreneurial universities that foster entrepreneurial activities are likely subject to higher levels of EO. Hence, EO emerges as a strength that helps universities obtain their essential goals (Sidrat and Boujelbene, 2020).

## Hypotheses development

### *Autonomy and entrepreneurial universities*

Autonomy refers to an institution's ability to make decisions independently, free from external control or interference. In the context of universities, autonomy encompasses academic freedom, governance and the capacity to shape their destiny (Michavila and Martinez, 2018).

Autonomy is an enabling factor for designing and developing an entrepreneurial university and is an essential condition for EO (Lee and Peterson, 2000). Hence, autonomy positively shapes the founding of entrepreneurial universities and their subsequent development (Clark, 2001). The findings of the Sidrat (2019) study indicate how autonomy positively influences the design and development of entrepreneurship. Even though entrepreneurial universities operate in complex and changing environments, they can establish hybrid forms. The same author states that entrepreneurial universities must rely on their resources, make difficult choices that determine their futures, think and act independently, engage in entrepreneurial ventures and establish new activities. This idea subsequently received backing from Sidrat and Boujelbene (2020), who conclude that autonomous universities work in complex and changing environments that may drive the founding of hybrid forms, potentially remaining independent and making the choices that reflect the freedom of choice and academic autonomy. Autonomy empowers entrepreneurial universities to navigate the complex landscape of knowledge creation, transfer and social impact (Feola *et al.*, 2021).

Based on the literature findings set out above, we may formulate our first hypothesis:

*H1*. Autonomy positively influences the design and development of entrepreneurial universities.

*Innovation and entrepreneurial universities*

According to Simoes *et al.* (2012), universities require innovation in their missions alongside the internal organisation necessary to become more entrepreneurial. Soetanto and Geenhuizen (2019) corroborate that innovation actively involves supporting new ideas, breakthroughs, experimentation and creative solutions in search of competitive advantages. Thus, these authors identify innovative universities as those launching new programs, creating new courses, generating new ideas, implementing new pedagogic methods, fostering the development of an internal system of motivation, facilitating the launching of spinoffs, integrating new working methods, deploying new structures and proposing new management methods.

Graf and Menter (2022) describe entrepreneurial universities as channels for spreading knowledge (spillovers), acting as key actors in innovation networks and stimulating ongoing activities. Therefore, what characterises an entrepreneurial university is not only the essential role played in innovation through technology transfers to industry but also extends to the contribution towards economic development achieved through implementing other initiatives, such as the practical training of their students in the abilities required by industry (Hu and Mathews, 2009; Philpott *et al.*, 2011).

The members of staff are another critical element for entrepreneurial universities to establish links with communities and promote innovations (Melkas *et al.*, 2019). Correspondingly, the capacities of entrepreneurial universities represent relevant factors for implementing strategic practices in managing technology transfers and developing the competencies of academics for generating innovations (Fischer *et al.*, 2020). In a similar vein, the capacities of entrepreneurial universities are pivotal in executing strategic methods for handling technology transfers. Additionally, they contribute significantly to enhancing the skills of academics in fostering innovative solutions (Bolatan *et al.*, 2022). Given the arguments set out, we may affirm our second hypothesis:

*H2*. Innovation positively influences the design and development of entrepreneurial universities.

*Proactiveness and entrepreneurial universities*

Proactiveness, whether in organisations or universities, embodies a forward-thinking approach that entails anticipating shifts, seizing opportunities, and acting pre-emptively. In the context of universities, proactiveness refers to actively seeking innovative solutions, adapting swiftly to evolving landscapes and ultimately driving positive change within academia (Linton, 2019).

According to Todorovic and McNaughton (2003), a university with EO is necessarily a proactive university. Therefore, proactiveness frequently anticipates and acts according to future needs, introducing new products and services before the competition (Soetanto and Geenhuizen, 2019). Hence, proactiveness plays a significant role in the design and development of entrepreneurial universities (Sidrat, 2019). Consequently, according to Sidrat and Boujelbene (2020), for universities to become entrepreneurial, they must exhibit a long-lasting commitment towards proactiveness and act proactively by not merely adapting to change but also introducing it through presenting new products, services and technologies. Therefore, rather than reacting to the competition, entrepreneurial universities must strive to be the leaders and not the followers.

Entrepreneurial universities exhibit proactiveness by swiftly adapting to emerging trends, and they anticipate shifts in technology, industry needs and societal demands (Guerrero *et al.*, 2016). Proactive universities engage with industry partners to identify collaborative opportunities. They co-create knowledge, address real-world challenges and foster economic growth (Feola *et al.*, 2021; Siqueira *et al.*, 2023).

According to Bell (2019), entrepreneurial universities nurture a culture of curiosity and faculty, and students proactively explore interdisciplinary collaborations, seeking novel solutions. Proactiveness extends beyond classrooms; it permeates incubators, accelerators and innovation hubs within the university.

We may, therefore, formulate our third hypothesis as follows:

*H3.* Proactiveness positively influences the design and development of entrepreneurial universities.

*Competitive aggressiveness and entrepreneurial universities*

Sidrat and Boujelbene (2020) argue that competitive universities engage in creative and innovative approaches to attract increasingly demanding clients, providing them with multiple opportunities while seeing off the competition to attract more clients and improve their image. Sidrat (2019) argues that competitive aggressiveness is a key factor in designing and developing entrepreneurial universities. Consequently, Sidrat (2019) details the prevailing expectation that universities pay increasing attention to EO-related issues to maintain their competitive positions and make universities about other universities. This strategic shift is essential for maintaining their competitive edge and positioning themselves as institutions that learn from and adapt to the practices of other universities. In this sense, the competitive drive within entrepreneurial universities catalyses innovation, economic expansion, and positive societal change (Feola *et al.*, 2021). We, therefore, arrive at our fourth hypothesis:

*H4.* Competitive aggressiveness positively influences the design and development of entrepreneurial universities.

