THE INTERPLAY BETWEEN ENTREPRENEURIAL RISK-TAKING AND INTELLECTUAL CAPITAL: EFFECTS ON INNOVATION NOVELTY IN HIGH-TECH FIRMS

Miriam Delgado-Verde and Jose Carlos Franco-Curiel
Economics and Business School, Business Management Department, Complutense University of Madrid, Madrid, Spain

ACCEPTED IN JOURNAL OF INTELLECTUAL CAPITAL

Funding sources
We would like to thank the financial support from Spanish Ministry of Economy and Competitiveness (#ECO2012-38190 and #ECO2015-65251-P), as well as Spanish Ministry of Science and Innovation (#PID2020-117564GA-I00).

ABSTRACT

Purpose: The paper aims to analyse the effects of interplay between entrepreneurial risk-taking behaviour and each of the three components of intellectual capital (IC) on the degree of novelty of new products.

Design/methodology/approach: This article studies one of the most recognized dimensions of entrepreneurial orientation (EO) along with knowledge-based assets owned by high-tech firms. In this way, entrepreneurial risk-taking is analysed considering the companies' IC endowment, as a contingent variable, to examine the achievement of a higher novelty in developing new products from firms' OE. The empirical study was carried out on a sample of 155 Spanish knowledge-intensive firms and based on survey data gathered from two different respondents. Hierarchical regression analysis was used.

Findings: Findings reveal heterogeneous effects of IC components on the relationship between entrepreneurial risk-taking and innovation novelty. While innovative culture (organizational capital) has a positive interaction with risk-taking in the influence on the degree of novelty of new products, relationships with customers (social capital) have a negative one. And, however, CEO industry experience (human capital) doesn't have any contingent effect.

Originality: This study contributes to shed light on the few empirical studies that analyse internal contingent elements in the relationship between entrepreneurial risk-taking behaviour and the novelty of product innovation in high-tech-firms. Concretely, specific manifestations of IC components are examined jointly with entrepreneurial risk-taking.

Keywords: Entrepreneurial Orientation, Risk-Taking, Intellectual Capital, Innovation Novelty

Paper type: Research paper

1. INTRODUCTION

The development of innovations with a high degree of novelty is essential for high-tech firms, as they compete in a dynamic and uncertain environment (Liu *et al.,* 2023). This situation involves taking risks, which is particularly relevant in the context of entrepreneurship within existing organisations (Wales *et al.,* 2013), to the extent that risk-taking behaviour is considered a major dimension of Entrepreneurial Orientation (EO) (Pérez-Luño *et al.*, 2011).

However, more recent studies emphasize the necessity of paying attention to other elements combined with entrepreneurial risk-taking to examine its effect on product innovation (García-Granero et al., 2015; Giaccone and Magnusson, 2021) and, specifically, on radical innovation (Liu *et al.,* 2023). This request arises mainly because not all companies benefit equally from EO and their relationship with radical innovation may not be as simple as assumed because it depends on context (Liu *et al.,* 2023). Wiklund and Shepherd's (2003) and Akbar *et al.*'s (2020) highlighted the importance of considering knowledge-based resources when analysing the effect of entrepreneurial strategic posture on firm performance. Considering that high-tech firms have a strong dependence on knowledge assets (Leitner, 2005) and their relevance to achieve innovation as key competitive tool (Laursen and Salter, 2006), the extent to which such firms employ EO on radical innovation may be influenced by their knowledge endowment. Indeed, the literature has shown some diversity regarding connections between risk-taking and knowledge-based resources (e.g., Estrin *et al.,* 2016), reflecting further the need to pay attention to the role played by knowledge in firms.

As intellectual capital (IC) is a growing topic in entrepreneurship research (Kaffka and Krueger, 2024), our objective is providing insights on the interplay between entrepreneurial risk-taking and different types of knowledge, categorized as IC. By doing so, we address the gap regarding the need to identify elements that interact with entrepreneurial risk-taking to achieve successful radical product innovation. Identifying these elements is crucial because each dimension of EO can generate diverse performance outcomes depending on the firm's specific context (Dai et al., 2014; Covin and Wales, 2019), which in turn determines the appropriate knowledge endowment that companies must have. Within EO framework, some studies have analysed close relationships, such as the interactions between knowledge-based issues and EO on firm performance (Wiklund and Shepherd, 2003; Wales *et al.,* 2013; Mostafiz *et al.,* 2021), but few examined the EO-IC combination on innovation performance (Wu *et al.,* 2008; Zhang *et al.,* 2019; Abbas *et al.,* 2022), considering a specific EO dimension together with each of IC components. Particularly, several specific aspects have been underexplored along with entrepreneurial risk-taking, especially when focusing on innovation radicalness (Chaudhary *et al.,* 2023). Therefore, it seems necessary to pay attention to concrete manifestations of each IC component, such as CEO industry experience, relationships with customers or innovative culture, due to their importance within EO as contingency internal factors (Joshi et al., 2015). Additionally, none of the three works on the EO-IC combination focused specifically on high-tech companies. Consequently, these interactions in the context of radical innovation still need to be explored in more detail for firms competing in high-tech industries. This exploration aims to understand the effective transformation of entrepreneurial risk-taking that can benefit from contingent internal factors (Liu *et al.,* 2023). In fact, from a more practical view, elements related to

knowledge, risk-taking and innovations have been highlighted in the Business and Entrepreneurship field by the Global Entrepreneurship Monitor (GEM)[1], demonstrating the importance of this subject currently.

Accordingly, we address the following research questions: Do the interplay between entrepreneurial risk-taking and IC components affect novelty of new products? What role does manifestations of each IC component play together with risk-taking in achieving a higher degree of innovation novelty in high-tech firms?

To answer these questions, we use the contingent perspective, which is the basic theory in the EO field (Akbar *et al.,* 2020), to deal with the importance of considering other factors, such as internal ones, because EO should be consistent with them to achieve better results. Also, we connect the resource-based view (RBV) with EO to develop a research model about high-tech companies' risk-taking behaviour in which knowledge-based assets have a pivotal role. Since RBV focuses on discerning resources necessary to compete, EO is recognised as its core (Lumpkin and Dess, 1996; Wu *et al.,* 2008; García-Villaverde *et al.,* 2018). Additionally, the RBV is also a solid framework to explain the potential relevance of IC, as intangible resources, on improved innovation outcomes, as way to achieve competitive advantage.

We provide three main contributions on risk-taking for innovation. First, studies on EO highlight knowledge-based resources as an essential factor for the firms' competitiveness (Hughes and Morgan, 2007; Rauch *et al.,* 2016; Mostafiz *et al.,* 2021). Based on this, we respond to a part of the recent literature that calls for empirically examining risk-taking behaviour along with other elements to delve into innovation performance (García-Granero *et al.,* 2015; Giaccone and Magnusson, 2021; Liu *et al.,* 2023) analysing IC as knowledge-based assets. Second, in dynamic environments, innovation in firms takes on a key role in achieving competitive advantage. Specifically, innovations with a high level of novelty are increasingly necessary to compete in complex competitive environments, which stimulate risk-taking to achieve better innovation results (Pérez-Luño *et al.,* 2011). We address this situation by applying our model in high-tech companies to consider the nuances of such environments. Third, we reveal the role played by IC in companies with risk-taking behaviour to attain more novel products, unpacking its composition through CEO industry experience (human capital), relationships with customers (social capital) and innovative culture (organisational capital).

Our paper is structured as follows. Section 2 presents a literature review on main concepts and their interrelations, and the proposed hypotheses. Section 3 describes the methodology used. Section 4 explains the results and Section 5 examines them. Last section provides the conclusions.

2. THEORY AND HYPOTHESES

2.1. Entrepreneurial risk-taking behaviour, innovation, and intellectual capital

EO has become one of the most recognized concepts in the entrepreneurship field within management literature (Wales, 2016). According to the behavioural model (Covin and

[1] It is the most recognized entrepreneurship research project worldwide. It evaluates 115 countries and helps to identify factors that increase entrepreneurship levels.

