



**Exploring Entrepreneurial Intentions, Innovation,
and Performance in Small
and Medium-Sized Enterprises**

Edited by

Anna Ujwary-Gil

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Entrepreneurial experience and venture success: A comprehensive meta-analysis of performance determinants

Matúš Grežo¹ , Róbert Hanák² 

Abstract

PURPOSE: In both theory and practice, the entrepreneur's prior experience is considered to be one of the most important human capital factors affecting venture performance. Nonetheless, the research on the effect of experience on venture performance has produced inconclusive findings. The literature explaining this inconclusiveness is sparse, but several determinants have been identified, such as the variability in the conceptualization and measurement of experience and performance, age of the investigated ventures, types of industry, or size and composition of venture management. The inconsistency of these features across primary studies makes it difficult to compare the results and to integrate findings. **METHODOLOGY:** This meta-analysis reviews and summarizes 80 primary studies in order to investigate the relationship between entrepreneur's experience and venture performance. We investigated the effect of five determinants of this relationship, namely the type of experience, type of performance, venture age, size of managerial team, and composition of managerial team. A random effect model was applied and the correlation coefficient was used as an indicator of effect size. **FINDINGS:** The study found that experience positively affected venture performance, although the magnitude of the effect was rather small. Venture performance showed to have the strongest significant relationship with start-up experience, followed by industrial, working, and managerial experience. International, functional, and entrepreneurial experience had a non-significant effect on venture performance. Moreover, the effect of experience on venture performance was not significant for older ventures. Experience significantly affected two types of venture performance, namely the size of venture and profitability, while the effect on growth was non-significant. Finally, of all the types of venture management, the experience of owner-inclusive entrepreneurial teams had the greatest effect on venture performance. **IMPLICATIONS:** Investor practitioners may find it helpful to assess entrepreneurs' experience within a broader context, taking account of the types of experience the entrepreneur possesses. Entrepreneurs' international, functional, and entrepreneurial experience should be considered very carefully, as they had a non-significant effect on venture performance. In contrast, having experience of founding a venture or of a particular industry seems to provide more value than experience of doing business internationally, or being in business for many years. Another important aspect that investors and venture capitalists should take into account is the size and composition of the entrepreneurial team and the extent to which the venture proposal reflects the different types of experience the team members possess. **ORIGINALITY AND VALUE:** The study contributes to the human capital literature by firstly attempting to examine systematically the overall magnitude of the relationship between entrepreneur's experience and venture performance. It also contributes by investigating the determinants of the relationship between experience and venture performance. It summarizes and combines previous inconclusive findings about the impact of different types of experience on different venture performance outcomes.

Keywords: entrepreneurial experience, venture performance, entrepreneurship, human capital, learning by doing, meta-analysis, start-up, investor decision-making, performance, knowledge generation

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INTRODUCTION

Since the human capital theory (Becker, 1964; Schultz, 1961) was postulated, there has been a great deal of research supporting the notion that venture performance is affected by entrepreneurs' and top executives' knowledge, skills, and managerial characteristics. So far, the entrepreneur's prior experience has been the single most commonly investigated human capital factor in entrepreneurship research (Marvel, Davis, & Sproul, 2016). Not surprisingly, the importance of this factor goes beyond the academic field. In business practice, the entrepreneur's prior experience is considered to be one of the most important criteria for assessing venture business proposals by venture capitalists and investors (e.g., MacMillan, Siegel, & Narasimha, 1985; Landström, 1998).

Although prior experience is considered to be of great importance, empirical research on its association with venture performance provides inconclusive evidence, ranging from positive, non-significant to negative associations (e.g., Garcés-Galdeano, Larraza-Kintana, Cruz, & Contín-Pilart, 2017; Zhao, Song, & Storm, 2013; Spanjer & von Witteloostuijn, 2017; Robb & Watson, 2012; Oe & Mitsuhashi, 2013; Naldi & Davidsson, 2014). Although the literature explaining this discrepancy is sparse, it suggests that these differences may result from inconsistencies in the way experience and performance are conceptualized and measured, differences in the age of firms, or differences in the size and composition of firm management (Reuber & Fischer, 1994; Cooper, Gimeno-Gascon, & Woo, 1994; Delmar & Shane, 2006). The inconsistency of these aspects in primary studies makes it difficult to integrate prior findings and draw general conclusions about the true importance of prior experience for venture performance.

To the best of our knowledge, there have been three meta-analytic studies that partially addressed this issue (Unger et al., 2011; Crook, Todd, Combs, Woehr, & Ketchen, 2011; Peake & Marshall, 2011). Yet, whilst these indisputably represent a contribution to the field, they have not provided sufficient clarity on the strength of the relationship between experience and venture performance or possible determinants of that relationship. Building on these gaps, the aim of this study is two-fold. Firstly, we attempt to integrate previous inconclusive findings by performing a meta-analysis to examine the strength of the relationship between entrepreneur's prior experience and venture performance. The second aim addresses the issue of variability in previous findings. We aim to test the impact of five specific determinants of the relationship between experience and venture performance: type of experience, type of performance, venture age, size of managerial team, and composition of managerial team.

The results of this study contribute to a human capital theory. To our best knowledge, there has been no systematic synthesis that summarizes the evidence on the relationship between experience and venture performance. Although venture performance has been shown to be positively related to a broad construct of human capital (Unger et al., 2011; Crook et al., 2011), we do not know what portion of this relationship is actually due to entrepreneurial experience. This study is therefore the first to focus exclusively on experience as a particular aspect of human capital. Not only does this study provide insights into the importance of entrepreneurial experience for ventures, but in conjunction with previous meta-analyses (Unger et al., 2011; Crook et al., 2011), it also allows us to assess this importance in the context of a broader set of human capital aspects such as education, knowledge, and skills. In addition, examining the determinants of the relationship between experience and venture performance helps to understand how different types of entrepreneurial experience are related to different types of venture performance and how these relationships vary by age of the firm, size, and composition of managerial team. Through this research, the study provides an understanding of the limits and constraints of the relationship between experience and venture performance.

Aside from the theoretical contributions, this study also provides some implications for entrepreneurial practice. Since entrepreneurial experience is an important criterion for investors and venture capitalists when making investment decisions, our study can inform business practitioners on whether it is justified to rely on experience when evaluating proposals for new ventures.

LITERATURE REVIEW

Human capital, experience, and learning-by-doing

The theory of human capital was originally conceptualized to study the importance of education for acquiring skills and knowledge that have economic value (Becker, 1964). This theory is based on the assumption that individuals who possess greater levels of knowledge, skills, competencies, education, and experience are able to achieve a better performance

than those who possess lower levels (Ployhart & Moliterno, 2011). The theory has been applied within the field of entrepreneurship, in an attempt to understand how specific attributes of human capital foster entrepreneurial success (Unger et al., 2011).

When investigating which human capital attributes were studied the most in the entrepreneurship literature, prior experience came top, with industry and managerial experience coming in first and second place and start-up experience being the third most commonly investigated attribute (Marvel et al., 2016). The reason for this great interest lies in the premise that entrepreneurs learn through experience (Dalley & Hamilton, 2000; Deakins & Freel, 1998; Rae, 2000; Rae & Carswell, 2000; Read, Sarasvathy, Dew, Wiltbank, & Ohlsson, 2011). In order to learn entrepreneurship practices, the entrepreneur must acquire knowledge by engaging in entrepreneurial processes, which is often referred to as “learning by doing” (Cope & Watts, 2000; Pittaway & Cope, 2007; Petkova, 2009). Most notably, by engaging in entrepreneurial processes, individuals acquire knowledge, skills, and competencies that help them to perform their job role successfully. As Krueger (2007) argues, it is not experience *per se*, but rather the specific knowledge, skills, and competencies gained from it that are important to entrepreneurship.

An important skill acquired through experience is the ability to identify new entrepreneurial opportunities (Ucbasaran, Westhead & Wright, 2009; Davidsson & Honig, 2003). For instance, in a study by Gompers, Kovner, Lerner, and Scharfstein (2010), experienced entrepreneurs exhibited a better ability to select the right industry and had better market timing skills. Other studies found that companies funded by more experienced venture capital firms were more likely to succeed in business (e.g., Kaplan & Schoar, 2005; Sorensen, 2007). This suggests that more experienced venture capitalists are able to identify better entrepreneurial opportunities, or possess better knowledge about how to set business strategy (Gompers et al., 2010). The reason for these benefits is that experience leads to richer, clearer, and more focused cognitive frameworks, which enables the entrepreneur to notice relationships between events that initially appear to be independent of one another, like changes in government policies or shifts in markets (Baron & Ensley, 2006). Moreover, experienced entrepreneurs have a better ability to see and include more distinct dimensions in their business opportunities and are also more aware of possible dangers. McGrath and MacMillan (2000) refer to this phenomenon as an “entrepreneurial mind set” that develops through the acquisition of more experience.

Besides the better ability to identify entrepreneurial opportunities, experience has been shown to foster the generation of both general and specific knowledge related to managing a business. Through managing a business, entrepreneurs gain general knowledge of tactics and distribution channels and acquire the operational and social skills required to establish relationships with customers, suppliers, and regulators (Ucbasaran, Wright, Westhead, & Busenitz, 2003; Mitchelmore & Rowley, 2010). Additionally, they generate knowledge about markets or funding possibilities (Rerup, 2005) as well as specific knowledge relating to finance, marketing, or logistics.

Does entrepreneur’s experience really matter for venture performance?

Although the literature provides extensive evidence that experience shapes the acquisition of important entrepreneurial knowledge, skills, and competencies, there remains ambiguity about whether it actually matters for venture performance. Indeed, the results of more than three decades of research in this area have not provided convincing support for the “learning by doing” hypothesis. Although a considerable portion of the research has shown that entrepreneur’s prior experience positively relates with venture performance (e.g., Evans & Leighton, 1989; Dyke, Fischer, & Reuber, 1992; Gimeno, Folta, Cooper, & Woo, 1997; Lerner, Brush, & Hisrich, 1997; Reuber & Fisher, 1997; Lerner & Almor, 2002; Chandler & Lyon, 2009; Gimmon & Levie, 2010; Zhao et al., 2013; Spanjer & von Witteloostuijn, 2017), there are a number of studies that have found a non-significant (e.g., Sandberg & Hofer, 1987; Bates, 1990; Robb & Watson, 2012; Oe & Mitsuhashi, 2013) or even a negative relationship between the two (e.g., Van de Ven, Hudson, & Schroeder, 1984; Jo & Lee, 1996; Naldi & Davidsson, 2014).