*Risk-taking and entrepreneurial universities*

Risk-taking involves strategic actions in uncertain environments (Soetanto and Geenhuizen, 2019), and it is an important factor for entrepreneurial universities, as it reflects their willingness and ability to engage in innovative and uncertain activities that can lead to economic and social benefits (Maheshwari *et al.*, 2023). Risk-taking can enhance university-industry collaboration by enabling the universities to explore new markets, create spin-offs and commercialise their research outputs (Guo and Jiang, 2020).

Furthermore, risk-taking is important, which means encouraging risk-taking within a university is a prerequisite to adopting an EO and is necessary for the institution to become entrepreneurial (Sidrat, 2019). In turn, the study results of Sidrat and Boujelbene (2020) convey how universities that assume risks are entities with favourable attitudes to specific risks, deciding to do the unknown, taking risks in risky situations and taking aggressive positions regarding the survival of their businesses. However, risk-taking also involves potential costs and challenges, and thus, entrepreneurial universities need to balance the risks and rewards of their actions and adopt effective risk management strategies (Soetanto and Geenhuizen, 2019). Therefore, we may formulate the following fifth hypothesis:

*H5.* Risk-taking positively influences the design and development of entrepreneurial universities.

*Moderating effect of networks, knowledge and trust*

Leih and Teece (2016) identify another important dimension within the scope of university EO: their academic activities (e.g., the implementation of an entrepreneurial culture, entrepreneurship content in study programs, projects with practical implications, strategic plans, among others), leading to the dimensions of EO becoming more dominant in entrepreneurial universities.

The networks between entrepreneurial universities and their spinoffs can be established through some mechanisms, such as providing support and resources for the development of entrepreneurial competencies (Rasmussen and Wright, 2015), offering entrepreneurship education and training programs for students, faculty and staff to foster an entrepreneurial culture, and building university-business and external knowledge exchange relationships, such as partnerships, collaborations, and networks, to access new markets, customers and stakeholders (Feola *et al.*, 2021).

The networks established between entrepreneurial universities and their spinoffs, along with the specific capacities of these networks, generate moderating effects (Walter *et al.*, 2006). Sharing knowledge also stands out as a moderating factor for the relationship between EO and the performance levels of research groups as measured in terms of the number of articles published (Hormiga *et al.*, 2017). Therefore, we may propose the following hypothesis:

*H6.* Networks, knowledge and trust moderate the relationship between a) autonomy, b) innovation, c) proactiveness, d) competitive aggressiveness, e) risk-taking and the design and development of entrepreneurial universities.

*Moderating effect of market orientation*

EO supports the performance of academic spinoffs even though there can be no market orientation without the EO, which serves as a conditioning antecedent (Migliori *et al.*, 2019). Entrepreneurial universities provide their surrounding capital through education and training in two different ways. Firstly, they produce graduates with the competencies demanded by employers, and secondly, they train individuals with the competencies appropriate to becoming entrepreneurs and generating employment (Urbano and Guerrero, 2013). Therefore, market orientation also moderates the relationship between EO and the subsequent performance levels of academic spinoffs (Migliori *et al.*, 2019), suggesting that EO produces better financial performance through the resulting orientation towards markets.

Abbate and Cesaroni (2017) argue that EO and market orientation, together, stand out as key factors in transforming knowledge into economic value. Migliori *et al.* (2019) propose that the EO and the market orientation are part of the same learning process, where market orientation represents an additional development of the EO components of innovation, risk-taking and proactiveness. For example, the market orientation enables the innovative capacity to design solutions that consider the needs of clients and the proactive orientation to anticipate the actions of competitors (Migliori *et al.*, 2019). Therefore, we propose the following hypothesis:

*H7.* The market orientation moderates the relationship between a) autonomy, b) innovation, c) proactiveness, d) competitive aggressiveness and e) risk-taking and the design and development of entrepreneurial universities.

*Moderating effects of the sustainable development goals*

Despite focusing on purely economic results in the past, in recent years, entrepreneurial universities have shifted their capabilities towards sustainable social development,

influenced by the United Nations Sustainable Development Goals (Klofsten *et al.*, 2019; Macht *et al.*, 2020). Hence, one of the most relevant current objectives for entrepreneurial universities is the sustainable development goal (Quality Education) that requires specific actions of universities in keeping with their unique position in society and broad competencies around the creation and dissemination of knowledge and public value (Nicolò *et al.*, 2020).

Furthermore, through teaching, research and third mission activities, universities can raise awareness among students and local communities, equipping them with the knowledge, skills, motivation and creativity necessary to achieve sustainable development goals (Leal Filho *et al.*, 2021). Hence, we propose the following hypothesis:

*H8.* The sustainable development goals moderate the relationship between a) autonomy, b) innovation, c) proactiveness, d) competitive aggressiveness and e) risk-taking and the design and development of entrepreneurial universities.

Figure 1 sets out the research model that is the focus of this study.

## Methodology

### *Sample and data*

Before initiating the actual data collection process, both a pre-test and a pilot test were conducted to confirm the content validity and reliability of the study instruments, respectively. To achieve this, we engaged three academicians to rigorously assess the pre-test, ensuring that our content was accurately aligned with our research objectives. Subsequently, for the pilot test, we contacted a group of 15 respondents. This step was crucial in refining our methodology, allowing us to make necessary adjustments based on the feedback received, thereby enhancing the overall integrity and effectiveness of our research approach.