Lumpkin, 2011), EO reflects the firm's conduct in business and alignment with its environment and is understood as a behaviour sustained over time that represents a strategic posture (Covin and Wales, 2019; Mostafiz *et al.*, 2021). In addition, there is an important consensus around the understanding that EO is a firm-level phenomenon and many of scholars, who have treated this concept as a strategic orientation, identify three core dimensions: proactiveness, risk-taking, and innovativeness (Covin and Slevin, 1989).

Even this phenomenon has been traditionally studied as a unitary construct, the literature also supports a separate treatment of its dimensions (e.g., Pérez-Luño *et al.*, 2011). On this sense, Xiao *et al.* (2022) identified some nuances in risk-taking dimension compared to the others, since it gives an unspecific entrepreneurial direction because it commits significant resources to bold projects whose outcome is uncertain. Accordingly, entrepreneurial risk-taking is a behaviour that commits resources to implement projects, activities, and solutions where the outcomes are unknown and uncertain (Lumpkin and Dess, 1996; Hughes and Morgan, 2007).

Specifically, risk-taking plays a leading role when companies, such as high-tech firms, compete in dynamic environments that push them to develop innovations (García-Granero *et al.*, 2015) due to their technological turbulence and market dynamics. These characteristics generate high uncertainty and a large resources commitment (Cai *et al.*, 2015) because firms must choose higher risk projects to be competitive. The focus on high-risk actions is even more relevant when pursuing radical innovations (Cai *et al.*, 2015), since their failure rate is especially high due to challenges they face (Genin *et al.*, 2023).

Radical innovations are characterized by the introduction of novel products that differ significantly from existing ones (Tidd, 2001) facilitating revolutionary changes within the market (Pavitt, 1991). Therefore, their implementation should be undertaken with caution without neglecting the risk assumed (Giaccone and Magnusson, 2021). At this point, firms' knowledge-based assets endowment is essential to predict better high-risk project viability (Mostafiz *et al.*, 2021), especially in high-tech firms where these types of assets are highly important to achieve competitive advantages through successful innovations.

To address this issue and following other studies about EO (Lumpkin and Dess, 2001; Wiklund and Shepherd, 2003; Wales, 2016; Akbar *et al.*, 2020; Mostafiz *et al.*, 2021; Liu *et al.*, 2023), the contingent perspective and the RBV are appropriate. The former holds that entrepreneurial success depends on organizational factors (Akbar *et al.*, 2020), and the latter asserts that some of them can be sources of competitive advantage (Barney, 1991). Thus, combining the two theoretical approaches helps to understand, first, the need to jointly address entrepreneurial risk-taking and knowledge-based assets to improve firm performance, and, secondly, how they can generate a competitive advantage.

Based on abovementioned, knowledge-based assets can facilitate the transformation of risky behaviours, which have been performed to take advantage of opportunities, into new products with high uncertainty (Mostafiz *et al.*, 2021). This is because knowledge

provides a great ability for companies to discover and exploit new opportunities (Wiklund and Shepherd, 2003). Specifically, IC has been used as synonym for knowledge-based assets and firms use it to attain and sustain competitive advantage (Popa *et al.,* 2022) through, in many cases, innovation performance (e.g., Subramaniam and Youndt, 2005). Therefore, IC is understood as 'the sum of all knowledge an organization is able to leverage in the process of conducting business to gain competitive advantage' (Youndt *et al.,* 2004:337).

One of the main challenges posed by IC at the theoretical level has been the identification of its main components, and their impact on aspects such as innovation performance (Crupi *et al.,* 2020). The most common categorization distinguishes human capital, social capital, and organizational capital (Youndt *et al.,* 2004).

Human capital is characterized as one of the key factors in the entrepreneurial success and innovation performance (Marvel and Lumpkin, 2007). It is defined as the knowledge and skills of the workforce and, in the entrepreneurship context, it has attracted a great deal of interest (Hatak and Zhou, 2021). Within human capital, we focus on specific knowledge derived from practice, such as CEO's previous experience in the industry, since experience years provide deep knowledge about market needs (Yli-Renko *et al.,* 2001) and, consequently, can help to predict whether an innovation will be successful (Marvel *et al.,* 2020). Social capital is also characterized by its importance to get entrepreneurial success (Davidsson and Honig, 2003) and refers to the knowledge embedded within, accessible through, and utilized in interactions among employees and their networks of interrelationships. It facilitates information exchange and, consequently, knowledge acquisition, so it enhances entrepreneurial performance by expanding social networks (Bosma *et al.,* 2004). Within social capital, our attention is focused on one of the most important aspect, relationship with customers (e.g., Yüksel *et al.,* 2022), which provides relevant external knowledge on market demands that improve firms' ability to develop new products (Scuotto *et al.,* 2017). Finally, organizational capital refers to the knowledge, skills, and information that remain within an organization even after its employees leave for the day, which includes organizational culture, management philosophies, organizational processes, or databases. Specifically, organizational culture contains reliable information (Katila, 2002) and facilitates information flows when it promotes innovative attitudes (Engelman *et al.,* 2017), which is relevant to entrepreneurial behaviour. Therefore, our focus lies on such culture that directly represents creative content and generation of new ideas, as values promoted by firms (Prajogo and Ahmed, 2006), that is, innovative culture, since it encourages pursuing innovation within companies.

2.2. The interaction between entrepreneurial risk-taking and intellectual capital on the degree of novelty of new products

Despite the relevance of the entrepreneurial risk-taking in the literature, some scholars have drawn inconsistent conclusions about its effects on firm performance (e.g., Gilley *et al.,* 2002). On the one hand, most scholars agree that entrepreneurial risk-taking has positive effects (e.g., Lumpkin and Dess 1996), as an incentive to seize risky opportunities and, thus, achieve higher novelty in the new product development (Calantone *et al.,*

2003). On the other hand, some authors posit that risk-taking behaviour could be pernicious (Hughes and Morgan, 2007), since it can lead to inappropriate strategic decisions related with the innovations' development that commit resources (Greco *et al.*, 2020).

Consequently, this entrepreneurial strategic posture and its effects on firm innovation cannot be fully understood without considering contingent variables, such as firm's knowledge (Akber *et al.*, 2020; Chaudhary *et al.*, 2023). So, firms' IC endowment can play an important role in the interaction with entrepreneurial risk-taking. Figure 1 outlines the conceptual model and proposed hypotheses.

-Figure 1-

However, there is no consensus that human capital, social capital, or organizational capital promote greater novelty in innovation when higher entrepreneurial risk-taking has been undertaken. In this regard, the literature highlights some concepts as the overconfidence of CEO, the "innovator's dilemma" related to customers, or a high homogeneity of beliefs and practices that could hamper this relationship.

Regarding human capital, overconfidence is the tendency of managers to overestimate the firm's prospects and underestimate its risks (Skala, 2008). Thus, the accumulation of knowledge by CEO can lead to overconfidence, tending to trust their own information, while underestimating other sources of information (Bernardo and Welch, 2001). This circumstance makes previous experience ineffective (Eggers and Song, 2014) since external information is key to the identification of novel opportunities to achieve a high degree of novelty of new products. Moreover, homogeneity in knowledge fosters risk aversion and leads to less innovative approaches to problem-solving and decision-making (Sarto *et al.*, 2019).

Even so, most academics agree that CEO's previous experience is beneficial. This knowledge offers deeper professional insights, including valuable information about markets, products, customers, and competitors (Cassar, 2014). This enables a more comprehensive understanding of industry and market demand (Politis, 2005), reducing the uncertainty when addressing innovative initiatives (Peng *et al.*, 2023). In this vein, Norton and Moore (2002) argued that having worked on similar projects provides an informational advantage to identify new opportunities, which makes it possible to undertake riskier projects aimed at achieving innovations with a higher degree of novelty. Thus, previous experience improves risk perception and tendencies, and allows appropriate actions to be taken that promote more novel innovations (Peng *et al.*, 2023). This is because new mental frameworks are developed, or existing ones are modified when new knowledge is acquired through experience (Shane and Venkataraman, 2000).