Unfortunately, existing meta-analytic studies in this area do not seem to explain this inconsistency adequately, and they do not provide integrative insights into the relationship between experience and venture performance (Peake & Marshall, 2011; Unger et al., 2011; Crook et al., 2011). The first of these, a meta-analysis by Peake and Marshall (2011), examined the effect of different types of experience on venture performance, represented by growth and earnings. However, it did not investigate the magnitude of the relationship between these two constructs. Instead, the authors tested for various moderators affecting the probability of obtaining a positive estimate for the relationship between experience and venture performance. They found that all the types of experience they examined positively affected venture performance.

The other two meta-analyses, by Unger et al. (2011) and Crook et al. (2011), focused on investigating the magnitude of the relationship, but not of the relationship between entrepreneurial experience and venture performance. Instead, prior experience has been included as one of many facets of a broad construct of human capital, along with variations in formal and nonformal education, training, learning, knowledge, competencies, or having self-employed parents. For this reason, we still do not know how entrepreneur's experience, as a particular aspect of human capital, is related to venture performance. However, these studies can at least provide some clues about the direction of the relationship. In particular, the study by Unger et al. (2011) found that the relationship between human capital and venture performance was positive and significant, though the overall effect size was relatively small. In contrast, Crook et al. (2011) found a strong positive association between human capital and venture performance. Since, in both of these studies, entrepreneur's prior experience was used as one of the indicator of human capital, their results could suggest that prior experience may indeed positively relate to venture performance. Therefore, we hypothesize that:

H1: The entrepreneur's experience is positively related to venture performance.

Determinants of the relationship between entrepreneur's experience and venture performance

Since the application of human capital theory to entrepreneurship research, researchers have tested the relationship between experience and venture performance in a variety of contexts. In particular, they have used different definitions and operationalizations of experience and performance, different industries, countries, and different firms in terms of age, size, and management composition. Unsurprisingly, this level of variation has produced different results and led to serious problems in integrating the findings. A number of scholars began appealing for a systematic examination of how these determinants shape the relationship between experience and venture performance (e.g., Cooper et al., 1994; Reuber & Fischer, 1999). Despite some efforts to examine the relationship between different types of experiences and venture performance in different contexts, results on the determinants are mixed, and findings on the limits of this relationship have yet to be integrated in the literature. It is not possible to focus on all possible determinants in a single study, so we have limited our scope to those that have been shown to influence the relationship between experience and venture performance significantly.

Type of experience

The notion that inconclusive findings about the relationship between experience and venture performance are caused by the differences in experience measures across studies was proposed more than twenty-five years ago (Cooper & Gimeno-Gascon, 1992; Reuber & Fischer, 1994). Despite such a long history, only a limited number of studies have systematically compared the effect of different types of experience on venture performance. Some of them have produced mixed results about the relationship between different types of experience and venture performance (e.g., Dyke et al., 1992; Lerner et al., 1997; Kalleberg & Leicht, 1991; Davidsson & Honig, 2003; Matsuda & Matsuo, 2017; Carbonara, Tran, & Santarelli, 2019; Dencker & Gruber, 2015; Gottschalk, Greene, & Müller, 2017). Since these studies differ in the type of experience measured, method for measuring venture performance and type of industry investigated, it is very difficult to draw any conclusions as to how different types of experience relate to venture performance or which are more or less important for venture performance.

Only one particular suggestion systematically occurs in both theoretical and empirical literature. From a theoretical point of view, the key factor for venture performance seems to be industrial experience. One possible reason for this is that, unlike other types of experience, industry experience not only involves generating knowledge about the internal organizational processes but, most importantly, helps entrepreneurs to obtain a clearer, deeper, more organized and structured view of their venture environment and the position of their venture in the industry and market. This knowledge includes better reactions to changing business conditions, better ability to plan and anticipate developments (Kor & Misangyi, 2008), length of time required to create a venture (Capelleras, Greene, Kantis, & Rabetino, 2010), the ability to identify early adopters who are willing to buy and try new products (Droge, Stanko, & Pollitte, 2010), unique knowledge about specific customer demands as well as knowledge about products, technologies, suppliers, and competitors (Helfat & Lieberman, 2002), familiarity with new technologies in industry (Roberts & Berry, 1985), faster access to the resources required for building a new venture (Cooper et al., 1994), knowledge of successful market-entry strategies (Cassar, 2014), knowledge of specific industry policies (Cimerova, 2012) and cost control (Marino & De Noble, 1997),

better understanding of market segments (Delmar & Shane, 2003), and participation in various social networks in a particular industry (Stam & Elfring, 2008). Acquiring this type of knowledge is a very time-consuming and costly process and, as Gimeno et al. (1997) have pointed out, it is hard to obtain without personal experience of industry.

When considering the available empirical evidence, a number of studies support the notion that industry experience does indeed play a key role in relation to venture performance (e.g., Eisenhardt & Schoonhoven, 1990; Lerner & Almor, 2002; Chandler & Lyon, 2009; Zheng, 2012; Seghers, Manigart, & Vanacker, 2012), even when compared with other types of experience. For instance, in a study by Jo and Lee (1996), industry experience had a positive moderate association with venture performance, while managerial and start-up experience had a negative relationship. Zhao et al. (2013), Cimerova (2012), Spanjer and von Witteloostuijn (2017), and Shu and Simmons (2018) similarly found that industry experience had the strongest association with venture performance when compared with other types of experience. Finally, in their meta-analytic study, Peake and Marshall (2011) found that industry experience had the strongest impact on the probability of obtaining a positive estimate for the relationship between experience and venture performance. Therefore, we hypothesize that:

H2: Industry experience has the strongest relationship with venture performance out of all the types of entrepreneur's experience.

Although the literature suggests that, of all the types of experience, industrial experience matters most for venture performance, it is difficult to differentiate further the effects of other types of experience. Despite the considerable amount of scientific knowledge on entrepreneurship, we still do not have a conclusive picture of how other types of experience relate to venture performance. There are a few empirical studies on this topic but their results are mixed, some suggest managerial experience is important (Carbonara et al., 2019; Dencker & Gruber, 2015; Gottschalk et al., 2017), while others highlight the significance of start-up experience (Miloud, Aspelund, & Cabrol, 2012) or functional experience (Li & Zhang, 2007). Consequently, the literature lacks any theoretical explanations of how different types of experience might relate to venture performance. This hampers our ability to even theoretically discuss and argue whether one particular type of experience has a stronger or weaker relationship with performance than other types. As a result, hypothesizing about how we might rank the strength of the relationship of different types of experience is somewhat speculative. Since our aim is to provide the first initial investigation of this issue, we formulate the following research question (RQ):

RQ1: How do different types of entrepreneur's experience relate to venture performance?

Type of venture performance

The lack of consistency in the findings on the relationship between experience and venture performance may be caused not only by the type of experience measured but also by how venture performance is operationalized (Cooper et al., 1994). Besides financial indicators, a wide range of performance measures can be used, like sales, growth, profit, size, or survival of a venture (see Van Looy & Shafagatova, 2016).

Unfortunately, compared to the research examining the effect of different types of experience, the research on different performance measures is even patchier. For instance, the relationship between industrial experience and venture size varies markedly from negative (Garcés-Galdeano et al., 2017), non-significant (Boeker, 1997; Dahl & Reichstein, 2007; Dencker & Gruber, 2015) to positive (Spanjer & Witteloostuijn, 2017; Gimmon & Levie, 2010; Cimerova, 2012; Eisenhardt & Schoonhoven, 1990). Similarly, this type of experience had a negative (Naldi & Davidsson, 2014), non-significant (Shrader & Siegel, 2007; Li & Zhang, 2007; Debrulle, Maes, & Ramboer, 2014; Matsuda & Matsuo, 2017), and positive association (Cimerova, 2012) with venture profitability.

Unfortunately, studies examining more than one performance measure in relation to experience have not clarified the matter (e.g., Kalleberg & Leicht, 1991; Jo & Lee, 1996; Pena, 2004; Muse, Rutherford, Oswald, & Raymond, 2005; Shrader & Siegel, 2007; Yang, Zimmerman, & Jiang, 2011; Naldi & Davidsson, 2014; Neville, Orser, Riding, & Jung, 2014; Zona, 2016; Shu & Simmons, 2018). For instance, Chandler and Hanks (1998) found entrepreneurial experience had a non-significant relationship with growth, but a positive moderate relationship with sales. By contrast, Hmieleski and Baron (2009) and Neville et al. (2014) found both relationships were non-significant.

Importantly, there are no theoretical explanations in the literature for how the prior experience may differ in its relationships with different types of performance. Although the meta-analysis by Unger et al. (2011) showed that human capital had the strongest relationship with size, followed by growth and profitability performance, it could be speculative to expect the same results with regard to experience. Therefore, we formulate the following research question (RQ):

RQ2: How does the entrepreneur's experience relate to different types of venture performance?

Age of the venture

Previous research supports the notion that experience matters more for the performance of younger ventures (e.g., Davidsson & Honig, 2003) and the effect of prior experience on venture performance declines as the venture ages. For instance, Delmar and Shane (2006) examined the effect of start-up and industry experience on the performance of new ventures and found that having a higher level of prior start-up experience was advantageous mainly in the early stages of a new business. As the ventures aged, experience had a declining effect on venture performance.

There are several reasons for this phenomenon. First, as suggested by Stinchcombe (1965), prior experience helps the entrepreneur to cope with liabilities of newness. In fact, it has been shown that experience-based knowledge is more helpful in coping with the liabilities of newness than knowledge gained through education (Cope & Watts, 2000; Shane, 2003).