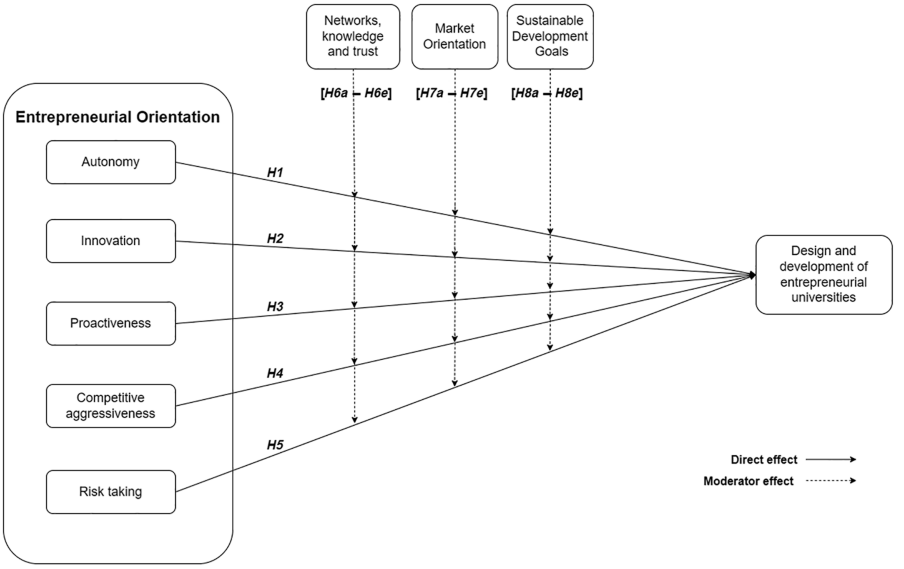


**Figure 1.**
Conceptual research model

**Source(s):** Authors' own work

After conducting the pre-test and the pilot, the questionnaire was sent to the participants via a Google form. The questionnaire was directly emailed to the rectors, faculty deans, polytechnic presidents and school directors of all 244 state HEIs in Portugal. The contact list was compiled by surveying the websites of the respective HEIs and utilizing the existing contact list available to our research team. Since there are different faculties or schools within the same university or polytechnic, multiple responses were possible from each HEI. We obtained 125 validated questionnaires obtained and validated, which corresponds to a response rate of 51%.

Table 1 provides a summary of the sample characteristics. The majority of respondents were in the 51- to 60-year-old range (52%). Of the respondents, 64% were male. The sample includes 19.2% of HEIs in the field of Basic Sciences, 21.6% of HEIs in the field of Engineering, 59.2% of HEIs in Social Sciences and 56.8% belonging to the polytechnic education system. Data was collected from institutions located in every district and autonomous region.

To validate the hypotheses under study, we deployed a structural equation model (SEM) by partial least squared method (PLS) as the estimation method, currently a fairly common practice in the behavioural sciences (Hair *et al.*, 2020). The utilisation of PLS-SEM as an alternative to covariance-based SEM (CB-SEM) stemmed from the items not following any normal distribution, being only a small sample, and the scales being composite measures (Freeman and Styles, 2014; Hair *et al.*, 2019, 2020; Sarstedt *et al.*, 2019).

To confirm the factorial structure of the instrument, we needed to examine the reliability and validity of the indicators that served to represent and measure the theoretical concepts (Hair *et al.*, 2019, 2020; Sarstedt *et al.*, 2019). The validity of the construct emerges out of the scale by which a set of the items reflects the latent theoretical construct under measurement, and the reliability of any instrument refers to its properties of consistency and the reproductivity of the measurements (Hair *et al.*, 2019, 2020; Sarstedt *et al.*, 2019).

The present study validated the constructs according to (1) composite reliability (CR), (CR > 0.70), as this does not fall under the influence of the number of items existing in each

| | | *N* | % |
|---|---|---|---|
| *HEIs* | | | |
| Scientific Field | Basic Sciences | 24 | 19.2 |
| | Engineering | 27 | 21.6 |
| | Social Sciences | 74 | 59.2 |
| Type of Education | Polytechnic | 71 | 56.8 |
| | University | 54 | 43.2 |
| *Rectors, deans, presidents, and directors* | | | |
| Age | 41–50 | 44 | 35.2 |
| | 51–60 | 65 | 52.0 |
| | +60 | 16 | 12.8 |
| Gender | Female | 45 | 36.0 |
| | Male | 80 | 64.0 |
| Qualifications | Master's Degree | 23 | 18.4 |
| | Aggregation | 1 | 0.8 |
| | Doctoral Degree | 101 | 80.8 |
| Length of academic career (No. of years) | 11–20 | 4 | 3.2 |
| | 21–30 | 62 | 49.6 |
| | 31–40 | 51 | 40.8 |
| | +40 | 8 | 6.4 |

**Source(s):** Authors own work

**Table 1.** Sample characteristics

construct, to the contrary of Cronbach's Alpha, as this deploys loads of items extracted from the model estimated; (2) factorial validity (factorial loads greater than 0.5 ideally greater than 0.7); (3) convergent validity through average variance extracted (AVE) demonstrating the existence of convergent validity whenever (AVE> 0.50); and (4) discriminant validity was assessed using the heterotrait–monotrait ratio (HTMT) criterion, which should be less than 0.85, and Fornell and Larcker criterion, which the square root of the AVE of two constructs should be higher than the correlation between these two factors (Fornell and Larcker, 1981; Sarstedt *et al.*, 2019).

To assess the overall fit of the estimated model, we evaluated the discrepancy between the variance–covariance matrix of the empirical indicator and the implicit counterpart of the estimated model. We used three discrepancy measures (SRMR – standardised root mean squared residual, $d_{ULS}$, and $d_G$) and 95% (HI95) and 99% (HI99) quantiles of their corresponding distribution, and all discrepancy measures should be lower than HI95, and the approximate model fit given by the SRMR value should be lower than 0.08.

To return a global evaluation of the structural model, we also examined the global fit of the estimated model, the estimates for the path coefficient and the respective statistical significance according to the bootstrap technique and the determining coefficient ($R^2$) (Hair *et al.*, 2019, 2020; Sarstedt *et al.*, 2019). In calculating the structural models to determine the *t*-statistic and its respective statistical significance, we applied the bootstrapping procedure (with a sample of 10,000 bootstraps), and all these calculations were made through the SmartPLS version 4.1.0.0 (Ringle *et al.*, 2022) and IBM SPSS version 28.0 for Windows (IBM Corporation, New York, USA) software programs.

### *Measurement of variables*

Our research model seeks to contribute to advancing studies on the EO of universities and assists in better understanding EO within the scope of influence of the third university mission as an entrepreneurial institution. In conjunction with some moderating factors, our research model aims to add empirical evidence on the university EO. This causal relationship between the dimensions of EO (autonomy, innovation, proactiveness, competitive aggressiveness and risk-taking) and entrepreneurial universities undergo moderation by the variables: networks, knowledge and trust, market orientation and sustainable development goals.