Based on these arguments, we formulate the following hypothesis:

Hypothesis 1: The interplay between entrepreneurial risk-taking and CEO industry experience has a positive effect on the degree of novelty of new products.

Concerning social capital, the “innovator's dilemma” refers to the customer-driven choice between developing radical or incremental innovations (Reinhardt and Gurtner, 2011; Christensen, 2015). When established firms are overly focused on their existing customers and large margins, they generally act by minimizing risk and often fail to invest in radical innovation (Henderson, 2006). Therefore, a consolidated relationship with mainstream customers can lead firms to invest fewer resources in risky projects aimed at achieving radical innovations, centring instead on incremental innovation (Reinhardt and Gurtner, 2011). In fact, this relationship encourages redundant information to the detriment of novel information necessary for radical innovations (Aldrich and Kim, 2007).

Still, most academics agree that relationships with customers is positive. These relationships break down barriers between companies (Greco *et al.,* 2020), either by providing resources or competencies, or by supporting the firm to overcome emerging problems during the entrepreneurial process (Antonioli *et al.*, 2017). Hence, cooperation with customers can grant access to crucial knowledge that would not otherwise be available (D'Este *et al.*, 2016) and provides opportunities to access complementary technological resources, which can contribute to cost-sharing, and risk distribution (De Faria *et al.*, 2010), thus improving firms’ ability to develop new products (Scuotto *et al.*, 2017). Therefore, the exchange of information and resources within customers' social networks fosters greater trust and stability for companies (Camps and Marques, 2014). Indeed, customers usually provide relevant external knowledge, and specific about their problems, essential to know market demands and understand their preferences (Tang and Murphy, 2012). Knowing what customers need and want enables the development of new products with a probably more positive response (Tsai, 2009).

Considering these arguments, we suggest the following hypothesis:

Hypothesis 2: The interplay between entrepreneurial risk-taking and relationships with customers has a positive effect on the degree of novelty of new products.

Finally, following Büschgens *et al.* (2013), a high homogeneity of beliefs and practices due to too strong organizational culture (organizational capital) can result in less novel innovations, even though firm assumes high entrepreneurial risk-taking, as it is detrimental to learning beyond a certain point. Additionally, the need to centralize decisions at higher management levels to implement changes that drive radical innovations is more characteristic of a hierarchical culture than an innovative culture (Dewar and Dutton, 1986).

Still, most academics agree that innovative culture is positive (e.g., Sánchez-Cañizares *et al.*, 2007). The presence of shared beliefs, values, and a philosophy for innovation allows employees to feel supported in developing new ideas. This encourages them to act creatively and innovatively, as well as assertively when faced with change and competition, thus enhancing the ability to manage risks when firm seeks newer products. Moreover, firms that accept a high level of error stemming from their innovative culture foster a risk-taking attitude (Kucharska, 2021). Specifically, Gui *et al.* (2024) revealed that innovation culture can help firms stimulate the collection, sharing, exploration,

exploitation of knowledge, which is very beneficial in reinforcing or supporting specific aspects of innovation. Therefore, stimulating the flow of information and creativity through an organizational innovative culture allows the novelty of innovation to be strengthened when it adopts higher entrepreneurial risk-taking.

Based on these arguments, we propose the following hypothesis:

Hypothesis 3: The interplay between entrepreneurial risk-taking and innovative culture has a positive effect on the degree of novelty of new products.

3. METHODOLOGY

3.1. Sample

This empirical study was realized on a sample of Spanish firms in high-tech manufacturing industry (Eurostat, 2020). This industry is composed by knowledge-intensive firms and is responsible for most of technological innovation (Rothaermel and Alexandre, 2009), so it seems appropriate for analysed research topic. Furthermore, such firms tend to exhibit EO properties (Falahat *et al.*, 2018) and its central assets are intangible factors (Leitner, 2005).

These firms were part of the following seven sectors: chemicals; pharmaceuticals; computer, electronic and optical products; electrical equipment; machinery and equipment n.e.c.; motor vehicles, trailers, and semi-trailers; and other transport equipment. In 2015, the population contained 1326 firms with five years of experience at least, and fifty or more full-time employees (Orbis database, Bureau van Dijk). With these restrictions, we capture data of companies that provide valid information to our research topic, since they are established firms that seek to adapt to competitive environment through an EO. And, regarding firms' size, smaller companies have different characteristics for acquiring knowledge compared to larger ones (Voudouris *et al.*, 2012). Table I shows the basic attributes of the sample firms according to these restrictions.

To achieve the objectives of our study, we developed an ad-hoc questionnaire to collect information on risk-taking behaviour materialized by entrepreneurial actions within companies, on IC endowment owned by firms through manifestations of different types of knowledge, and on innovation performance about new products. A pre-test with fifteen firms was conducted to ensure a proper questionnaire design before the contracted polling company collected the data needed for our research. This company used Computer Aided Telephone Interviewing (CATI). Total sample is made up of 202 firms, but we only consider those firms with new or improved products introduced into the market (N=155) (response rate: 11.69%), because the purpose is to analyse firms with innovation performance[2]. The frequency relative to each of the NACE codes reflects response rates close to the total response rate with respect to population. Almost 70% of sample firms operate more than 20 years, over 80% of the firms have at least 200 employees, and more than 75% of the firms have both total assets and annual sales exceeding 10,000 thousand euros (Table I).

[2] The questions used in this paper are just part of a broader research project funded by the Spanish Ministry of Economy and Competitiveness. This research project was focused on knowledge management and innovation performance in firms with special attention to entrepreneurship phenomenon.

-Table I-

Firms were selected for interviews using a simple random sample to ensure representative sampling. Additionally, we conducted mean difference tests in terms of full-time employees, total assets, and sales using a non-parametric test (Mann-Whitney U test) because the tested variables are not normally distributed. This test showed no significant differences between the treatment variables and the control group (NACE), suggesting that NACE code does not significantly impact any of three variables.

Questionnaire was answered by two different managers to avoid common method bias, with one of them responding to dependent variable and the other to independent one (Podsakoff *et al.*, 2003). Thus, CEO or, alternatively, marketing/sales director, responded to questions on innovation results, and number of years working in the industry as objective information, and R&D manager responded on risk-taking, as well as innovative culture and relationships with customers. Additionally, following Podsakoff *et al.*'s (2003) recommendations, two months elapsing between answers from two respondents, and respondents were informed that there were no right or wrong answers to reducing thus the probability of common method variance. Moreover, due to our research model is characterized by two-way interactions, the likelihood of common method variance is reduced because of difficult of anticipating cognitive maps by respondents (Chang *et al.*, 2010).

Finally, Table II shows descriptive statistics for study variables. Despite possible heterogeneities regarding geographic areas and/or industry characteristics of our study, the data obtained are like others observed in previous works close to aimed topic (Wiklund and Shepherd, 2003; García-Villaverde *et al.*, 2018). This could allow for greater generalization of findings.

-Table II-

3.2. Measures and analysis

The scale used to measure the constructs were based on previous empirical research. The detailed items for research constructs are displayed in Appendix.

To measure our dependent variable, the *degree of novelty of new products*, we asked by the number of truly new products to the firm introduced during the last three years (2012-2014). The final measure was calculated dividing the number of strongly new products by the total number of new or improved products (Cruz-González *et al.*, 2015). This ratio informs about the portion of total products innovation that are really new.

All items of independent variable and contingent variables were measured on 7-point Likert scales, ranging from 1 (strongly disagree) to 7 (strongly agree), except experience years of CEO in the industry.