Second, experienced entrepreneurs are able to reach important developmental milestones more quickly and with fewer resources. These milestones include hiring employees, having contract suppliers, or making sales by implementing adaptive sales strategies. This allows them to overcome the barriers and obstacles of venture development more easily (Starr & Bygrave, 1991; Forbes, 2005; Capelleras & Greene, 2008).

Third, there is a considerable difference in founders' impact on the entrepreneurial processes of young and old ventures. When a new venture is founded, the only assets it possesses come mainly from its founder's human capital (Bhide, 2000). Consequently, founder's experience dramatically affects the way in which a venture controls its resources and performs on the market (Aldrich & Martinez, 2001). Figuratively speaking, the founder's human capital determines where the new venture begins on its learning curve. As Delmar and Shane (2006, p. 225) suggest, "ventures founded by more experienced entrepreneurs begin their lives further up the learning curve because the human capital that their founders provide is more valuable to the performance of the new ventures than the human capital of inexperienced founders". However, as ventures age, the responsibilities and work tasks become more complex and they are therefore divided among venture employees. Consequently, the founders' involvement in the entrepreneurial process reduces, and so the performance of older ventures is less affected by their human capital attributes. Therefore, we hypothesize that:

H3: The relationship between entrepreneur's experience and venture performance is stronger for younger ventures than for older ventures.

Team vs. individual experience

The studies suggest that venture performance differs depending on whether the venture is managed by an individual entrepreneur or an entrepreneurial team. Specifically, the literature shows that entrepreneurial teams have a significant positive impact on venture performance (Cooper & Bruno, 1977; Cooper & Daily, 1997; Kamm, Shuman, Seeger, & Nurick, 1990; Jackson, 1992; Watson, Ponthieu, & Critelli, 1995; Hambrick, Cho, & Chen, 1996). By contrast, ventures managed by solo entrepreneurs have been shown to have lower levels of survivability, i.e. were more likely to fail in their entrepreneurial activities than those managed by entrepreneurial teams (Kamm et al., 1990; Watson et al., 1995).

In addition, there seems to be a positive relationship between the size of the founding team and venture performance (e.g., Sine, Mitsuhashi & Kirsch, 2006; Eisenhardt & Schoonhoven, 1996; Baron, Hannan & Burton, 1999). Perhaps the best support for these findings is provided by a meta-analysis by Jin et al. (2016) which shows that entrepreneurial team size had a significant positive effect on venture performance, suggesting that use of knowledge acquired through experience and having a greater number of top executives in the entrepreneurial team can foster entrepreneurial success.

There are several reasons for the better performance by entrepreneurial teams over individual entrepreneurs. First and most importantly, entrepreneurial teams wield greater human capital, which is important for coping with a complex and uncertain entrepreneurial environment (Kozlowski & Bell, 2003). Compared with an individual, entrepreneurial teams possess more knowledge of the industry environment, markets, and suppliers, which has a positive effect on

venture success (Delmar & Shane, 2003; 2006). Involving more people in the entrepreneurial process results in greater heterogeneity and diversity of the team's experience and more varied specializations among the team members, which leads to improved decision making (Colombo, Croce & Murtinu, 2014; Kerr & Tindale, 2004; Reynolds & White, 1997; Schutjens & Wever, 2000). Compared with an individual, entrepreneurial teams are better at processing information and executing more tasks simultaneously (Eisenhardt & Schoonhoven, 1990; Haleblan & Finkelstein, 1993).

Second, compared to individual entrepreneurs, entrepreneurial teams possess more financial resources that are critical to venture survival and performance (Cooper et al., 1994). As Aldrich and Martinez (2001) suggest, limited financial resources put ventures at risk during the early months and years of funding. Also, compared to individual entrepreneurs, entrepreneurial teams have better chances of obtaining external financial resources (Kamm et al., 1990). Therefore, we hypothesize that:

H4: The relationship between entrepreneur's experience and venture performance is stronger for entrepreneurial teams than for individuals.

Composition of managerial team

Besides the size of the entrepreneurial team, another important aspect that significantly contributes to the success of the business is the composition of the managerial team. The entrepreneurship literature suggests that the delegation of managerial power from owner to top executives increases the risk that top executives and agents will free-ride or shirk, threatening the survival and performance of the venture (Ross, 1973; Jensen & Meckling, 1976; Meyer & Zucker, 1989). As managers are naturally interested in maximizing their own compensation, this may lead to discrepancies between the top executives' interests and the owners' interests, i.e. the principal-agent conflict, which can lead to weaker venture performance (Panda & Leepsa, 2017).

The research in this field supports the idea that ventures managed by their owners perform better (Fahlenbrach, 2009; Jayaraman, Khorana, Nelling & Covin, 2000; Nelson, 2003). Lerong (2008) found that ventures with founder CEOs were associated with a higher venture performance and increased chance of survival than those with professional CEOs. Moreover, when the post of CEO was combined with that of chairperson, it was shown that including the founder in the management composition had even greater benefits for venture performance.

The reason for these effects lies in the higher motivation of founders to apply their human capital in the entrepreneurial process. As Lerong (2008) outlined, they have extrinsic as well as intrinsic motivations for doing so. First, founders most often own more of their venture's equity than professional CEOs, which creates stronger economic links between them and their ventures. Second, in addition to this extrinsic motivation, founders possess several specific intrinsic attributes that professional CEOs do not. They exhibit a greater need for achievement and possess a stronger psychological attachment and commitment to their ventures (Arthurs & Busenitz, 2003). Consequently, they are more willing to use their human capital in the entrepreneurial process. In contrast to founders, the effect of top executives' experience on venture performance should be weaker because professional CEOs lack this intrinsic motivation, despite having a substantial amount of prior experience. Therefore, we hypothesize that:

H5: The experience of founder CEOs is associated with higher venture performance compared to the experience of non-founder CEOs.

METHODOLOGY

Literature search

In order to identify the relevant studies, we conducted multiple manual and computerized searches. First, we used the electronic databases for all the available years (EBSCO, PsychINFO, Google and Google scholar, Science Direct). In this search, variations of keywords were used so each search covered three basic areas: experience (*experience, industry experience, managerial experience, start-up experience, entrepreneurial experience, supervising experience*), performance (*growth, sales, employees, ROA, ROE, ROI, ROS, profit, income, assets, success, firm size*), and venture (*start-up, entrepreneur,*

business owner, small business, small firm, venture). When a relevant study was found in a database, we used the tool that displays similar studies to check for any relevant studies that had not been detected.

Second, there are numerous studies addressing various economic areas, which use experience and venture performance as control variables. Since these studies often use different keywords in their titles and abstracts, we manually reviewed the results of all the studies published in the most relevant journals relating to entrepreneurship, namely: Journal of Business Venturing, Small Business Economy, Entrepreneurship Theory and Practice, Journal of Small Business Management, Academy of Management Journal and Administrative Science Quarterly.

Third, we used Google scholar to search for all relevant papers that were not included in the above-mentioned databases or journals. In order to check for the publication bias by comparing the observed effects of published and unpublished studies, we also searched for non-published studies, theses, dissertations and reports at this stage.

Fourth, we examined the references of all the relevant studies to find previously unidentified papers and we tried to contact all the authors whose papers were not available to download asking for a copy of their study or the data.

Selection and exclusion criteria

Our search produced a total of 521 studies. Titles, abstracts and full texts of these studies were reviewed to determine whether they are eligible to be included in the meta-analysis. In order to evaluate the eligibility of these studies, we applied the following set of inclusion criteria. First, the studies had to be both empirical and quantitative. Therefore, we excluded qualitative studies, theoretical studies, case studies, and financial reports. Second, studies had to investigate the relationship between experience and venture performance. Therefore, we excluded all the irrelevant studies on different topics that did not provide indicators of both experience and venture performance. Third, studies had to report the data required for performing a correlation meta-analysis, i.e. at least one correlation coefficient for the relationship between any type of experience and venture performance. Thus, all the studies using regression approach (e.g., multiple linear regression analysis), comparison, or experimental approach (e.g., mean comparison analysis), were excluded. We did not set any criteria for time of publication or country. We included both published and unpublished studies (e.g., masters or dissertation theses, working papers, preprints). Finally, we checked whether there was any overlap between the datasets in the studies, and on that basis, excluded studies by Beckman and Burton (2008), Lerner et al. (1997), Lerner and Haber (2001), and Hmieleski and Baron (2009).

After the eligibility screening, we ended up with a total number of 85 independent samples from 80 studies that met the inclusion criteria. Of all the studies included in our meta-analysis, only ten primary studies overlapped with those in the meta-analysis by Unger et al. (2011) and six in Crook et al.'s (2011) study. The description of each study included in our meta-analysis is shown in Table 1. The primary studies that overlap with Unger et al.'s (2011) study are marked with an asterisk (*) and those overlapping with Crook et al.'s (2011) study are marked with the number sign (#).