To measure our dependent variable (Design and Development of Entrepreneurial Universities) and our independent variables (Autonomy, Innovation, Proactiveness, Competitive aggressiveness, and Risk-taking), we adapted the measurement items and scale proposed by Sidrat and Boujelbene (2020). For measuring the moderating variables (Networks, knowledge and trust, Market orientation, and Sustainable development goals), we adapted the scales put forward by Hormiga *et al.* (2017) and Migliori *et al.* (2019). Thus, our sample answered the questions on a 7-point Likert scale, from 1 (totally disagree) to 7 (totally agree), indicating how much our sample agrees or disagrees with each question that describes our variable dependent.

Appendix summarises the measurement scale items and scales used for each construct.

### *Robustness tests*

To avoid common method bias, we initially ensured the anonymity and confidentiality of the study and informed respondents via a cover letter that there were no right or wrong answers. In addition, as recommended, we used an item-randomizer to balance and randomize the order and types of questions, ensuring the impartiality and effectiveness of the data collection process (De Jong *et al.*, 2010; Gregori *et al.*, 2023).

We analysed the presence of non-response bias by comparing data obtained at the beginning (first 33%) and at the end (last 33%) of the data collection process based on exploitation, exploration and embeddedness scores. We performed independent samples *t*-tests on these variables, indicating that non-response bias was not a significant concern in this research. To assess common method bias, we applied Harman's one-factor test, where a single factor, extracted through an exploratory factor analysis, accounted for 28.5% of the total variance, indicating that common method bias is not problematic in this study.

## Results

### *Validity and construct reliability*

The factorial weightings and composite reliability of the constructs return values above the limits required, 0.5 and 0.7, respectively. All constructs' AVE is above the 0.5 level (Table 2). The factorial loads and composite reliability return values were above the limits of 0.5 and 0.7 for all these constructs, respectively. Similarly, the AVE results for all constructs were also above the 0.5 limit.

To test whether the constructs were sufficiently mutually different, we inspected the discriminant validity by the Fornell and Larcker criteria (1981), which stipulated that the square root of AVE of any construct must be greater than the largest correlation between any of its constructs (Table 3). Discriminant validity was also assessed using the HTMT ratio; all values are less than 0.85 (Table 4). This correspondingly observes that the diverse constructs display high levels of reliability as well as factorial validity, convergent validity and discriminant validity and, therefore, class as valid and reliable for utilisation.

Table 5 presents three discrepancy measures (SRMR – standardised root mean squared residual, $d_{ULS}$, and $d_G$) and 95% (HI95) and 99% (HI99) quantiles of their corresponding distribution. The results reveal that the model's quality fits in this study and meets all the criteria. Thus, the model was not rejected at the 5% significance level, providing empirical support for the proposed approach.

### *Testing the hypotheses*

Table 6 sets out the results returned by the structural model within the scope of validating the hypotheses. The structural model shows good predictive power ($R^2 = 73.3\%$).

Regarding H1, we may report that autonomy positively influences entrepreneurial universities ($\beta = 0.27$; $p < 0.05$). Autonomy has a moderate effect size of 0.259, indicating a noticeable but not very strong influence on entrepreneurial universities. As regards H2, there is confirmation that innovation positively influences entrepreneurial universities ($\beta = 0.27$; $p < 0.05$). Innovation has a moderate effect size of 0.197, suggesting that its influence is significant in entrepreneurial universities. Regarding H3, the results show no statistically significant positive effect of proactivity on entrepreneurial universities ($\beta = -0.06$; $p = 0.705$).

Regarding H4, the findings convey a statistically significant positive impact of competitive aggressiveness on entrepreneurial universities ($\beta = 0.37$; $p < 0.01$). Competitive aggressiveness has a moderate effect size of 0.301, indicating a robust influence on the competitive nature of entrepreneurial universities. About H5, we may report that risk-taking generates a statistically significant impact on entrepreneurial universities ($\beta = 0.24$; $p < 0.05$). Risk-taking exhibits a slight to medium effect size of 0.173, reflecting a moderate impact on the propensity for risk-taking in entrepreneurial universities.

Regarding H6, there was no statistically significant moderating effect of networks, knowledge and trust on the relationship between the various dimensions of entrepreneurial orientation on entrepreneurial universities. In the case of H7, the market orientation does generate a statistically significant moderating effect on the relationship between risk-taking