Independent variable, *entrepreneurial risk-taking*, represents the propensity of a firm to take risks and was measured through three items (Covin and Slevin, 1989). They are the most adequate for measuring this construct to capture risky entrepreneurial behaviours according to entrepreneurship literature (Lumpkin and Dess, 2001; Wiklund and Shepherd, 2003; Wales et al., 2013; Mostafiz *et al.*, 2021). Respondents were asked to

indicate daring propensity and adaptation to environmental opportunities (Hughes and Morgan, 2007; Kraus and Rigtering, 2017). Exploratory factor analysis was suitable for our data (KMO index=0.724; significant at the 0.000 value for Bartlett's test; and the determinant of the correlation matrix=0.296). The analysis revealed a one-factor solution that explains 75.833% of total variance and it showed that all factor loadings are equal to or higher than 0.853. Measure consisted of the average score for the three items (α=0.840).

Seven items were included to measure contingent variables. One item related to *CEO industry experience* (in years and represented by logarithm) (Barasa *et al.*, 2017). According to Mueller *et al.* (2021), a higher previous experience in the sector involves deeper and more specific knowledge, which allows to capture relevant information with respect to human capital. This is represented by a larger number of experience years in the industry as a manifestation of human capital, since experience is a result of learning at work and is one of the factors of human capital (Delgado-Verde *et al.*, 2015). To measure the other two IC components, three items were considered for each one. For social capital, we captured knowledge derived to *relationships with customers* (O'Cass and Heirati, 2015), asking about information on market (Yli-Renko *et al.*, 2001) and collaborative processes (Delgado-Verde *et al.*, 2014). Knowledge resources derived from a network of relationships and collected through linkages with customers are a manifestation of social capital (Youndt *et al.*, 2004). Finally, to measure organizational capital, we focus on corporate culture -one of its manifestations (Youndt *et al.*, 2004), which is recognised as construct of organisational excellence. It considers basic values, commitments and approaches shared by the members of a firm that facilitate cooperation, joint action and problem solving (Martín-de Castro *et al.*, 2013). Specifically, we based on *innovative culture* by identifying of creativity and experimentation promotion, as well as a common system of values, beliefs, and goal direction to develop new ideas (Martín-de Castro *et al.*, 2013; Javanmardi *et al.*, 2021). Exploratory factor analysis with varimax orthogonal rotation was suitable for our data (KMO index=0.730; significant at the 0.000 value for Bartlett's test; and the determinant of the correlation matrix=0.024). The analysis replicated three factors, and each item loaded as expected, showing factor loadings clearly higher than 0.84. Specifically, the first factor refers to innovative culture, which explains 37.531% of total variance; the second one, relationships with customers, accounts for 32.134%; and the third one, CEO industry experience explains 14.449%. Relationships with customers and innovative culture measures consisted of the average of the scores on the three items they included (α=0.832 and α=0.921, respectively).

Finally, six control variables referred to corporate and industry effects were added. Firm's size and age, company's sales growth and profit growth, firm's R&D intensity, and technological environmental dynamism (see Appendix). *Firm's size* and *age* are very used by management literature (e.g., Dalwai and Mohammadi, 2020), and in our study they are relevant because may influence the development of innovation in firms (Martín-de Castro *et al.*, 2013), as well as on its EO (García-Villaverde *et al.*, 2018). Firm size was measured by the number of employees, and firm age by the year it was established (both represented by logarithm). Company growth is also used by many authors (e.g., Xu

and Li, 2019) and we considered two types to represent distinctive characteristics, such as *sales growth* to capture information from market, and *profit growth* to capture information from inside firm. Both was measured with one item for each by Likert-type scale. *Firm's R&D intensity* may reflect external knowledge acquired (Cruz-González *et al.*, 2014) what also play an interesting role for our research topic. It was measured as average percentage of sales dedicated to internal R&D activities on Likert scale. Environmental dynamism was used to control a relevant industry effect that may influence firms' innovations (Pérez-Luño *et al.*, 2011), such as *technological dynamism*, which captures the rate of technological changes (Danneels and Sethi, 2011). This variable was measured with one item on a Likert scale.

Finally, Table II shows correlations among variables, and there are no apparent multicollinearity problems. Moreover, variance inflation factors (VIF) calculated for lineal regressions are below the recommended level of 10 (Kutner *et al.*, 2005). The highest one is 2.614. And, to minimize potential multicollinearity problems, we standardized variables before creating interaction terms (Cohen *et al.*, 2003). Regarding the reliability and validity of constructs, Cronbach's Alphas (α) show good internal consistency with values greater than 0.83, and convergent and discriminant validities are met because the Average Variance Extracted (AVE) of each is higher than 0.5, and the square roots of the AVE are higher than the off-diagonal elements in the matrix of correlations (Claver-Cortés *et al.*, 2011), respectively. Finally, the construct validity of each is also accepted with a composite reliability higher than recommended level of 0.7 (Fornell and Larcker, 1981).

4. RESULTS

To contrast the hypotheses, a hierarchical regression analysis estimated by ordinary least squares was used. Table III shows the results obtained of the proposed interplay-model. Model 1 (M1) is the baseline one including control variables and the three contingent variables of each IC component; Model 2 (M2) adds the independent variable, entrepreneurial risk-taking; and Model 3 includes the interaction terms among risk-taking and the three elements of IC. The three models show statistical validity, with a Durbin-Warton value close to 2 and F-statistic values different from zero at $p<0.01$. Regarding control variables, firm size has not a significant effect on novelty of new products in any models, but the rest ones do significantly influence analysed dependent variable. The evidence found is positive for sales growth and technological dynamism, and negative for firm age, profit growth, and R&D intensity.

-Table III-

M3 indicates two significant interaction effects on novelty of new products, which determines that we observe interplay (moderation) according to Dawson (2014). Specifically, the interaction of entrepreneurial risk-taking with innovative culture, and with relationships with customers, but while the first one shows a positive effect, the second one shows a negative effect. So, the results support Hypothesis 3 that predicted a positive contingent effect of innovative culture on the relationship between risk-taking and novelty of new products ($\beta=0.072;p<0.05$). However, contrary to our expectations, for Hypothesis 2 we find a significant and negative contingent effect of relationships with

customers on the effect of risk-taking on novelty of new products (β=-0.048;p<0.1). Finally, Hypothesis 1 is not supported since the contingent role of CEO industry experience on the relationship between risk-taking and novelty of new products is not significant (β=0.037;ns). It is important highlight that inclusion of the interaction terms in M3 shows an increase in explanatory power and model fit (ΔR^2=0.048;p<0.05).

Figures 2 and 3 plot findings with the aim to ease visual interpretation. Following Aiken and West (1991), unstandardized coefficients were used. Figure 2 shows the positive contingent role of innovative culture on the relationship between entrepreneurial risk-taking and the degree of novelty of new products. The effect of risk-taking on novelty of new products increases when innovative culture is strong. Figure 3 shows the identified negative contingent role of relationships with customers on the effect of risk-taking on the degree of novelty of new products. This case, the effect of risk-taking on novelty of new products diminishes when relationships with customers are robust.

-Figures 2 and 3-

5. DISCUSSION

Our results reveal high heterogeneity regarding the interplay between entrepreneurial risk-taking and each IC dimension on new products novelty. While innovative culture has a positive contingent effect on the relationship between risk-taking and the degree of novelty of new products, relationships maintained with customers have a negative contingent one. And, however, CEO's experience in the industry doesn't influence on analysed relationship.

First, a firms' strong innovative culture together with entrepreneurial risk-taking contributes to increasing the novelty of new products, as proposed. The positive effect of innovative culture can be explained based on Sánchez-Cañizares *et al.*'s (2007) arguments, as they stated that innovative culture makes risk-taking easer because it is formed through flexible structures that encourage the development of a corporate mindset to experiment and generate new ideas with the aim to develop newer products. Thus, innovative culture allows learning through failure and risk-taking, promoting innovation in uncertain environments (Kucharska, 2021). Culture of sharing underlies innovative culture, promoting communication among members and facilitating knowledge exchange, which is linked to entrepreneurial risk-taking (García-Villaverde *et al.*, 2018), since innovative culture shares information and tolerates risk (Martín-de Castro *et al.*, 2013). Therefore, our findings would involve that a strong innovative culture provides reliable knowledge by facilitating communication among different departments (Engelman *et al.*, 2017), thus reaching higher novelty levels of new products when a firm has adopted higher entrepreneurial risk-taking.