Table 1. Studies included in meta-analysis

Authors (year)	Type of experience	Performance indicator/s	Country of origin	Venture age	Sample size	Correlation coefficients
Arthurs et al. (2009)	start-up	size, profitability	USA	2.02	313	-0.14; -0.02
Batjargal et al. (2013)	managerial	size, profitability	China, Russia, France, USA	4.47	637	-0.03
Beckman et al. (2007)	managerial, start-up	size	USA	ns	161	-0.05; 0.09
Boeker (1997)	industry	size, growth	USA	ns	67	0.05; 0.06
Boeker & Wiltbank (2005)	industry	growth	USA	4.6	86	0.11; 0.13
Cao & Im (2018)	entrepreneurial	size	USA	0.549	1211	0.31; 0.38
Capelleras et al. (2010)	industry, entrepreneurial	growth	Argentina, Brazil, Chile, Peru	7.21	647	0.08; 0.01
Carbonara et al. (2019)	industry, working, managerial	size	Vietnam	45.39	18850	0.04 to 0.21
#Carpenter et al. (2001)	functional	size, profitability	International	ns	245	0.02 to 0.27
Cimerova (2012)	industry	size, profitability	USA	ns	14483	-0.10 to 0.19
Colombelli (2015)	entrepreneurial	size	EU	10	486	-0.02

Authors (year)	Type of experience	Performance indicator/s	Country of origin	Venture age	Sample size	Correlation coefficients
Dahl & Reichstein (2007)	industry, start-up	size	Denmark	ns	1246	0.05 to 0.24
Dalziel (2008)	start-up	profitability	Canada	21.58	52	0.09
Dana et al. (2016)	functional	size	Italy	ns	100	-0.12; 0.09
*Davidsson & Honig (2003)	managerial, start-up	size, profitability	Sweden	ns	379	-0.01 to 0.14
Debrulle et al. (2014)	industry	profitability	Belgium	ns	66	0.01
Dencker & Gruber (2015)	industry, entrepreneurial	size	Germany	ns	451	0.02 to 0.15
DeTienne & Cardon (2012)	entrepreneurial	size	ns	6.52	189	0.21
Dyke et al. (1992) computer services	managerial, start-up, entrepreneurial	size, profitability, growth	USA	6.23	103	-0.12 to 0.70
Dyke et al. (1992) food manufacturing	managerial, start-up, entrepreneurial	size, profitability, growth	USA	9.7	62	-0.16 to 0.68
Dyke et al. (1992) food retail	managerial, start-up, entrepreneurial	size, profitability, growth	USA	12.37	73	-0.17 to 0.09
Dyke et al. (1992) food wholesale	managerial, start-up, entrepreneurial	size, profitability, growth	USA	9.97	71	-0.12 to 0.77
Dyke et al. (1992) furniture manufacturing	managerial, start-up, entrepreneurial	size, profitability, growth	USA	8.78	77	-0.20 to 0.15
Eggers & Song (2014)	entrepreneurial	size, profitability, growth	China	12.1	219	-0.07; -0.08
Eisenhardt & Schoonhoven (1990)	industry	size	USA	ns	66	0.24
Garcés-Galdeano et al. (2017)	industry	size	Spain	24.28	823	-0.02; -0.05
*Gimeno et al. (1997)	managerial, functional, entrepreneurial	size	USA	ns	1457	-0.08 to 0.18
Gimmon & Levie (2010)	industry, managerial	size	Israel	7.51	193	0.15; 0.03
Gottschalk et al. (2017)	industry, managerial	size	Germany	< 8 years	7400	0.07; 0.12
*#Haber & Reichel (2007)	start-up	size, growth	Israel	ns	305	-0.06 to -0.02
Hayton (2005)	industry	size	USA	3.41	237	-0.06
He & Wang (2009)	managerial	size	USA	19.9	546	-0.06; 0.04
Herrmann & Datta (2006)	functional, entrepreneurial	size, profitability, growth	USA	ns	380	-0.08 to 0.39
#Hmieleski & Baron (2009)	entrepreneurial	size, growth	USA	5.74	201	0.00; 0.06
*Chandler & Hanks (1998)	entrepreneurial	size, growth	USA	3.52	102	-0.03; 0.33
#Chandler & Lyon (2009)	industry	growth	USA	ns	124	0.18
Iversen et al. (2016)	working, entrepreneurial	profitability	Denmark	ns	26116	0.08; 0.24
Jo & Lee (1996)	industry, managerial, start-up, functional, entrepreneurial	profitability, growth	South Korea	ns	48	-0.56 to 0.51
Kallenberg & Leicht (1991) men	industry, entrepreneurial	size	USA	13.19	878	-0.01 to 0.17
Kallenberg & Leicht (1991) women	industry, entrepreneurial	size	USA	10.55	261	0.02 to 0.19
Kazanjian & Rao (1999)	functional	size, growth	USA	6.72	71	-0.22; -0.08
Khayesi et al. (2014)	functional	size	Uganda	5.41	242	0.10; 0.17
Kiss et al. (2017)	international	size	France, Spain, Italy	ns	3280	-0.12
*Kundu & Katz (2003)	international	size	India	ns	47	-0.08
Laskovaia et al. (2017)	work	size	Global	2.33	3411	0.01
*Lee et al. (2001)	industry	size	Korea	4.59	143	0.06; 0.18

Authors (year)	Type of experience	Performance indicator/s	Country of origin	Venture age	Sample size	Correlation coefficients
*Lerner & Almor (2002)	industry	size	Israel	ns	220	0.24
Li & Zhang (2007)	industry, functional	size, profitability	China	4.83	184	0.09 to 0.34
Marino & De Noble (1997)	industry	size, growth	USA	5.8	28	0.01; 0.16
Matsuda & Matsuo (2017)	industry, managerial	profitability	Japan	ns	1307	0.10
McGee et al. (1995)	industry, functional	size, growth	USA	ns	210	-0.13 to 0.16
Miloud et al. (2012)	industry, managerial, start-up	size	France	15.46	102	0.11 to 0.15
Morgan et al. (2018)	managerial	size	Canada	ns	9977	-0.03 to 0.23
*Muse et al. (2005)	managerial	size, profitability, growth	USA	15.31	4637	-0.07 to 0.26
Nadkarni & Herrmann (2010)	managerial	size, profitability	India	8.57	195	-0.20; 0.19
Naldi & Davidsson (2014)	industry, managerial	size, profitability	Sweden	35.76	138	-0.23 to 0.15
Neville et al. (2014)	entrepreneurial	size, growth	Canada	3.3	2145	-0.03 to 0.15
Nuscheler et al. (2019)	start-up, industry	growth	USA	3.39	374	-0.04; 0.02
Oe & Mitsuhashi (2013)	industry, start-up	size	USA	ns	382	-0.01 to 0.03
Pascal et al. (2017)	managerial	size	Global	ns	353	0.17
*Pena (2004)	managerial, entrepreneurial	growth	Spain	5	114	-0.21 to 0.17
Pennings et al. (1998)	industry	size	Netherlands	1.81	1851	0.08
Rauch & Rijdsdijk (2013)	industry, managerial, entrepreneurial	growth	Germany	2.29	93	0.01
Reuber & Fischer (1997)	functional	size	Canada	11.16	49	0.44
Robb & Watson (2012)	entrepreneurial	size, profitability	USA	ns	4016	-0.01; 0.00
Seghers et al. (2012)	industry	size	Belgium	ns	103	0.13
Shi et al. (2018)	managerial	size, profitability	USA	7.16	1500	-0.06 to -0.01
*#Shrader & Siegel (2007)	industry, start-up, functional	profitability, growth	USA	ns	198	-0.10 to 0.25
Shu & Simmons (2018)	industry, start-up	size	USA	ns	3529	-0.03 to 0.14
Soriano & Castrogiovanni (2012)	industry	Size, profitability	Spain, Austria, Germany, France	ns	2713	0.02; 0.39
Spanjer & von Witteloostuijn (2017)	industry, entrepreneurial	size	USA	ns	2120	0.01 to 0.26
Stam & Elfring (2008)	industry, start-up, managerial	size, growth	Netherlands	ns	87	0.12; 0.21
Stone and Tudor (2005)	managerial, functional	profitability	USA	ns	58	-0.28 to 0.26
Toft-Kehler et al. (2014)	managerial, entrepreneurial	size	Sweden	ns	65390	0.08; 0.14
Uy et al. (2013)	start-up	size	Philippines	3.86	156	0.06
Wasserman (2003)	managerial	size	USA	ns	202	0.01; 0.05
Weng & Lin (2014)	industry	size, profitability	USA	2.6	558	0.01; 0.04
#West & Noel (2009)	start-up	size	ns	4.77	83	-0.04; 0.19
Westhead & Cowling (1995)	managerial, entrepreneurial	size	UK	6.4	67	-0.24; 0.09
Yamakawa et al. (2013)	industry	size	Japan	6.47	203	-0.03
Yang et al. (2011)	managerial	size	USA	7.12	237	-0.01; 0.03
Zhao et al. (2013)	industry, start-up, functional	profitability	USA	ns	372	0.22 to 0.37
Zheng (2012)	industry	growth	China	ns	98	0.11
Zheng et al. (2016)	industry	profitability	USA	ns	344	0.08

Authors (year)	Type of experience	Performance indicator/s	Country of origin	Venture age	Sample size	Correlation coefficients
Zona (2016)	managerial	size, profitability, growth	Italy	45.48	104	-0.05 to 0.07

Note: ns – not specified; * – studies that overlap with Unger et al. (2011); # – studies that overlap with Crook et al. (2011). The “Correlation coefficient” column shows the correlation coefficients reported in the included primary studies. If the primary study reports three or more coefficients, we indicate the range in which these coefficients fall.

Variable coding procedures

Table 2 displays the operationalizations, coding, and frequencies of experience in the primary studies contained in the present meta-analysis. After a careful examination of these operationalizations, we summed up and organized experience into five main categories. Table 2 shows that *Managerial Experience* was the most investigated type of experience (used 81 times), followed by *Industry Experience* (used 59 times), and *Start-up Experience* (used 52 times).

Table 2. Frequencies and operationalizations of different types of experience used in the primary studies

Type of experience	N	Operationalizations
Managerial experience	81	Total years individual spent in management/executive 1/0 CEO's board experience in other firm CEO's tenure in company CEO's leadership experience 1/0 management experience
Industry experience	59	Total years individual spent in industry 1/0 industry experience
Start-up experience	52	Number of ventures founded 1/0 working in fast growing firm
Entrepreneurial experience	50	Total years individual spent in entrepreneurship Total years individual spent in self-employment
Functional experience	24	Experience in engineering Total years of production, marketing, and research development experience
International experience	15	Number of years of international experience 1/0 team's international experience
Working experience	7	Number of years in wage job 1/0 working as an employee before entering business

With regard to venture performance, we decided to use exactly the same operationalizations as in the study by Unger et al. (2011) in order to be able to compare our results with their findings. Thus, we divided venture performance into three groups: size, growth, and profitability. The categories and their frequencies are listed in Table 3. The most examined measure in the *Size* category was number of employees (used 68 times) followed by sales (used 53 times). In the *Profitability* category the most examined were ROA (used 24 times) and profit (used 22 times). In the *Growth* category, we found that growth in sales (used 37 times) was the most frequent indicator of venture growth. It is worth noting that we have identified some studies that use subjective self-assessment scales that capture entrepreneurs' beliefs about their firm's performance. However, we decided to focus our study on objective indicators of venture performance and therefore did not include these studies.