| | Mean | SD | Range | Factor loading | Cronbach Alpha | CR | AVE |
|---|---|---|---|---|---|---|---|
| *Autonomy* | *66.86* | *13.84* | *0–100* | | *0.801* | *0.855* | *0.541* |
| AUT1 | 4.86 | 1.36 | 1–7 | 0.82 | | | |
| AUT2 | 4.87 | 1.35 | 1–7 | 0.74 | | | |
| AUT3 | 5.08 | 0.95 | 1–7 | 0.75 | | | |
| AUT4 | 5.30 | 0.96 | 1–7 | 0.70 | | | |
| AUT5 | 5.17 | 1.06 | 2–7 | 0.70 | | | |
| *Innovation* | *65.14* | *16.71* | *2.42–100* | | *0.876* | *0.896* | *0.634* |
| INOV1 | 5.54 | 0.80 | 3–7 | 0.85 | | | |
| INOV2 | 5.74 | 0.74 | 3–7 | 0.74 | | | |
| INOV3 | 5.01 | 1.09 | 2–7 | 0.73 | | | |
| INOV4 | 5.58 | 0.98 | 3–7 | 0.86 | | | |
| INOV5 | 5.45 | 0.97 | 2–7 | 0.81 | | | |
| *Proactiveness* | *59.14* | *18.30* | *5.67–100* | | *0.838* | *0.850* | *0.654* |
| PROA1 | 5.30 | 0.96 | 2–7 | 0.87 | | | |
| PROA2 | 5.52 | 0.84 | 3–7 | 0.81 | | | |
| PROA3 | 5.55 | 0.78 | 4–7 | 0.75 | | | |
| *Competitive aggressiveness* | *66.34* | *15.00* | *0–100* | | *0.751* | *0.778* | *0.598* |
| AGRE1 | 2.41 | 1.55 | 1–7 | 0.58 | | | |
| AGRE2 | 5.04 | 1.17 | 1–7 | 0.84 | | | |
| AGRE3 | 5.53 | 1.00 | 1–7 | 0.87 | | | |
| *Risk-taking* | *63.73* | *15.00* | *1.72–86.77* | | *0.783* | *0.800* | *0.571* |
| ARIS1 | 5.39 | 0.91 | 2–7 | 0.61 | | | |
| ARIS2 | 5.29 | 0.90 | 2–7 | 0.86 | | | |
| ARIS3 | 5.23 | 1.01 | 2–7 | 0.86 | | | |
| ARIS4 | 3.81 | 1.22 | 1–7 | 0.57 | | | |
| *Networks, knowledge and trust* | *73.41* | *13.56* | *3.4–100* | | *0.736* | *0.746* | *0.513* |
| RCC2 | 5.41 | 0.91 | 1–7 | 0.55 | | | |
| RCC3 | 5.61 | 0.95 | 1–7 | 0.96 | | | |
| RCC5 | 4.73 | 1.17 | 2–7 | 0.59 | | | |
| *Market orientation* | *62.22* | *15.85* | *2.22–98.58* | | *0.733* | *0.753* | *0.550* |
| OM1 | 5.55 | 0.99 | 2–7 | 0.68 | | | |
| OM2 | 5.39 | 0.81 | 3–7 | 0.92 | | | |
| OM3 | 4.91 | 1.00 | 2–7 | 0.59 | | | |
| OM4 | 5.44 | 0.88 | 2–7 | 0.74 | | | |
| *Sustainable development goals* | *60.70* | *18.61* | *0–94.59* | | *0.847* | *0.860* | *0.757* |
| SDGS1 | 5.40 | 0.88 | 2–7 | 0.76 | | | |
| SDGS2 | 5.32 | 0.85 | 3–7 | 0.97 | | | |
| *Entrepreneurial universities* | *66.41* | *15.28* | *0–100* | | *0.859* | *0.894* | *0.680* |
| UE1 | 5.14 | 1.08 | 2–7 | 0.86 | | | |
| UE2 | 5.46 | 1.01 | 1–7 | 0.89 | | | |
| UE3 | 4.59 | 1.05 | 2–7 | 0.78 | | | |
| UE4 | 5.51 | 0.92 | 1–7 | 0.76 | | | |

**Source(s):** Authors own work

**Table 2.**
Construct validity and reliability

and entrepreneurial universities (H7e: $\beta = 0.57$; $p < 0.05$). These latter results indicate that the greater the market orientation, the greater the impact of risk-taking on entrepreneurial universities. The influence of market orientation on the relationship between risk-taking and entrepreneurial universities exhibits a strong effect size ($f^2 = 0.038$).

In the case of H8, we may observe that the sustainable development goals play a moderating role with statistical significance for the impact of competitive aggressiveness on entrepreneurial universities (H8d: $\beta = -0.36$; $p < 0.05$). These latter results indicate how the higher the sustainable development goals, the lower the impact of competitive aggressiveness on entrepreneurial universities. The influence of sustainable development goals on the relationship between competitive aggressiveness and entrepreneurial universities shows a strong effect size ($f^2 = 0.044$).

## Discussion

The core objective of this study was to contribute, through empirical evidence, to a greater understanding of the EO of HEIs for the design and development of entrepreneurial universities. These empirical results confirm that the EO of HEIs significantly influences the design and development of entrepreneurial universities. This aligns with Sidrat and Boujelbene's (2020) study that defends how the EO stands out as a factor of strength that assists HEIs in obtaining their essential goals.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *1. Competitive aggressiveness* | *0.77* | | | | | | | | |
| 2. Risk taking | 0.37 | *0.76* | | | | | | | |
| 3. Autonomy | 0.40 | 0.42 | *0.74* | | | | | | |
| 4. Innovation | 0.33 | 0.58 | 0.42 | *0.80* | | | | | |
| 5. Sustainable development goals | 0.09 | 0.25 | 0.49 | 0.54 | *0.87* | | | | |
| 6. Market orientation | 0.12 | 0.18 | 0.06 | 0.29 | 0.46 | *0.74* | | | |
| 7. Proactiveness | 0.45 | 0.49 | 0.33 | 0.59 | 0.30 | 0.20 | *0.81* | | |
| 8. Networks, knowledge and trust | −0.10 | 0.08 | 0.02 | 0.17 | 0.29 | 0.40 | −0.03 | *0.72* | |
| 9. Entrepreneurial universities | 0.64 | 0.49 | 0.52 | 0.56 | 0.34 | 0.21 | 0.49 | 0.17 | *0.82* |

**Source(s):** Authors own work

**Table 3.** Correlations between the constructs (the squared root of AVE in the diagonal)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| 1. Competitive aggressiveness | 0.82 | 0.81 | 0.52 | 0.34 | 0.32 | 0.22 | 0.24 | 0.29 | 0.34 |
| 2. Risk taking | | 0.82 | 0.76 | 0.49 | 0.56 | 0.29 | 0.26 | 0.41 | 0.51 |
| 3. Autonomy | | | 0.58 | 0.26 | 0.38 | 0.23 | 0.30 | 0.22 | 0.20 |
| 4. Innovation | | | | 0.66 | 0.74 | 0.41 | 0.35 | 0.47 | 0.45 |
| 5. Sustainable development goals | | | | | 0.77 | 0.61 | 0.64 | 0.52 | 0.61 |
| 6. Market orientation | | | | | | 0.83 | 0.88 | 0.68 | 0.60 |
| 7. Proactiveness | | | | | | | 0.83 | 0.80 | 0.89 |
| 8. Networks. knowledge and trust | | | | | | | | 0.71 | 0.62 |
| 9. Entrepreneurial universities | | | | | | | | | 0.84 |