Second, maintaining intense relationships with customers together with entrepreneurial risk-taking hamper achieving a higher degree of new products novelty. This can be explained considering the "innovator's dilemma" (Reinhardt and Gurtner, 2011) and the fact that a high dependence may induce conformity and reduce firms' autonomy and creativity (Aldrich and Kim, 2007). Therefore, focusing on mainstream customers and

maintaining intense relationships with them can decrease the degree of novelty of new products even though firms are daring and have tendency to carry out high risk projects. Our findings might also respond to the need to access advanced and unique knowledge that has not been previously disseminated in the market to achieve a higher level of novelty in innovation outcomes (Asimakopoulos *et al.*, 2023). This could conflict with knowledge acquired from customers because such information could likely be available to competitors who also collaborate with those customers. Furthermore, radical innovations require a solid knowledge base that reduces associated risks (Bouncken *et al.*, 2018), which could imply that if the knowledge provided by customers does not have specific characteristics, the combination of entrepreneurial risk-taking and customers' relationships is not suitable for achieving high degree of novelty in product innovations.

Third, we identified that CEO industry experience does not have an interaction effect with entrepreneurial risk-taking on the degree of new products novelty. Considering our firm`s dynamic environment, the development of new ideas demands heterogeneous skill and knowledge at the management level (Sarto *et al.*, 2019), which may be difficult to achieve with a high CEO tenure in the same industry. This later provides experience and knowledge to CEO about similar businesses, which could hamper the diversity needed to develop innovations (Nieto *et al.*, 2015), to the detriment of an entrepreneurial risk-taking behaviour. Delving deeper, our findings could also respond to the importance of considering cognitive aspects such as perceived self-efficacy, understood as the perceived ability to make good decisions. This is related to learning experience and may involve taking more risks when perceptions are high, otherwise knowledge derived from experience may not be transmitted (Krueger and Dickson, 1994; Kaffka and Krueger, 2024).

Finally, it is worth noting that entrepreneurial risk-taking does not have a significant effect on novelty of product innovations, which aligns with Wales *et al.*'s (2020) and Mostafiz *et al.*'s (2021) insights, who asserted that knowledge-based resources could be key condition to the utility of EO, as shown by our findings across different IC dimensions.

6. CONCLUSIONS

Entrepreneurial risk-taking is recognised as a key behaviour for the firms' competitiveness, both in the academic and business fields. The aim of our study is to shed new insights into the effect of entrepreneurial risk-taking on the degree of new products novelty in high-tech firms, where knowledge-based assets and the launch of radical innovation are crucial (Liu *et al.*, 2023). Thus, analysing the interplay of entrepreneurial risk-taking with different IC components allows us to provide a more accurate picture of such EO dimension and to reach better implications for academia and practice.

6.1. Theoretical implications

Our study provides evidence to clarify the complex relationship between entrepreneurial risk-taking behaviour and innovation performance. We found that it is indeed necessary to consider under what conditions this relationship occurs, since there is not link without contingent variables according to our results. Therefore, in response to whether the

interplay between entrepreneurial risk-taking and IC components influences the novelty of new products, we found that entrepreneurial risk-taking is not sufficient to accomplish satisfactory outcomes *per se*. Our study reveals the relevance of considering other factors, such as IC, to achieve high degree of novelty in product innovations (Mostafiz *et al.*, 2021).

Regarding the role of the manifestations of each IC component together with risk-taking in achieving higher innovation novelty in high-tech firms, our study contributes to body of research about entrepreneurial risk-taking in specific context of high-tech companies. They compete in a dynamic environment characterised by high uncertainty, which pushes them to take risks to develop radical product innovations (Cai *et al.*, 2015). So, by focusing on a specific type of industry, our work shows more precise needs of knowledge resources -combined with risk-taking propensity, to compete and achieve more radical new products and, thus, a potential competitive advantage according to its key success factors. Our findings suggest that innovative culture plays a prominent role in developing radical innovations, as a knowledge-based asset that combines with entrepreneurial risk-taking.

Additionally, considering that the achievement of each kind of innovation is determined by different internal factors (López-Cabrales *et al.*, 2008), we reveal that IC can take on a critical role in their interaction with entrepreneurial risk-taking as a facilitator depending on innovation results that companies seek to achieve a competitive advantage. Thus, knowledge needs will vary according to different degrees of innovation novelty. Specifically, our results indicate that innovative culture acts as contingent variable for achieving high degree of novelty of new products, while relationships with customers for a lower degree of novelty. This provides valuable insights into radicalness of firms' innovation portfolio, which is adjusted considering strategic objectives and environmental circumstances (Huvaj and Johnson, 2019).

6.2. Managerial implications

According to asymmetric roles played by the different manifestations of IC components, the results of our study highlight the need for different actions by managers when companies seek to achieve product innovations from firms' EO. The importance of paying attention to two of IC components is confirmed, which act as essential condition to the usefulness of entrepreneurial risk-taking.

In high-tech companies with high propensity to take risks, the first managerial implication is that executives should promote creativity, experimentation, and a common system of values around the development of new ideas and work processes by implementing practices aimed at helping their employees achieve a higher degree of novelty in their product innovation results. And, unexpectedly, the second implication is that managers should maintain weak collaborations with their customers to avoid being conditioned by them when it comes to reaching radical product innovations, since relationships with these stakeholders could lead to conformism and, consequently, to less novelty of new products when company has a high risk-taking propensity. However, based on the finding found, practical implication can be put another way for firms with risk-taking behaviour:

managers should maintain strong collaborations with their customers if they are pursuing new products with incremental improvements. Indeed, it is worth focusing on incremental innovations -also necessary for established firms, since they increase profits by reducing production costs of existing products derived from minor changes in product design, production processes or materials (Huvaj and Johnson, 2019), allowing thus achieve competitive advantages. So, we suggest that executives strive to attract valuable customers who provide information about true needs of the market and help develop useful knowledge to offer new products that are truly valued by them in terms of level of novelty. This can be due because sometimes companies with an important entrepreneurial risk-taking behaviour could develop radical new products without projection in the market.

Finally, as regards CEO industry experience, we propose that managers access diverse knowledge beyond acquired by experience in the same industry because, otherwise, it could be limiting for developing new products even if firms have risk-taking behaviour. Without relevant and overly specific knowledge, strategic posture aimed at high-risk projects can be harmed. So, executives should have a combined portfolio of basic knowledge as education and training, and advanced knowledge as experience and abilities, as well as suitable personal attitude, which allow enhancing entrepreneurial risk-taking behaviour of firms focused on innovativeness.

6.3. Limitations and future research

Our research has several limitations that could affect the scope of the findings obtained, but that could be useful to cover future research. First, we used cross-sectional data that entail problems regarding time lags that make it difficult to reach conclusions on relationships of causality. Even though we introduced different years periods for each block of questions, it would be desirable to access panel data to overcome this concern, as well as recent data to validate our findings. In addition, despite we have answers from two different managers, objective data should be used to minimise common method variance.

Extrapolating our findings to firms in industries other than high-tech or other sizes and maturity should be taken with caution. Thus, the proposed research model should be investigated by future studies to analyse potential differences that provide more knowledge about EO and IC endowment on new products novelty considering other industries or types of companies, such as services or young firms, whose special features could offer interesting insight. Additionally, the literature has addressed a variety of cultural dimensions that can be used to distinguish differences among countries (e.g., Hofstede and Bond, 1988), which would also provide nuances of interest on our topic, since we focus only on Spanish firms.

Moreover, we addressed only some contents of very complex phenomena. Therefore, other dimensions of EO and IC should be analysed with the aim to achieve additional evidence about their potential interactions and, thus, provide towards a more complete understanding of business reality in this respect. Regarding EO, proactiveness and innovativeness could be analysed in combination with IC, and even pay attention to

competitive aggressiveness or autonomy, as added dimensions according to Lumpkin and Dess (1996). And, in the same way, other manifestations of each of the three IC components, such as CEO's or employees' education, training, abilities, or motivation (human capital) without forgetting cognitive development (Kaffka and Krueger, 2024), relationships with other stakeholders different than customers -such as suppliers, universities or competitors, or company's reputation (social capital), and communication and information technologies, or company's processes and routines (organizational capital) should be examined together with EO dimensions, as well.