Table 3. Frequencies and operationalizations of different types of venture performance used in the primary studies

Type of venture performance	N
Size	
Number of employees	68
Sales volume	53
Assets	6
Earnings	6
Market valuation	4

Type of venture performance	N
Profitability	
ROA	24
Profit	22
Composite index: ROA, ROI, ROS average, ROA + ROE + profit margin	11
ROS	7
Return on employees	6
Stock market returns	2
Revenues	2
Growth	
Growth in sales	37
Growth in employees	13
Growth in assets	6
Growth in profit	3
Composite index: sales + profit, employee + revenue, growth of sales + profit + assets+ employees + market	2

Meta-analytic procedures

Primary and subgroup comparison analyses

The meta-analytic procedures were conducted using Comprehensive Meta-analysis software version 4. In the analyses, a random effect model was applied (Borenstein, Hedges, Higgins, & Rothstein, 2009), where the correlation coefficient was used as an indicator of effect size. In this type of analysis, the correlation coefficients are transformed into Fisher's Z value and then the results are reconverted back to correlations for display. Since both the dependent and independent variables were exact values that were not subject to measurement error, we did not correct for this possible statistical artefact. We computed the inverse variance-weighted mean correlation (r) and its 95% confidence intervals to investigate the statistical significance of the observed effects. The effect sizes are statistically significant when the 95% confidence intervals do not contain a zero value. Heterogeneity of results across studies was examined using Q-statistic. To quantify the heterogeneity, we examined the variance of the effect sizes across the population of studies (τ^2).

Based on the extant literature, we decided to examine the effect of five determinants of the relationship between entrepreneur's experience and venture performance, namely, type of experience, type of performance, venture age, size of managerial team, and composition of managerial team. Therefore, we calculated separate effect sizes for the subgroups and statistically tested the differences between these effect sizes. We used a Q-test, which is analogous to the main effect in analysis of variance test (ANOVA), and it indicates whether the categorical moderator explains the heterogeneity of correlations between observed groups. In order to examine the differences in effect sizes of specific pair of moderator groups, we calculated the z-statistic which is analogous to the t-test and it indicates whether the difference in effect sizes of two particular groups is statistically significant. For the venture age, our aim was to obtain results comparable to the prior findings in the literature. Therefore, we decided to follow the study by Unger et al. (2011) and created two groups – young ventures and old ventures. Studies that reported results for companies that had existed for fewer than 8 years were coded as young ventures, while those reporting results for companies that had existed for more than 8 years were coded as old ventures.

Publication bias

To measure publication bias, we wanted to compare the effect sizes of published studies and non-published studies. However, in our sample we had identified only two studies that had not been published (Cimerova, 2012; Batjargal et al., 2013). Consequently, we were unable to perform this comparison. Therefore, we decided to use a file drawer analysis (Rosenthal, 1979). We performed Classic Fail – safe N test, which calculated the number of studies required to nullify the observed effect. As the criterion for the presence of publication bias, we used the 5k + 10 rule (Hedges & Olkin, 1985). If the fail safe N is less than 5 times the number of samples plus 10, it indicates that publication bias might be present and that it might affect the results.

It showed that in order to obtain insignificant effect size between entrepreneur’s experience and venture performance, 1339 more studies would have to be included in the analysis. This result suggested the absence of publication bias in our study. In Table 4, we report Classic Fail – safe N for every subgroup with 5k + 10 guideline to determine the presence of publication bias. We found that 7 of the 19 observed effect sizes (see Table 4, column 8 for distributions with “no” statement) failed to satisfy the 5k + 10 rule, indicating that one should be cautious when interpreting these particular results.

RESULTS

Primary analysis

The results of the overall effect size, based on 85 independent samples and 190,348 observations, supported Hypothesis 1 about the positive relationship between entrepreneurial experience and venture performance. As shown in Table 4, the effect size was positive $r = 0.086$; 95% CI [0.058, 0.114]. Since the confidence interval of the effect size did not contain a zero, the data suggest a significant positive relationship between entrepreneur’s experience and venture performance. The Q -value was 694.820 with a $p < 0.001$ and τ^2 was 0.012. Thus, it could be concluded that the studies were heterogeneous, i.e. they might differ in some key variables that could moderate the relationship between experience and venture performance.

Table 4. Results of meta-analysis on the relationship between experience and venture performance

Variable	K	N	r	95% CI	τ^2	SE	Fail safe N (> 5k + 10)	Q
Overall effect								
Fixed	85	190348	0.091	0.082 - 0.095	0.012	0.006	1339 (yes)	694.820***
Random	85	190348	0.086	0.058 - 0.114	0.012	0.006		
Type of experience								
Industrial	39	65349	0.105	0.065 - 0.144	0.012	0.007	3594 (yes)	
Start-up	20	70190	0.125	0.057 - 0.193	0.018	0.015	1304 (yes)	
Entrepreneurial	21	37380	0.053	-0.020 - 0.125	0.023	0.018	725 (yes)	
Managerial	35	131642	0.080	0.036 - 0.123	0.013	0.009	2967 (yes)	13.329*
Functional	8	1523	0.051	-0.100 - 0.200	0.039	0.028	9 (no)	
International	7	4299	0.142	-0.061 - 0.333	0.067	0.060	11 (no)	
Working	6	51190	0.098	0.060 - 0.134	0.002	0.002	423 (yes)	
Type of performance								
Profitability	29	34904	0.034	0.003 - 0.065	0.004	0.002	97 (no)	
Size	73	186879	0.087	0.057 - 0.116	0.012	0.007	1176 (yes)	24.006***
Growth	27	10487	0.023	-0.017 - 0.063	0.004	0.003	0 (no)	
Venture age								
Old	20	28881	0.051	-0.012 - 0.114	0.014	0.012	88 (no)	
Young	28	12872	0.067	0.022 - 0.112	0.010	0.005	248 (yes)	1.464
Size of managerial team								
Individual	67	181163	0.081	0.051 - 0.111	0.011	0.006	8276 (yes)	
Team	19	9430	0.111	0.021 - 0.199	0.034	0.020	228 (yes)	1.960
Composition of managerial team								
Entrepreneur	50	161485	0.101	0.071 - 0.131	0.008	0.005	8601 (yes)	
Entrepreneurial team	7	2506	0.165	0.068 - 0.259	0.013	0.011	115 (yes)	
CEO	17	19678	0.024	-0.042 - 0.089	0.014	0.011	0 (no)	9.250*
CEO team	13	7085	0.070	-0.034 - 0.172	0.029	0.023	7 (no)	

Note: K – number of samples; N – sample size, r – inverse variance-weighted mean correlation coefficients, 95% CI – 95% confidence interval, τ^2 – tau squared, SE – standard error, Q – statistic assessing the homogeneity of observed studies, * $p < 0.05$, *** $p < 0.001$.

Subgroup comparison analyses

Since the effect sizes in primary studies were shown to be heterogeneous, the type of experience, type of performance, venture age, size of a managerial team and composition of managerial team were examined as potential moderator variables. *Q*-statistic for venture age and size of managerial team were not significant (Table 4), suggesting that these variables did not moderate the relationship between experience and venture performance. As shown in Table 4, however, the *Q*-statistic for the type of experience, type of performance, and composition of managerial team was significant. Therefore, these three variables contributed to the heterogeneity, and were thus considered as moderator variables in the correlation between experience and venture performance. To examine the differences in effect sizes between the specific pairs of subgroups observed in the moderator variables, we performed *z*-tests subgroup comparison analyses (Table 5).

As shown in Table 4, the effect sizes and variances were different for different types of experience. However, the results of the *z*-test do not support Hypothesis 2 that industry experience has the strongest relationship with venture performance. Start-up experience had the strongest impact on venture performance, followed by industrial, working, and managerial experience. The other three types of experience showed a non-significant effect on venture performance (entrepreneurial, functional, international). The differences in effect sizes between the first three significant types of experience were non-significant (see Table 5).

We formulated a research question to find out how experience relates to different types of venture performance. We found that significant differences exist. In particular, the effect on growth was the weakest $r = 0.023$ and non-significant. The effect size of experience on venture profitability $r = 0.034$ was significant and it was also significantly higher compared to growth (see Table 5). In addition, experience had the strongest and most significant effect on venture size, $r = 0.087$.

We hypothesized that the relationship between entrepreneur's experience and venture performance is stronger for younger ventures than for older ventures (Hypothesis 3). The results, however, do not support this hypothesis. In particular, the effect of experience on venture performance was not significant in older ventures $r = 0.051$, but significant in younger ventures $r = 0.067$. The difference between these two effects was not statistically significant (Table 5).

Hypothesis 4 assumed that the relationship between entrepreneur's experience and venture performance is stronger for entrepreneurial teams than for individuals. This hypothesis was not supported. Size of managerial team alone was not important in the relationship between experience and venture performance. We found that the experience of individuals and teams alike significantly affected venture performance (Table 4) and the strengths of these effects did not significantly differ (Table 5).

Finally, we hypothesized that the experience of founder CEOs is associated with higher venture performance compared to the experience of non-founder CEOs (Hypothesis 5). For composition of managerial team, we found that CEO experience and CEO team experience did not significantly affect venture performance. However, for owner-inclusive management (see Table 4 for effect sizes of entrepreneur and entrepreneurial team), the effect of experience on venture performance was significant. The strongest effect of experience on venture performance was observed when the management consisted of a team of entrepreneurs who owned the venture, $r = 0.165$.