**Source(s):** Authors own work

**Table 4.** The heterotrait-monotrait (HTMT) ratio

| Discrepancy | Value | HI95 | HI99 |
|---|---|---|---|
| SRMR | 0.076 | 0.078 | 0.087 |
| $d_{ULS}$ | 0.601 | 0.654 | 0.857 |
| $d_G$ | 0.539 | 0.557 | 0.689 |

**Source(s):** Authors own work

**Table 5.** Results of the overall fit of the estimated model

| Hypotheses | | β | SD | $p$ | $f^2$ |
|---|---|---|---|---|---|
| | Basic Sciences | 0.11 | *0.08* | 0.169 | 0.026 |
| | Engineering | 0.18 | *0.03* | *0.036* | *0.114* |
| | University | 0.17 | *0.08* | *0.035* | *0.105* |
| H1 | *Autonomy* | *0.27* | *0.11* | *0.014* | *0.259* |
| H2 | *Innovation* | *0.27* | *0.12* | *0.024* | *0.197* |
| H3 | Proactiveness | −0.06 | 0.16 | 0.705 | 0.002 |
| H4 | *Competitive aggressiveness* | *0.37* | *0.10* | *0.000* | *0.301* |
| H5 | *Risk taking* | *0.24* | *0.11* | *0.029* | *0.173* |
| | Networks. knowledge and trust | 0.08 | 0.11 | 0.473 | 0.010 |
| | Market orientation | 0.11 | 0.12 | 0.351 | 0.015 |
| | Sustainable development goals | 0.03 | 0.13 | 0.835 | 0.008 |
| H6a | Networks. knowledge and trust × Autonomy | −0.08 | 0.16 | 0.678 | 0.009 |
| H6b | Networks. knowledge and trust × Innovation | −0.22 | 0.18 | 0.894 | 0.008 |
| H6c | Networks. knowledge and trust × Proactiveness | 0.11 | 0.20 | 0.545 | 0.009 |
| H6d | Networks. knowledge and trust × Competitive aggressiveness | 0.24 | 0.17 | 0.155 | 0.024 |
| H6e | Networks. knowledge and trust × Risk taking | −0.14 | 0.16 | 0.801 | 0.008 |
| H7a | Market orientation × Autonomy | −0.08 | 0.17 | 0.696 | 0.008 |
| H7b | Market orientation × Innovation | −0.06 | 0.26 | 0.608 | 0.010 |
| H7c | Market orientation × Proactiveness | −0.39 | 0.26 | 0.926 | 0.005 |
| H7d | Market orientation × Competitive aggressiveness | −0.07 | 0.16 | 0.685 | 0.008 |
| H7e | *Market orientation × Risk taking* | *0.57* | *0.26* | *0.029* | *0.038* |
| H8a | Sustainable development goals × Autonomy | −0.05 | 0.14 | 0.645 | 0.010 |
| H8b | Sustainable development goals × Innovation | 0.01 | 0.22 | 0.967 | 0.003 |
| H8c | Sustainable development goals × Proactiveness | 0.27 | 0.32 | 0.406 | 0.012 |
| H8d | *Sustainable development goals × Competitive aggressiveness* | *−0.36* | *0.14* | *0.010* | *0.044* |
| H8e | Sustainable development goals × Risk taking | 0.13 | 0.17 | 0.466 | 0.014 |

**Note(s):** *$p < 0.05$; **$p < 0.01$; β – Standardized Coefficients; SD – Standard Deviation; $f^2$ – Effect size
**Source(s):** Authors own work

**Table 6.** Standardized coefficients of the model

This study deepens the knowledge validating the great relevance of the university EO for the design and development of entrepreneurial universities through innovation, autonomy, risk-taking and competitive aggressiveness. Additionally, through the moderating effects, market orientation, and sustainable development goals, our study also advanced the literature by conveying how these moderating effects positively impact the design and development of entrepreneurial universities.

Our results evidence that autonomy, innovation, competitive aggressiveness and risk-taking positively influence the design and development of entrepreneurial universities (H1, H2, H4 and H5). This evidence corroborates with some previous studies. For instance, Sidrat and Boujelbene (2020) report that autonomous universities engage in complex and changing environments, which may require the emergence of hybrid forms while retaining their independence and the capacity to make the difficult decisions that determine the future of institutions. Soetanto and Geenhuizen (2019) have demonstrated that innovative universities engage in various activities like launching new programs, designing new courses, generating new ideas, implementing new pedagogies, fostering the development of an internal system of motivation, facilitating the launching of spinoffs, integrating new working methods, deploying new structures and proposing new management methods. According to Graf and Menter (2022), entrepreneurial universities play a critical role in promoting knowledge spillovers, as they act as central players in innovation networks and stimulate networking activities. Concerning the positive influence of competitive aggressiveness on the design and

development of entrepreneurial universities, our evidence corroborates with the position taken by Sidrat's (2019) findings, which identify how competitiveness is a determining factor in the design and development of entrepreneurial universities. We may thus state that attempts by universities to improve their brand image and seek to develop creative and original approaches to attracting an increasingly demanding clientele that enjoys multiple opportunities positively influence the creation and development of entrepreneurial universities.

We may also report that risk-taking has a statistically significant and positive impact on designing and developing entrepreneurial universities. These findings also corroborate earlier studies, particularly those by Todorovic and Mcnaughton (2003), that emphasise how any entrepreneurial university displays a favourable attitude towards taking calculated risks.

Another relevant aspect of our empirical findings emerges from the fact that there are no statistically significant positive impacts of proactiveness on the design and development of entrepreneurial universities (H3). This indicates that proactive behaviour and a leadership-oriented approach do not influence the design and development of entrepreneurial universities. In this regard, our study runs counter to the position taken by Sidrat (2019), who details the influence of proactiveness on the creation and development of entrepreneurial universities as significant. Furthermore, our study counters the findings of Soetanto and Geenhuizen (2019) that maintain how proactiveness conveys the tendency to anticipate and act on future needs and introduce new products and services before the competition. This suggests that proactive behaviour and leadership orientation do not influence university entrepreneurship.