REFERENCES

Abbas, M.G.; Wang, Z.; Ullah, H.; Mohsin, M.; Abbas, H.; Mahmood, M.R. (2022) 'Do entrepreneurial orientation and intellectual capital influence SMEs' growth? Evidence from Pakistan', *Environmental Science and Pollution Research,* Vol.29 No.17, pp.5774-25789.

Aiken, M.J. and West, S.G. (1991) *Multiple regression: Testing and interpreting interactions,* Sage, Newbury Park, London.

Akbar, F., Khan, R. A., Wadood, F. and Bon, A.T.B. (2020) 'Entrepreneurial orientation dimension affects firm performance: a perspective from the Malaysian furniture industry', *Entrepreneurial Business and Economics Review,* Vol.8 No.4, pp.157–181.

Aldrich, H.E. and Kim, P.H. (2007) 'Small worlds, infinite possibilities? How social networks affect entrepreneurial team formation and search', *Strategic Entrepreneurship Journal,* Vol.1 No.1–2, pp.147–165.

Antonioli, D., Marzucchi, A. and Savona, M. (2017) 'Pain shared, pain halved? Cooperation as a coping strategy for innovation barriers', *Journal of Technology Transfer,* Vol.42, pp.841-864.

Asimakopoulos, G., Revilla, A. and Rodríguez, A. (2023) 'International R&D sourcing, innovation and firm age: The advantage of 'born-international sources'', *Technovation,* Vol.122, pp.102662.

Barasa, L., Knoben, J., Vermeulen, P., Kimuyu, P and Kinyanjui, B. (2017) 'Institutions, resources and innovation in East Africa: A firm level approach', *Research Policy,* Vol.46 No.1, pp.280–291.

Barney, J. (1991) 'Firm resources and sustained competitive advantage', *Journal of Management,* Vol.17 No.1, pp.99-120.

Bernardo, A.E. and Welch, I. (2001) 'On the evolution of overconfidence and entrepreneurs', *Journal of Economics & Management Strategy,* Vol.10 No.3, pp.301–330.

Bosma, N., van Praag, M., Thurik, R. and de Wit, G. (2004) 'The value of human and social capital investments for the business performance of startups', *Small Business Economics,* Vol.23 No.3, pp.227–236.

Bouncken, R.B., Fredrich, V., Ritala, P. and Kraus, S. (2018) 'Coopetition in new product development alliances: Advantages and tensions for incremental and radical innovation', *British Journal of Management*, Vol.29 No.3, pp.391–410.

Büschgens, T., Bausch, A. and Balkin, D.B. (2013) 'Organizational culture and innovation: A meta-analytic review', *Journal of Product Innovation Management*, Vol.30 No.4, pp.763–781.

Cai, L., Yu, X., Liu, Q. and Nguyen, B. (2015) 'Radical innovation, market orientation, and risk-taking in Chinese new ventures: an exploratory study', *International Journal of Technology Management*, Vol.67 No.1, pp.47-76.

Calantone, R., Garcia, R. and Dröge, C. (2003) 'The effects of environmental turbulence on new product development strategy planning', *Journal of Product Innovation Management*, Vol.20 No.3, pp.90–103.

Camps, S. and Marques, P. (2014) 'Exploring how social capital facilitates innovation: The role of innovation enablers', *Technological Forecasting and Social Change*, Vol.88, pp.325–348.

Cassar, G. (2014) 'Industry and startup experience on entrepreneur forecast performance in new firms', *Journal of Business Venturing*, Vol.29 No.1, pp.137–151.

Chang, S.J.; Van Witteloostuijn, A; Eden, L. (2010) 'Common method variance in international business research', *Journal of International Business Studies*, Vol. 41, pp.178-184.

Chaudhary, S., Dhir, A., Farronato, N., Nicotra, M. and Pironti, M. (2023) 'Nexus between entrepreneurial orientation and intellectual capital', *Journal of Intellectual Capital*, Vol.24 No.1, pp.70–114.

Chen, J., Chen, Y. and Vanhaverbeke, W. (2011) 'The influence of scope, depth, and orientation of external technology sources on the innovative performance of Chinese firms', *Technovation*, Vol.31 No.8, pp.362–373.

Christensen, C.M. (2015) *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Harvard Business Review Press, Boston, Massachusetts.

Claver-Cortés, E., Pertusa-Ortega, E.M. and Molina-Azorín, J.F. (2011) 'Estructura organizativa y resultado empresarial: Un análisis empírico del papel mediador de la estrategia', *Cuadernos de Economía y Dirección de la Empresa*, Vol.14, pp.2–13.

Cohen, P., Cohen, S.G., West, L.S. and Aiken, M.J. (2003) *Applied multiple regression/correlation analysis for the behavioral sciences*, Lawrence Erlbaum, London.

Covin, J.G. and Lumpkin, G.T. (2011) 'Entrepreneurial orientation theory and research: Reflections on a needed construct', *Entrepreneurship: Theory and Practice*, Vol.35 No.5, pp.855–872.

Covin, J.G. and Slevin, D.P. (1989) 'Strategic management of small firms in hostile and benign environments', *Strategic Management Journal*, Vol.10 No.1, pp.75–87.

Covin, J.G. and Wales, W.J. (2019) 'Crafting high-impact entrepreneurial orientation research: Some suggested guidelines', *Entrepreneurship Theory and Practice*, Vol.43 No.1, pp.3-18.

Crupi, A., Cesaroni, F. and Di Minin, A. (2020) 'Understanding the impact of intellectual capital on entrepreneurship: a literature review', *Journal of Intellectual Capital*. Vol.22 No.3, pp.528–559.

Cruz-González, J., López-Sáez, P. and Navas-López, J.E. (2015) 'Absorbing knowledge from supply-chain, industry and science: The distinct moderating role of formal liaison devices on new product development and novelty', *Industrial Marketing Management*, Vol.47, pp.75–85.

Cruz-González, J., López-Sáez, P., Navas-López, J.E. and Delgado-Verde, M. (2014) 'Directions of external knowledge search: Investigating their different impact on firm performance in high-technology industries', *Journal of Knowledge Management*, Vol.18 No 5, pp.847-866.

Dai, L., Maksimov, V., Gilbert, B. A., Fernhaber, S. A. (2014) 'Entrepreneurial orientation and international scope: The differential roles of innovativeness, proactiveness, and risk-taking', *Journal of Business Venturing*, Vol.29 No.4, pp.511–524.

Dalwai, T. and Mohammadi, S.S. (2020) 'Intellectual capital and corporate governance: an evaluation of Oman's financial sector companies', *Journal of Intellectual Capital*, Vol. 21 No.6, pp.1125–1152.

Danneels, E. and Sethi, R. (2011) 'New Product Exploration Under Environmental Turbulence', *Organization Science*, Vol. 22 No. 4, pp.1026–1039.

Davidsson, P. and Honig, B. (2003) 'The role of social and human capital among nascent entrepreneurs', *Journal of Business Venturing*, Vol.18 No.3, pp.301–331.

Dawson, J.F. (2014) 'Moderation in management research: What, why, when, and how', *Journal of Business and Psychology*, Vol.29 No.1, pp.1–19.

Delgado-Verde, M., Cooper, S. and Martín-de Castro, G.M. (2015) 'The moderating role of social networks within the radical innovation process: A multidimensionality of human capital-based analysis', *International Journal of Technology Management*, Vol.69 No.2, pp.117–138.

Delgado-Verde, M., Martín-de Castro, G., Navas-López, J. E. and Amores-Salvadó, J. (2014) 'Vertical relationships, complementarity and product innovation: An intellectual capital-based view', *Knowledge Management Research and Practice*, Vol.12 No.2, pp.226-235.