Table 5. The comparison of effect sizes between specific subgroups

Groups comparison	<i>z</i> -value	<i>p</i> -value
Type of experience		
Industrial experience - Start-up experience	-1.21	0.226
Industrial experience - Entrepreneurial experience	2.84	0.005
Industrial experience - Managerial experience	2.40	0.016
Industrial experience - Functional experience	1.94	0.052
Industrial experience - International experience	-0.59	0.552
Industrial experience - Working experience	1.23	0.218
Start-up experience - Entrepreneurial experience	3.17	0.002
Start-up experience - Managerial experience	2.67	0.008
Start-up experience - Functional experience	2.39	0.017
Start-up experience - International experience	-0.26	0.793
Start-up experience - Working experience	1.88	0.060

Groups comparison	z-value	p-value
Type of experience		
Entrepreneurial experience - Managerial experience	-0.28	0.778
Entrepreneurial experience - Functional experience	0.01	0.991
Entrepreneurial experience - International experience	-1.43	0.153
Entrepreneurial experience - Working experience	-2.54	0.011
Managerial experience - Functional experience	0.99	0.321
Managerial experience - International	-1.03	0.304
Managerial experience - Working experience	-2.01	0.044
Functional experience - International experience	-1.38	0.168
Functional experience - Working experience	-1.69	0.091
International - Working experience	0.74	0.461
Type of venture performance		
Profitability - Growth	2.74	0.006
Profitability - Size	-7.50	< 0.001
Growth - Size	-8.59	< 0.001
Venture age		
Old - Young	1.21	0.228
Size of managerial team		
Individual - Team	-1.40	0.162
Composition of managerial team		
CEO - Entrepreneur	-6.56	< 0.001
CEO - Entrepreneurial team	-9.18	< 0.001
CEO - Top management	-1.83	0.067
Entrepreneur - Entrepreneurial team	-5.30	< 0.001
Entrepreneur - CEO team	1.33	0.184
Entrepreneurial team - CEO team	3.74	< 0.001

DISCUSSION

Over the past few decades, entrepreneurship research has produced contradictory results on how the entrepreneur's experience shapes business outcomes. This meta-analysis combined the results of 80 studies in order to estimate the magnitude of the relationship between experience and venture performance. Moreover, we tested for the effect of five determinants of this relationship, namely, type of experience, type of performance, venture age, size of managerial team, and composition of managerial team.

The results of this meta-analysis show that there is a positive relationship between experience and venture performance. Therefore, in general, our study is in line with the longstanding notion that experience plays a crucial role in shaping business outcomes. However, the results regarding the strength of this relationship are far from convincing, especially when we consider the importance attached to it in both the research (Marvel et al., 2016) and practice (e.g., MacMillan et al., 1985; Babcock-Lumish, 2005; Maxwell, Jeffrey, & Lévesque, 2011; Landström, 1998; Stuart & Abetti, 1990; Zacharakis & Meyer, 2000). Given our findings, we think there are two reasons why we should be careful when assessing the potential effect of experience on venture performance.

First, although we found a significant relationship and therefore support for Hypothesis 1, the magnitude of the relationship between experience and venture performance was rather weak. This was consistent with the meta-analysis by Unger et al. (2011), which found the magnitude of the relationship between the more general concept of human capital and venture performance was slightly greater than in our study. Compared to the meta-analysis by Crook et al. (2011), the overall magnitude of the effect reported both in Unger et al. (2011) and in our study was significantly lower.

Second, the analysis of the determinants of the relationship between experience and venture performance showed that there were several questionable effect sizes that contained a zero value in their confidence intervals. In fact, of the five

determinants, four had at least one non-significant effect, suggesting the effect of experience on venture performance is highly sensitive to specific conditions. In the next sections, we describe these results in detail and discuss the contribution they make to both human capital theory and business practice.

Implications for theory and future research

The overall magnitude of the relationship between experience and venture performance

This meta-analysis contributes to the extant literature on human capital theory in several ways. Most importantly, to the best of our knowledge, this was the first attempt to examine systematically the overall magnitude of the relationship between entrepreneur's experience and venture performance. Previously, there had been two broader meta-analyses on the relationship between human capital and business outcomes (Crook et al., 2011; Unger et al., 2011), but in those studies experience was merged with other human capital factors, like knowledge, education, or competencies. In our study, we found a weak overall relationship between experience and venture performance, which suggests that the importance of experience for business outcomes is limited.

A possible explanation for the weak relationship between experience and venture performance may be provided by studies from the field of entrepreneurial learning. As Krueger (2007) stated, it is not experience *per se* but rather the specific knowledge, skills, and competencies gained from "learning by doing" that contribute to business success. In this sense, the well-established measures of experience, like the number of years in business or the number of ventures founded, may be insufficient to capture what knowledge the entrepreneur actually learned through experience. As Spanjer and von Witteloostuijn (2017) argued, entrepreneurs are not able to exploit fully every learning opportunity offered by a new experience. In order to learn from experiencing new activities or situations, they have to actively experiment and, most importantly, reflect on the outcomes of their decisions (Kolb, 1984). In the literature, there are a number of reasons as to why someone may not learn from experiencing new entrepreneurial events (see Frankish, Roberts, Coad, Spearsz, & Storey, 2012). In this sense, our findings suggest the need to focus more deeply on the process of entrepreneurial learning with regard to how both situational and personality characteristics shape the process, whereby knowledge is acquired through experience.

The determinants of the relationship between experience and venture performance

Our study also contributes to human capital theory by investigating the determinants of the relationship between experience and venture performance. Perhaps most importantly, we were able to combine previous inconclusive findings about the impact of different types of experience on different venture performance outcomes. Venture performance showed to have the strongest significant relationship with start-up experience, followed by industrial, working, and managerial experience. In comparison to these types of experience, international, functional, and entrepreneurial experience had a non-significant effect on venture performance.

These findings naturally raise questions about why start-up and industrial experience matter the most for venture performance and what might be the important specific knowledge entrepreneurs learn through this experience. Since the most relevant knowledge required for entrepreneurship is acquired through learning by doing (Cope & Watts, 2000; Pittaway & Cope, 2007), prior experience in creating and founding new ventures serves as the first principal instance for generating knowledge about "what it really means to be an entrepreneur," that is, what needs to be done to transform an identified business opportunity into a successful venture. In other words, start-up experience is helpful at the very early stages of entrepreneurial processes, since it helps entrepreneurs to identify and set up business opportunities with better prospects (Ucbasaran et al., 2009). Fundamentally, the start-up experience is directly related to the phenomenon of serial entrepreneurship, as it is mostly operationalized in the literature as a number of ventures founded. As Zhang (2011) notes, serial entrepreneurs with rich start-up experience are able to raise more venture capital and complete the early stages of development much faster, which gives them a significant advantage over novice entrepreneurs. Moreover, the extant literature showed that entrepreneurs with start-up experience possess richer, clearer, and more focused cognitive frameworks, which helps them to notice relationships between seemingly independent events or trends, like shifts in markets or changes in government policies. Moreover, they are also more aware of possible dangers and risks associated with business creation (Baron & Ensley 2006) and show a better ability to select the right industry and better market timing skills (Gompers et al., 2010). On the other hand, entrepreneurs without start-up experience tend to focus on newness and

the perceived superiority of the products or services they propose. This so-called “cognitive dazzle” causes them not to see many of the important business and financial factors that significantly affect venture performance (Baron & Ensley, 2006).

Moreover, it seems that, at the early stages of a venture, industrial experience can support the benefits of start-up experience to a large degree (Bosma, van Praag, Thurik & Wit, 2004). In the literature, there is a wide consensus that understanding the industry environment is significant to venture performance (e.g., Jo & Lee, 1996; Cimerova, 2012; Zhao et al., 2013; Spanjer & von Witteloostuijn, 2017; Shu & Simmons, 2018). In general, industry experience increases the entrepreneur’s knowledge of industry trends, current technologies, and manufacturing processes, as does information about other businesses in the same area (Landier & Thesmar, 2009). Consequently, entrepreneurs with industry experience are better able to evaluate their own prospects (Chandler, 1996) and new business opportunities (Dimov, 2010). Moreover, they gain knowledge about proper pricing, cost structure, the value chain and the profitability of different products on different markets (Brudel, Preisendorfer, & Ziegler, 1992). This knowledge may significantly reduce entrepreneurial uncertainty and lead to more sophisticated business strategies resulting in better performance for starting ventures. Together with our results, these findings suggest that having knowledge generated from both industrial and start-up experience could be most beneficial to venture performance, because they support one another, multiplying their effects.

Besides investigating the effect of different types of experience, we examined how experience, in general, is related to different types of venture performance. Using a broad construct of human capital, the only study that so far has tried to integrate the findings in this field is that by Unger et al. (2011). Our findings differed from their meta-analysis. In our study, the largest effect size was found for size of venture, followed by profitability. Interestingly, the effect of experience on growth was non-significant. This finding was somewhat surprising and differed from Unger et al.’s (2011) study. In their study, human capital mostly affected size of a venture, followed by growth and profitability, while all three effects were significant.

Consistent with our hypothesis, we found that the effect size of younger ventures was stronger than that of older ventures (Delmar & Shane, 2006). However, a surprising finding was that the effect of experience on venture performance in older ventures was not significant. Comparing our results with the meta-analysis by Unger et al. (2011), we found that the magnitude of the effect of experience in older ventures was very similar to that in their study. This could suggest that the effect of human capital for older ventures found in their study can mainly be attributed to experience, while the contribution of other attributes was limited. By contrast, for younger ventures, Unger et al. (2011) found that human capital had an approximately two times larger effect than the effect of experience in our study. This indicates that, for younger ventures, all human capital attributes are critically important for venture performance. Besides prior experience, entrepreneurs gain advantage by using their knowledge and competencies from previous training or formal and informal education. Unfortunately, there is still very little information in the existing literature on how human capital attributes affect the performance of younger and older ventures. Therefore, further investigation is required to see whether our interpretations are correct.