Our research also reaches beyond the EO of universities to analyse the moderating effects of networks, knowledge and trust on the relationship between EO and the creation and development of entrepreneurial universities (H6a, b, c, d, and e). In this sense, our results showed no statistically significant moderating effects for networks, knowledge and trust on the impact of various dimensions of the entrepreneurial orientation on the design and development of entrepreneurial universities. Our study results differ from those of Leih and Teece (2016). They suggest that academic activities within the context of an entrepreneurial university are an important dimension to consider in the EO of universities. This implies that the dimensions of EO become more prominent in such institutions. This also counters the study by Hormiga *et al.* (2017), who find that knowledge sharing is a significant moderating factor for the relationship between EO and the levels of performance returned by research groups as measured by the number of articles published.

The findings also have significant relevance regarding the second moderating factor, market orientation. Hence, our results provide evidence of statistically significant moderating effects for risk-taking (H7e). This suggests that the higher the level of market orientation, the greater the impact of risk-taking in designing and developing entrepreneurial universities. Thus, our study concurs with that referenced above by Urbano and Guerrero (2013), who state that entrepreneurial universities produce undergraduates with the competencies required by employers and train personnel with the competencies appropriate to becoming entrepreneurs and creating employment. Our results also align with Migliori *et al.* (2019) and their defence of how market orientation moderates the relationship between EO and the subsequent performance levels of academic spinoffs.

Finally, regarding the moderating effect that the sustainable development goals hold over the relationship between the EO of universities and the design and development of entrepreneurial universities. We may report that the sustainable development goals moderate the relationship between competitive aggressiveness and the design and development of entrepreneurial universities (H8d). These findings convey how the higher the level of the sustainable development goals, the lower the impact of competitive aggressiveness on the design and development of entrepreneurial universities. Hence, our results support Nicolò *et al.* (2020), who assert that sustainable development goals represent

one of the most relevant objectives for the design and development of entrepreneurial universities (Quality Education) that requires specific and active policies on behalf of universities in keeping with their unique position in society and broad competences in terms of creating and disseminating public knowledge and value.

Hence, this study provides a new angle to return deeper insights and convey the influence that EO holds over the creation and development of entrepreneurial universities and how this relationship is moderated by the aforementioned factors: networks, knowledge and trust, market orientation and sustainable development goals.

*Theoretical implications*

The current research strengthens the role of universities in the economy and in society in keeping with the literature and that affirmed by Carl and Menter (2021) while also strengthening the three main tasks of universities: academic teaching, research and the transmission of knowledge to society, as already defined Etzkowitz *et al.* (2000) or more recently emphasised by Graf and Menter (2022). In addition, our research provides evidence of the importance of EO for HEIs that aim to become more entrepreneurial universities. This clarifies the gap in the existing literature and supports the findings of previous studies (e.g. Balasubramanian *et al.*, 2020; Pacheco *et al.*, 2024; Sidrat and Boujelbene, 2020).

Our study has contributed to the understanding of the role of EO in universities, particularly from the perspective of academic management. According to management theory, particularly the resource-based view (Barney, 2001; Rugman and Verbeke, 2002), university leaders must leverage these influential factors to enhance the outcomes of their entrepreneurial activities. We have provided empirical evidence that links EO with entrepreneurial universities and identified several moderating factors that affect this relationship. We may report a strong and positive correlation between four dimensions of EO (autonomy, innovation, risk-taking and competitive aggressiveness) and the design and development of entrepreneurial universities. This conveys how the constructs for the EO of universities can successfully predict the design and development of entrepreneurial universities. Furthermore, this study highlights the moderating factors' utility while verifying a positive correlation between the moderating factors of market orientation and sustainable development goals and entrepreneurial universities.

This study also lends additional support to studies on entrepreneurial universities. It contributes to the theory by expanding the applicability of EO and the moderating factors in an otherwise poorly explored context like the university's context. We believe this analysis of Portuguese HEIs provides an important vision of how the dissemination and acceptance of entrepreneurial universities occur among European academics. However, it would be normal to expect the extent and the results of EO within universities to vary between countries and universities (Clark, 2001; Davies, 2001; Sidrat and Boujelbene, 2020). While universities all mutually differ in their traditions and characteristics and take measures aligned to their particular national context, they must follow a common European strategic objective to ensure uniformity in the design and development of entrepreneurial universities.

Finally, even while entrepreneurial university-related phenomena and the introduction of the third mission alongside those of teaching and research emerge all around the world (Nelles and Vorley, 2011; Sidrat, 2019), the results of our research indicate that the academic community is very much in harmony with the attitudes prevailing towards entrepreneurial universities.

*Practical implications*

Our findings highlight the significant influence of EO on hold over entrepreneurial universities, with this causal relationship moderated by networks, knowledge and trust,

market orientation and sustainable development goals. By fostering the development of skills and knowledge among staff and students and implementing effective actions and policies, universities can create and sustain an entrepreneurial culture. Management theory suggests that strategic collaboration with industry and external partners can provide access to new markets, customers and stakeholders, thereby facilitating the commercialization of research outputs (Engez and Aarikka-Stenroos, 2023). This approach aligns with the principles of dynamic capabilities, which emphasize the importance of adapting and reconfiguring organizational resources to achieve competitive advantage (Feola *et al.*, 2021; Ferreira and Ferreira, 2024).

Our study provides a new perspective and methodology for identifying factors that enable university entrepreneurship by aligning with management theories. This approach is an important point of departure for researchers and professionals interested in evaluating this theme. By incorporating a sample that includes rectors, faculty deans, polytechnic presidents and school directors of Portuguese state HEI, our study offers significant contributions to the field.

Management theory emphasizes the importance of strategic leadership and resource allocation in achieving organizational goals (Maritan and Lee, 2017). Therefore, our findings assist university leaders in determining the optimal strategy for designing and developing entrepreneurial universities. Finally, through our empirical study and research, we hope to inspire more academics and researchers to explore this exciting field further.