D'Este, P., Amara, N. and Olmos-Peñuela, J. (2016) 'Fostering novelty while reducing failure: Balancing the twin challenges of product innovation', *Technological Forecasting and Social Change*, Vol. 113, pp.280-292.

De Faria, P., Lima, F. and Santos, R. (2010) 'Cooperation in innovation activities: The importance of partners', *Research policy*, Vol.39 No.8, pp.1082-1092.

Dewar, R.D. and Dutton, J.E. (1986) 'The adoption of radical and incremental innovations: An empirical analysis', *Management Science* Vol.32 No.11, pp.1422-1433.

Eggers, J.P. and Song, L. (2014) 'Dealing with Failure: Serial Entrepreneurs and the Costs of Changing Industries Between Ventures', *Academy of Management Journal*, Vol.58 No.6, pp.1785-1803.

Engelman, R.M., Fracasso, E.M., Schmidt, S. and Zen, A.C. (2017) 'Intellectual capital, absorptive capacity and product innovation', *Management Decision*, Vol.55 No.3, pp.474–490.

Estrin, S., Mickiewicz, T. and Stephan, U. (2016) 'Human capital in social and commercial entrepreneurship', *Journal of Business Venturing*, Vol.31 No.4, pp.449–467.

Eurostat (2020). Statistics explained. Glossary: High-tech classification of manufacturing Industries.
https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Glossary:Hightech_classification_of_manufacturing_industries

Falahat, M., Knight, G. and Alon, I. (2018) 'Orientations and capabilities of born global firms from emerging markets', *International Marketing Review*, Vol.35 No.6, pp.936–957.

Fornell, C. and Larcker, D.F. (1981) 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, Vol.18, pp.39–50.

García-Granero, A., Llopis, Ó., Fernández-Mesa, A. and Alegre, J. (2015) 'Unraveling the link between managerial risk-taking and innovation: The mediating role of a risk-taking climate', *Journal of Business Research*, Vol.68 No.5, pp.1094–1104.

García-Villaverde, P.M., Rodrigo, J., Ruíz Ortega, M.J. and Parra Requena, G. (2018) 'The role of knowledge absorptive capacity on the relationship between cognitive social capital and entrepreneurial orientation', *Journal of Knowledge Management*, Vol.22 No.5, pp.1015–1036.

Genin, A., Ms, W., Bhagwat, V. and Bernile, G. (2023) 'Board experiential diversity and corporate radical innovation', *Strategic Management Journal*, Vol.44 No.1, pp.2634–2657.

Giaccone, S. C. and Magnusson, M. (2021) 'Unveiling the role of risk-taking in innovation: antecedents and effects', *R&D Management*, Vol. 52 No.1, pp.93–107.

Gilley, K.M., Walters, B.A., and Olson, B.J. (2002) 'Top management team risk taking propensities and firm performance: Direct and moderating effects', *Journal of Business Strategies,* Vol.19 No.2, pp.95-114.

Greco, M., Grimaldi, M. and Cricelli, L. (2020) 'Interorganizational collaboration strategies and innovation abandonment: the more the merrier?', *Industrial Marketing Management,* Vol.90, pp.679–692.

Gui, L., Lei, H. and Le, P.B. (2024) 'Fostering product and process innovation through transformational leadership and knowledge management capability: the moderating role of innovation culture', *European Journal of Innovation Management,* Vol.27 No.1, pp.214–232.

Hatak, I. and Zhou, H. (2021) 'Health as human capital in entrepreneurship: Individual, extension, and substitution effects on entrepreneurial success', *Entrepreneurship Theory and Practice,* Vol.45 No.1, pp.18-42.

Henderson, R. (2006) 'The Innovator's Dilemma as a Problem of Organizational Competence' *Journal of Product Innovation Management,* Vol 23 No.1, pp.5-11.

Hofstede, G. and Bond, M. (1988) 'The Confucius connection: From cultural roots to economic growth', *Organizational Dynamics,* Vol.16, pp.4-21.

Hughes, M. and Morgan, R.E. (2007) 'Deconstructing the relationship between entrepreneurial orientation and business performance at the embryonic stage of firm growth', *Industrial Marketing Management,* Vol.36 No.5, pp.651–661.

Huvaj, M.N. and Johnson, W.C. (2019) 'Organizational complexity and innovation portfolio decisions: Evidence from a quasi-natural experiment', *Journal of Business Research,* Vol.98, pp.153–165.

Javanmardi Kashan, A., Wiewiora, A. and Mohannak, K. (2021) 'Unpacking organisational culture for innovation in Australian mining industry', *Resources Policy,* Vol.73, p.102149.

Joshi, M.P., Das, S.R., Mouri, N. (2015) 'Antecedents of innovativeness in technology-based services (TBS): peering into the black box of entrepreneurial orientation', *Decision Science,* Vol.46 No.2, pp.367-402.

Kaffka, G. and Krueger, N. (2024) 'How entrepreneurs engage with feedback during value creation–a taxonomy', *Journal of Intellectual Capital,* Vol.25 No.7, pp.109–128.

Katila, R. (2002) 'New product search over time: past ideas in their prime?', *Academy of Management Journal,* Vol.45 No.5, pp.995–1010.

Kraus, S. and Rigtering, C. (2017) 'Strategic corporate entrepreneurship: A configuration approach-based case study', *International Journal of Entrepreneurial Venturing,* Vol.9 No.2, pp.101–121.

Krueger Jr, N. and Dickson, P. R. (1994) 'How believing in ourselves increases risk taking: Perceived self-efficacy and opportunity recognition', *Decision sciences*, Vol.25 No.3, pp.385–400.

Kucharska, W. (2021) 'Do mistakes acceptance foster innovation? Polish and US cross-country study of tacit knowledge sharing in IT', *Journal of Knowledge Management*, Vol.25 No.11, pp.105–128.

Kutner, M.H., Nachtsheim, C.J. and Neter, J. (2005) *Applied linear statistical models*, McGraw-Hill Higher Education, Columbia.

Laursen, K. and Salter, A. (2006) 'Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms', *Strategic Management Journal*, Vol.27, pp.131–150.

Leitner, K.-H. (2005) 'Managing and reporting intangible assets in research technology organisations', *R and D Management*, Vol.35 No.2, pp.125–136.

Liu, Y., Wu, Y. and Wu, W. (2023) 'Which kind of board benefits more from the relationship between entrepreneurial orientation and radical innovation? The asymmetric roles of board characteristics in China', *Humanities and Social Sciences Communications*, Vol.10 No.1., pp.1-14.

López-Cabrales, A., Cabello-Medina, C., Carmona-Lavado, A. and Valle-Cabrera, R. (2008) 'Managing functional diversity, risk taking and incentives for teams to achieve radical innovations', *R&D Management*, Vol.38 No.1, pp.35–50.

Lumpkin, G.T. and Dess, G.G. (1996) 'Clarifying the entrepreneurial orientation construct and linking it to performance', *Academy of Management Review*, Vol. 21 No.1, pp.135-172.

Lumpkin, G.T. and Dess, G.G. (2001) 'Linking two dimensions of entrepreneurial orientation to firm performance: the moderating role of environment and industry life cycle', *Journal of Business Venturing*, Vol.16, pp.429-451.

Martín-de Castro, G., Delgado-Verde, M., Navas-López, J.E. and Cruz-González, J. (2013) 'The moderating role of innovation culture in the relationship between knowledge assets and product innovation', *Technological Forecasting and Social Change*, Vol.80 No.2, pp.351-363.

Marvel, M.R. and Lumpkin, G.T. (2007) 'Technology entrepreneurs' human capital and its effects on innovation radicalness', *Entrepreneurship: Theory and Practice*, Vol.31 No.6, pp.807–828.

Marvel, M.R., Wolfe, M.T. and Kuratko, D.F. (2020) 'Escaping the knowledge corridor: How founder human capital and founder coachability impacts product innovation in new ventures', *Journal of Business Venturing*, Vol.35 No.6, pp.1-16.