Lastly, we integrated the findings from the investigation of the effect of size and composition of managerial team on the relationship between experience and venture performance. This investigation resulted in two main findings. First, although the effect size of team experience on venture performance was stronger than the individual’s experience, the difference was not significant. This finding is not in line with the extant literature suggesting that compared to individuals, entrepreneurial teams are able to utilize their broader experience resulting in a better venture performance or survivability (e.g., Eisenhardt & Schoonhoven, 1990; Haleblian & Finkelstein, 1993; Kozlowski & Bell, 2003; Delmar & Shane, 2003; 2006; Jin et al., 2016; Kamm et al., 1990; Watson et al., 1995).

Second, rather than size of managerial team, our findings suggest that involvement of the venture owner in the management is more important. Our findings are in line with the idea that owner involvement in the management of a venture significantly affects the relationship between experience and venture performance (Fahlenbrach, 2009; Jayaraman et al., 2000; Nelson, 2003; Lerong, 2008). We found support for this at both the individual and group level. Owner experience had a larger effect size than CEO experience did and the owner-inclusive entrepreneurial teams had a larger effect size on venture performance than did teams consisting only of professional CEOs. These findings suggest that separating ownership from control may result in a weaker venture performance, simply because managers do not always work for the benefit of the owners and therefore do not utilize their experience such that the venture performs better (Panda & Leepsa, 2017).

Implications for practice

This meta-analysis has several implications for entrepreneurial practice. First, our results suggest that investors and venture capitalists should be very careful when considering the entrepreneur's prior experience in assessing a venture proposal. More specifically, they should reconsider the weight they currently attach to the entrepreneur's prior experience as an assessment criterion. As we stated before, it is common business practice for investors and venture capitalists to consider the entrepreneur's prior experience to be one of the most important criteria for making investment decisions (e.g., MacMillan et al., 1985, Babcock-Lumish, 2005; Maxwell et al., 2011; Landström, 1998; Stuart & Abetti, 1990; Zacharakis & Meyer, 2000). Our findings suggest that the contribution of prior experience to venture performance is limited.

Second, our findings suggest that investor practitioners may find it helpful to assess entrepreneurs' experience within a broader context, taking account of the types of experience the entrepreneur possesses. Investors and venture capitalists should be very careful when considering entrepreneurs' international, functional, and entrepreneurial experience. Since these had a non-significant effect on venture performance, they may have little, if any, benefit for venture performance. In general, having experience of founding a venture or of a particular industry seems to provide more value than experience of doing business internationally, or being in business for many years. Another important aspect that investors and venture capitalists should take into account is the size and composition of the entrepreneurial team and the extent to which the venture proposal reflects the different types of experience the team members possess. In general, our results support previous findings that, by drawing on their experience, a larger number of individuals in the entrepreneurial team may be better at fostering entrepreneurial success than the individual entrepreneur is (Jin et al., 2016). Additionally, whether the owner is a member of the venture's executive is important for venture performance. Our results suggest that owners' experience matters much more for venture performance than the experience of professional CEOs does (Lerong, 2008). Therefore, when making their assessments, practitioners should take into account the size of the entrepreneurial team as well as whether the owner of the venture plans to be part of the venture executive.

Study limitations

Naturally, our study has some limitations. The first limitation of this meta-analysis is the small number of studies and samples in some of the subgroup comparison analyses. For instance, only a limited number of studies (8, 7, and 6 studies respectively) were used to study the effect of functional, international, and working experience on venture performance. The reason for this is that only a limited proportion of primary studies provide evidence of the bivariate relationship between experience and venture performance. In selecting eligible studies, we had to exclude many studies using multiple regression analyses simply because correlation coefficients were missing. Since analyses based on a limited number of samples can be susceptible to second-order sampling errors (see Hunter & Schmidt, 2004), some of our results based on a limited number of studies should be interpreted with caution.

The second limitation concerns the investigation of the effect of size of managerial team on the relationship between experience and venture performance. Although we found that the effect sizes of experience on performance varied for the four types of management, these results should be interpreted cautiously because we lacked knowledge about the size of the entrepreneurial teams and the number of owners in the ventures investigated. For instance, we found that the experience of managerial teams that included the venture owner had the largest effect size on venture performance. However, we lacked information on the number of owners, how the owners were included in these teams, and the structure of the teams. Without this information, we were not able to discuss the optimal number of team members or to what extent team structure affects how the prior experience of team members is utilized in relation to better venture performance. In this sense, our findings are more exploratory in nature and should be viewed as a first initial attempt to integrate this area of research. Since these aspects may significantly shape a venture's outcomes (Panda & Leepsa, 2017), we recommend that future research should explore how various types of experience can be utilized under different types of venture management.

The third limitation of the study concerns the very limited number of unpublished studies in the meta-analysis. Surprisingly, we were able to identify only two such studies. This made it impossible to test for publication bias by comparing the effect sizes of the published and unpublished studies. Although the fail safe N-test did not indicate that publication bias was present in the overall relationship between experience and venture performance, some of the results from the partial subgroup comparison analyses should be interpreted with some caution.

CONCLUSION

This meta-analysis systematically summarized the inconclusive extant literature on the relationship between experience and venture performance. The inclusion of 80 primary studies allowed us to test the effect of five different determinants of this relationship, namely, type of experience, type of performance, venture age, size of managerial team, and composition of managerial team. The meta-analysis found that, overall, experience positively related to venture performance. However, the relationship was rather weak, considering the importance attributed to experience in both research and practice. Our results have practical implications for investors and venture capitalists, suggesting that they should be cautious in considering the prior experience of entrepreneurs when evaluating business proposals. Since the relationship between experience and venture performance has been shown to depend on multiple determinants, investors should evaluate entrepreneurs' prior experience in a much broader context, taking into account other important aspects such as the age of the firm or the size and composition of the management team.

Our findings on the determinants of the relationship between experience and venture performance contribute to human capital theory. Synthesizing previous meta-analytic findings (Unger et al., 2011; Crook et al., 2011; Peake & Marshall, 2011) with our results helps to learn not only about the importance of human capital for venture performance, but also about its limitations and constraints. Despite some limitations, such as the limited number of included studies, our study may encourage other researchers to investigate further possible determinants of the relationship between experience and venture performance. Since it is the actions and decisions of entrepreneurs that significantly influence the success of firms, future studies should strive to understand more fully how and under what circumstances certain experiences are incorporated into the behavior of entrepreneurs and, thus indirectly determine their success.

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Authorship contribution statement

Matúš Grežo: Data Curation, Formal Analysis, Investigation, Funding Acquisition, Methodology, Resources, Supervision, Validation, Project Administration, Writing - Original Draft, Writing – Review & Editing. **Róbert Hanák:** Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Software, Writing – Review & Editing.

Conflicts of interest

The authors declare no conflict of interest.

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Entrepreneurial orientation and SME export performance: Unveiling the mediating roles of innovation capability and international networking accessibility in the brass industry

Nuryakin¹ 

Abstract

PURPOSE: This paper answered the research gap on entrepreneurial orientation with a sample of small and medium-sized enterprises' (SMEs) export performance and the mediating role of innovation capability and international networking accessibility that has not been tested in previous research. This study also tested the effect of entrepreneurial orientation on SMEs' export performance in the global market. The mediating role of international networking accessibility and innovation capability on SMEs' export performance also became another focus of this study. **METHODOLOGY:** This paper implemented a quantitative approach with 282 owners or managers of the SMEs brass industry cluster in Boyolali, Indonesia, who were examined using purposive sampling. **FINDINGS:** The findings of this study revealed that entrepreneurial orientation did not significantly affect SMEs' export performance but did significantly affect innovation capability and international networking accessibility. Another empirical test found that innovation capability had significantly affected SMEs' export performance and the international networking accessibility. International networking accessibility also significantly affected the performance of export SMEs. This study also found an important mediating role of international network accessibility and innovation capability in the relationship between entrepreneurial orientation and SMEs' export performance. **IMPLICATIONS:** This study contributes to research investigating the effect of entrepreneurial orientation on performance by conducting in-depth studies on innovation capabilities and international networking accessibility. Many studies have tested the mediating role of innovation capability and international networking accessibility. The practical implication of this study is that it can help managers or owners of SMEs better understand and find optimal solutions through enhancing innovation capability and international networking accessibility, which can be instilled in the characteristics of SME owners or managers to improve performance. **ORIGINALITY AND VALUE:** The results of this study indicate the mediating role of innovation capability and accessibility of international networking on SMEs' export performance. Therefore, the main contribution of the study is to determine the mediating role of innovation capability and international network accessibility in the relationship between entrepreneurial orientation and performance by integrating the theoretical perspective of the resource-based view (RBV).

Keywords: entrepreneurial orientation, SME export performance, innovation capability, international networking accessibility, brass industry, Indonesia, resource-based view, RBV

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INTRODUCTION

Small and medium-sized enterprises (SMEs) can speed up response to a changing environment and increase economic growth (Pedauga, Sáez, & Delgado-Márquez, 2022; Van Song et al., 2022). SMEs are also driving economic growth, job creation, and regional growth. Studies have found that SMEs could support economic activity by two-thirds of the decline in unemployment due to environmental uncertainty and 43% of income (Pedauga, et al., 2022). The brass crafts industry is one of many SMEs in Indonesia. The products from small and medium industrial centers in Boyolali Regency, Central Java, can penetrate the export market (Export market, 2023). 53% of the products from copper and brass artisans are distributed on the global market in France, Australia, Malaysia, and the United States. The rest is for local markets such as Jakarta, Surabaya, Bali, Yogyakarta, Bandung, and Semarang. This potential has been developed for quality and innovation through product design to have competitiveness at the international level. Products from the center include indoor and outdoor decorative lamps, wall hangings, calligraphy, tables, domes, sinks, bathtubs, and sculptures. SMEs must have strong entrepreneurial characteristics to compete with similar products from other countries. Entrepreneurial orientation will be studied in depth in this study.