## Conclusion, limitations and future lines of research

This study sought to overcome the unexplored field of the role of university EO and put forward empirical evidence on the moderating effects of networks, knowledge and trust, market orientation and implementing sustainable development goals on the development of entrepreneurial universities. Our work underscores the relevance of management theories in understanding and promoting university entrepreneurship, thereby contributing to the broader discourse on management in HEIs. University leaders can create an environment that supports and actively promotes innovation and entrepreneurial activities.

Despite the contributions made, this research displays certain limitations that future studies need to consider. Firstly, this empirical study focuses on the context of European HEIs, specifically Portuguese state HEIs; therefore, any generalisation of the results requires certain reservations. Our sample does not include private universities, so these results may not extend to the higher education sector. However, since the respondents were the various rectors, deans and directors of different HEIs, coming from different academic backgrounds and with correspondingly varying research interests, we believe this study is valid in generalising its results.

Furthermore, we applied a structured questionnaire for data collection, and even while this method demonstrated its effectiveness, this may have influenced the type of answers given. As future lines of research, it would be significant to undertake comparative empirical research covering the universities of other countries, especially other European countries, and thus verify the differences prevailing among the universities from different countries, with different university governance structures as well as the different academic backgrounds of their rectors, deans and directors. Furthermore, future research might complement our study by also including private HEIs.

Regarding sample selection, we limited the distribution of our questionnaire to the rectors, presidents and directors of Portuguese HEIs. Additionally, another questionnaire targeting lecturers teaching entrepreneurship-related subjects and their students would further enrich these research results. Furthermore, considering the validity of the variable measurements, we adopted a widely accepted approach in research on EO, deploying a structured

questionnaire for data collection. Still, future studies will yield interesting results by applying factual and secondary data. Additionally, we applied a quantitative, questionnaire-based methodology and propose that researchers seek to deploy qualitative methodologies to obtain a deeper understanding that may stimulate the creation and development of entrepreneurial universities.



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Appendix

**Table A1.**
Measurement of variables

| Constructs | | Items | | Source |
|---|---|---|---|---|
| *Dependent variable* | *The design and development of entrepreneurial universities (4 items)* | (1) | The design and development of an entrepreneurial university as reflected in the publication of works with practical implications | Adapted from Sidrat and Boujelbene (2020) (7-point Likert scale) |
| | | (2) | The design and development of an entrepreneurial university through the implementation of a strategic plan | |
| | | (3) | The design and development of an entrepreneurial university reflected in the total revenues generated by contracts, projects and patents by academic department | |
| | | (4) | The design and development of an entrepreneurial university through the incorporation of entrepreneurial culture into study programs | |
| *Independent variables* | *Autonomy (5 items)* | (1) | The operational application of autonomy through means of the university's capacity to remain independent and make endless choices that determine its future | |
| | | (2) | The operational application of autonomy through means of the university thinking and acting independently | |
| | | (3) | The operational application of autonomy through means of the university showing trust in itself and, above all, being able to gain either financial autonomy or access the necessary sources of financing | |
| | | (4) | The operational application of autonomy reflected through freedom of choice | |
| | | (5) | The operational application of autonomy through the financial freedom of managing research funds that contribute towards the success of commercialisation within which freedom is important to individuals developing new ideas | |
| | *Innovation (5 items)* | (1) | The implementation of innovation emerges through means of new programs and pedagogies | |
| | | (2) | The implementation of innovation takes place through means of creating new ideas and projects | |
| | | (3) | The implementation of innovation takes place through means of launching spinoffs | |
| | | (4) | The implementation of innovation takes place through introducing new working methods | |
| | | (5) | The implementation of innovation takes place through means of establishing management structures and methods | |
| | *Proactiveness (3 items)* | (1) | The operational application of proactiveness reflects in the university being the first to engage in new technologies rather than reacting to the "competitors" | |
| | | (2) | The operational application of proactiveness reflects in the university standing out more as a leader and less as a follower | |
| | | (3) | The operational application of proactiveness reflects in the university achieving excellence in identifying opportunities | |
| | *Competitive aggressiveness (3 items)* | (1) | The operational application of competitive aggressiveness reflects in the university working hard to defeat its "competitors" to attract more students | |
| | | (2) | The operational application of competitive aggressiveness reflects in the university improving its brand image | |
| | | (3) | The operational application of competitive aggressiveness reflects in the university striving to develop creative and original approaches to attracting an increasingly demanding public and thereby providing multiple opportunities | |
| | *Risk taking (4 items)* | (1) | The operational application of risk taking emerges through means of decision-making with uncertainties and risks | |
| | | (2) | The operational application of risk taking emerges through means of the university displaying a favourable attitude to a particular risk | |
| | | (3) | The operational application of risk taking emerges through means of the university taking decisions in situations of risk and deciding to do unknown things | |
| | | (4) | The operational application of risk taking emerges through means of the university being willing to invest significantly in lucrative projects | |

(*continued*)

**Table A1.**

| Constructs | | Items | | Source |
|---|---|---|---|---|
| *Moderating Variables* | *Networks, knowledge and trust (4 items)* | (1) | We encourage our students to get involved in research with significant implications for industry or for society | Adapted from Migliori *et al.* (2019), Hormiga *et al.* (2017) |
| | | (2) | We encourage our students to seek out practical applications for their research | |
| | | (3) | The teaching staff at our institution emphasise applied research | |
| | | (4) | Our professors frequently seek out research opportunities outside of the traditional university environment | |
| | | (5) | In comparison with other similar institutions in our region, our professors are renowned for their highly efficient and productive research | |
| | *Market orientation (4 items)* | (1) | In comparison with other similar institutions in our region, our institution has a reputation for contributing towards industry and society | |
| | | (2) | There is the expectation that members of staff make substantial contributions towards industry or society | |
| | | (3) | Our students very often obtain high-quality positions in industry | |
| | | (4) | Our institution is highly considered by industry | |
| | *Sustainable development goals (2 items)* | (1) | We feel that the university policies contribute subsequently to this institution achieving its targets and goals | |
| | | (2) | In comparison with the majority of other institutions, our institution is highly sensitive to new ideas and innovative approaches | |

**Source(s):** Authors own work