Mostafiz, M.I., Hughes, M. and Sambasivan, M. (2021) 'Entrepreneurial orientation, competitive advantage and strategic knowledge management capability in Malaysian family firms', *Journal of Knowledge Management*, Vol.26 No.2, pp.423–458.

Mueller, P.E.M., Georgakakis, D., Greve, P., Peck, S. and Ruigrok, W. (2021) 'The curse of extremes: Generalist career experience and CEO initial compensation', *Journal of Management*, Vol.47 No.8, pp.1977–2007.

Nieto, M.J., Santamaría, L. and Fernandez, Z. (2015) 'Understanding the Innovation Behavior of Family Firms', *Journal of Small Business Management*, Vol.53 No.2, pp.382–399.

Norton, W.I. and Moore, W.T. (2002) 'Entrepreneurial risk: Have we been asking the wrong question?', *Small Business Economics*, Vol.18, pp.281–287.

O'Cass, A. and Heirati, N. (2015) 'Mastering the complementarity between marketing mix and customer-focused capabilities to enhance new product performance', *Journal of Business & Industrial Marketing*, Vol.30 No.1, pp.60–71.

OECD (2005). *Oslo Manual: Guidelines for collecting and interpreting innovation data* (3rd ed.), OECD and Eurostat, Paris.

Pavitt, K. (1991) 'Key characteristics of the large innovating firm', *British Journal of Management*, Vol.2 No.1, pp.41–50.

Peng, H., Chang, Y. and Liu, Y. (2023) 'Risk preference, prior experience, and serial entrepreneurship performance: evidence from China', *Asia Pacific Business Review*, Vol.29 No.3, pp.613–631.

Pérez-Luño, A., Wiklund, J. and Cabrera, R.V. (2011) 'The dual nature of innovative activity: How entrepreneurial orientation influences innovation generation and adoption', *Journal of Business Venturing*, Vol.26 No.5, pp.555–571.

Podsakoff, P.M., MacKenzie, S. B., Lee, J.-Y.Y. and Podsakoff, N. P. (2003) 'Common method biases in behavioral research: a critical review of the literature and recommended remedies', *Journal of Applied Psychology*, Vol.88 No.5, pp.879–890.

Politis, D. (2005) 'The process of entrepreneurial learning: A conceptual framework', *Entrepreneurship Theory and Practice*, Vol.29 No.4, pp.399–424.

Popa, S., Soto-Acosta, P. and Palacios-Marqués, D. (2022) 'A discriminant analysis of high and low-innovative firms: the role of IT, human resources, innovation strategy, intellectual capital and environmental dynamism', *Journal of Knowledge Management*, Vol.26 No.6, pp.1615–1632.

Prajogo, D.I. and Ahmed, P.K. (2006) 'Relationships between Innovation Stimulus, Innovation Capacity, and Innovation Performance', *R&D Management*, Vol. 36, pp.499-515.

Rauch, A., Rosenbusch, N., Unger, J. and Frese, M. (2016) 'The effectiveness of cohesive and diversified networks: A meta-analysis', *Journal of Business Research,* Vol.69 No.2, pp.554–568.

Reinhardt, R. and Gurtner, S. (2011) 'Enabling disruptive innovations through the use of customer analysis methods', *Review of Managerial Science,* Vol.5, pp.291–307.

Rothaermel, F.T. and Alexandre, M.T. (2009) 'Ambidexterity in technology sourcing: The moderating role of absorptive capacity', *Organization Science,* Vol.20 No.4, pp.759–780.

Sánchez-Cañizares, S.M., Ángel Ayuso Muñoz, M. and López-Guzmán, T. (2007) 'Organizational culture and intellectual capital: a new model', *Journal of Intellectual Capital,* Vol.8 No.3, pp.409–430.

Sarto, F., Saggese, S., Viganò, R. and Mauro, M. (2019) 'Human capital and innovation: mixing apples and oranges on the board of high-tech firms', *Management Decision,* Vol.58 No.5, pp.897–926.

Scuotto, V., Del Giudice, M., Bresciani, S. and Meissner, D. (2017) 'Knowledge-driven preferences in informal inbound open innovation modes. An explorative view on small to medium enterprises', *Journal of Knowledge Management,* Vol.21 No.3, pp.640–655.

Shane, S. and Venkataraman, S. (2000) 'The Promise of entrepreneurship as a field of research', *Academy of Management Review,* Vol.25 No.1, pp.217-226.

Skala, D. (2008) 'Overconfidence in psychology and finance-an interdisciplinary literature review', *Bank I Kredyt,* Vol.4, pp.33-50.

Subramaniam, M. and Youndt, Mark A. (2005) 'The influence of intellectual capital on the types of innovative capabilities', *Academy of Management Journal,* Vol.48 No.3, pp.450–463.

Tang, J. and Murphy, P.J. (2012) 'Prior knowledge and new product and service introductions by entrepreneurial firms: The mediating role of technological innovation', *Journal of Small Business Management,* Vol.50 No.1, pp.41–62.

Tidd, J. (2001) 'Innovation management in context: environment, organization and performance', *International Journal of Management Reviews,* Vol.3 No.3, pp.169–183.

Tsai, K. H. (2009) 'Collaborative networks and product innovation performance: Toward a contingency perspective', *Research policy,* Vol.38 No.5, pp.765–778.

Voudouris, I., Lioukas, S., Iatrelli, M. and Caloghirou, Y. (2012) 'Effectiveness of technology investment: Impact of internal technological capability, networking and investment's strategic importance', *Technovation,* Vol.32, pp.400–414.

Wales, W.J. (2016) 'Entrepreneurial orientation: A review and synthesis of promising research directions', *International Small Business Journal,* Vol.34 No.1, pp.3–15.

Wales, W.J., Covin, J.G. and Monsen, E. (2020) 'Entrepreneurial orientation: The necessity of a multilevel conceptualization', *Strategic Entrepreneurship Journal*, Vol.14 No.4, pp.639–660.

Wales, W.J., Parida, V. and Patel, P.C. (2013) 'Too much of a good thing? Absorptive capacity, firm performance, and the moderating role of entrepreneurial orientation', *Strategic Management Journal*, Vol. 34 No.5, pp.622–633.

Wiklund, J. and Shepherd, D. (2003) 'Knowledge-Based Resources, Entrepreneurial Orientation, and the Performance of Small and Medium-Sized Businesses', *Strategic Management Journal*, Vol.24, pp.1307-1314.

Wu, W., Chang, M. and Chen, C. (2008) 'Promoting innovation through the accumulation of intellectual capital, social capital, and entrepreneurial orientation', *R&D Management*, Vol. 38 No.3, pp.265–277.

Xiao, Z., Chen, X., Dong, M.C. and Gao, S. (2022) 'Institutional support and firms' entrepreneurial orientation in emerging economies', *Long Range Planning*, Vol.55 No.1, pp.102106.

Xu, J. and Li, J. (2019) 'The impact of intellectual capital on SMEs' performance in China', *Journal of Intellectual Capital*, Vol.20 No.4, pp.488–509.

Yli-Renko, H., Autio, E. and Sapienza, H.J. (2001) 'Social capital, knowledge acquisition, and knowledge exploitation in young technology-based firms', *Strategic Management Journal*, Vol.22 No.6–7, pp.587–613.

Youndt, M.A., Subramaniam, M. and Snell, S.A. (2004) 'Intellectual capital profiles: An examination of investments and returns', *Journal of Management Studies*, Vol.41 No.2, pp.335–361.

Yüksel, A., Gok, M.S, Özen, G. and Ciğerim, E. (2022) 'A new theoretical approach to intellectual capital: Meta-synthesis definitions of innovative literacy', *Journal of Intellectual Capital*, Vol.23 No.6, pp.1435–1460.

Zhang, F., Zhu, L. and Lyu, C. (2019) 'Large shareholder–manager social capital and firms' radical innovation: empirical evidence from Chinese firms', *Innovation*, Vol.22 No.2, pp.377–398.