Other studies showed a lack of consistency in determining SMEs success in achieving performance. Some researchers stated that the success of SMEs is influenced by individual characteristics such as entrepreneurial attitudes, business planning, and innovativeness (Grabowski & Stawasz, 2023; Kohtamäki, 2008), networking and innovation capabilities (Farida & Nuryakin, 2021), and external factors such as support for international market access (Urban & Sefalafala, 2015). However, the available evidence explains that entrepreneurs as owners will determine a business's success (Aljanabi & Noor, 2015).

Entrepreneurial orientation (EO) is an approach organizations take through business processes, including proactiveness, competitive aggressiveness, autonomy, innovativeness, and risk-taking in achieving entrepreneurial activities (Akbar, Khan, Wadood, & Bon, 2020). Several studies showed that organizations with entrepreneurial orientation characteristics could achieve success in performance (Su, Xie, & Li, 2011; Urban & Mothusiwa, 2014; Zhang & Zhang, 2012). Entrepreneurial orientation is also important for business processes in reaching international markets (Wach, 2015). It is closely related to cycles, practices, and dynamic capabilities of organizations in utilizing resources and responding to the environment (Kropp, Lindsay, & Shoham, 2006; Tkacz, Agirre-Aramburu, & Lizartza-Martin, 2023), rapid economic changes (Pratono & Mahmood, 2015), and technological adaptation, especially in new organizations (Su et al., 2011). Lumkins and Dess (1996) conceptualized entrepreneurial orientation as a combination of risk-taking courage, proactiveness, independence, creativity, and serious strength.

Business ventures oriented to the global market require courage in taking risks, being proactive and creative in behavior, and innovative attitudes in emerging economic conditions and technological innovation (Arabeche et al., 2022; Piwowar-Sulej & Podsiadły, 2022). Various empirical studies revealed that entrepreneurial orientation influenced company performance positively. Previous researchers focusing on SMEs (Omerzel & Antoncic, 2008; Su et al., 2011; Teck, 2012; Urban & Mothusiwa, 2014) had studied the strong effect between entrepreneurial orientation and performance. This topic of this study still attracts SMEs attention, especially when the unit being analyzed is within SMEs oriented to the export market, where there seems to be only a few studies with that scope.

The conceptual framework and empirical research model for researching to develop the mediating role of innovation capability, entrepreneurial orientation, and international networking accessibility, and analyzing the significance of the effect between entrepreneurial orientation SMEs performance with a focus on the firm's resource-based perspective were examined (Barney, 1991). Therefore, this study will examine entrepreneurial orientation on SMEs export performance with two research questions (RQs):

RQ1: How does entrepreneurial orientation affect performance in export market-based SMEs?

RQ2: How can the mediating function of innovation capability and international networking accessibility enhance performance?

Although previous researchers have observed the influence of entrepreneurial orientation on performance, a research gap still exists where not much research on entrepreneurial orientation has been carried out on a sample of export-based SMEs and where the mediating role of innovation capability and international networking accessibility is tested. In addition, this research aims to determine the mediating role of innovation capability and international networking accessibility in the relationship between entrepreneurial orientation and SMEs' export performance by integrating the theoretical perspective of the resource-based view (RBV).

The paper starts with a literature review on resource-based view, entrepreneurial orientation, innovation capability, international networking accessibility, SMEs' export performance, and associated with the hypothesis development. Then, the traditional sections are presented as research methods, results, discussion, conclusion, and implications.

LITERATURE REVIEW

Resource-based view

A resource-based view (RBV) is used in resource-based strategic orientation, assuming that the company wants managerial efforts to achieve a sustainable competitive advantage (Barney, 2001). It measures the company's success in achieving competitive advantage derived from the characteristics of the company itself. This RBV theory asserts that a company will continue striving to maintain its competitive advantage by using useful and superior resources, which competing companies cannot imitate (Barney, 1991). Company resources are all the tangible and intangible assets linked to relatively permanent companies. This view is often used in understanding strategic marketing problems, and it was originally based on several previous works of industrial economists. This concept has grown and been popular in strategic management literature since the mid-1980s.

According to Javidan (1998), company resources comprise capacity, talent, skill, and core competence. These intangible resource factors determine the success of the company's performance. These factors come from the internal aspects of the company as a source of internal strength as the maximum limit in achieving organizational goals. Meanwhile, Hunt and Morgan (1996) argued that RBV theory addresses corporate diversity issues. The theory sees the company as a combination of heterogeneous and imperfect resources, so the resource-based theory is the basis for the competency perspective of the company.

This study focuses on research analysis of the internal capabilities of organizations consisting of entrepreneurial orientation, innovation capabilities, and accessibility of international networks in improving SMEs, focusing on the export market. Therefore, the efforts made by SMEs to compete and achieve the character of innovation capability, entrepreneurial orientation, and the accessibility of international networks were tested in this study. The development of SME strategies based on internal resources was also examined depending on the organization's internal conditions, and the company was seen as having a series of capabilities and resources. To optimize performance, SMEs must learn to combine their capabilities with other companies.

Entrepreneurial orientation

Miller (1983) originally popularized entrepreneurial orientation. This concept focuses on an entrepreneurial firm's characteristics as a company that conducts market innovation on products, the characteristics of courage in risk-taking businesses, and proactive innovation to barrier of competitors. The three characteristics of entrepreneurial companies are then considered an entrepreneurial orientation, referring to the practices, processes, and decision-making activities leading to the latest players. He also categorized entrepreneurship into three types of companies, namely simple firms, planning firms, and organic firms. Furthermore, entrepreneurship is related integrally to environmental variables, structure, strategy, and leaders' personalities. These relationships involve systems and logic from one type of company to another.

Lumpkin and Dess (2001) included entrepreneurial orientation's two dimensions: the tendency to act autonomously and aggressively to competitors. Furthermore, entrepreneurship has been applied at several levels, such as individual, group, and organizational. Entrepreneurial orientation refers to a new company's processes, decision-making activities, and practices. In other words, entrepreneurial orientation includes the key players' intentions and actions, who function in a dynamic generative process that is shown to create new ventures.

Wiklund (1999) emphasized that entrepreneurial orientation is based on the company where proactive actions, innovation, and risk-taking by companies can be affected by several actors inside and outside the company, so that these actions are inherent in entrepreneurship in a management framework. Entrepreneurial orientation is associated with increased organizational performance because the relationship assumes that entrepreneurial-oriented companies have a first-mover advantage and tend to benefit from market opportunities.

Innovation capability

Innovation capability can optimize innovation activities through information technology (Aljanabi & Noor, 2015), new ideas, and taking advantage of opportunities (Keskin, 2006). Innovation capability is also the company's capacity to absorb knowledge in achieving innovative performance by suggesting new services or products in the system or process (Aljanabi & Noor, 2015; Kilic, 2015). Organizations need to acquire the ability to continuously innovate by incorporating their ideas into novelty and bringing that value through business networks (Konsti-Laakso, Pihkala, Kraus, & Management, 2012a; Phuong et al., 2022; Yeşil, Koska, & Büyükbeşe, 2013). Innovation capabilities include processes and outcomes that create value-added products and critical factors in the era of digital technology (Florek-Paszowska et al., 2021; Yousaf et al., 2022).

Kaszowska-Mojsa (2020) found that corporate strategic innovation has helped accelerate the company's innovation process and collaboration in innovation activities to encourage organizational growth. The study measured the innovation capability of four indicators from the capability dimensions to do the product innovation process. Process innovation capability refers to strategies for rebuilding innovation and company activities in product creation. Innovation capability improves the company's processes and performance because it updates its activities and market achievements (Ahmed, Ibrahim, & Hasaballah, 2017).

International networking accessibility

Network access in Jian and Wang (2013) originally came from the resource-based view from internal companies as the major support in the strategic management publications. Company competencies and resources are all the company's processes, capabilities, assets, and knowledge (Barney, 1991). The competitive advantage and resource-based view assume that heterogeneous firms in their control over these strategic resources are essential assets. Enterprise network accessibility enhances relationships with business networks and handles certain network relationships (Jian & Wang, 2013). Network competence can manage and grow relationships with other organizations, key suppliers, and customers to deal effectively in those relationships, which are core company competencies that influence the company's competitive strength and performance. Networking competence is a firm-specific ability to handle, utilize and exploit inter-firm relationships (Ritter, Wilkinson, & Johnston, 2002).

According to competitive advantage, managers must develop strategies to survive and outperform the global market's competition (Porter, 1980). If a corporation can support and promote competition within its industry, it must also possess the potential to produce exceptional corporate performance. Hormiga, Batista-Canino, and Sánchez-Medina (2011) studied relationships with suppliers, customers, informal networks, and reputation on company performance success. Furthermore, the results indicated that relationships with customers and relationships with suppliers correlated with the company's performance. A similar result was found by Borchert and Bruhn (2010), revealing that human and relational capital, team performance, and company team size impacted the company's goals as measured by company performance.

Taghieh, Taghieh, and Poorzamani (2013) discussed relational capital's role in firm performance. Intellectual and relational capital impacted the company's financial performance. Also, relational and intellectual capital affected the market value of the company. Meanwhile, in their study, GertHuman and Naude (2009) revealed a positive relationship between network capabilities, network competence, and company performance and network capabilities.

SMEs' export performance

Business success depends on the performance in the market position (Day & Wensley, 1988) during uncertain conditions (Rust et al., 2004). Overall business performance can be reflected in the company's financial and non-financial measures (Varadarajan & Clark, 1994). Performance is measured within the company to build the financial aspect and the market of achieving business success. Financial performance means financial measures, such as profit margin fit and returns on investment, while market business performance implies sales volume and market share (Farida & Nuryakin, 2021; Nuryakin, 2021). A company is supposed to pay attention to sales more than growth. A positive relationship exists between market share and measures of performance achievement as measured by ROI (Buzzell & Gale, 1987). Hooley et al. (2005), Srivastava, Shervani, and Fahey (1998) found similar findings. Furthermore, Hooley et al. (2005) stated that superior market business performance resulted in superior financial performance.

Obadia (2008) assessed the relationship between exporters and importers through a pattern of cooperation in terms of collaborative activities between two exchange partners. For example, joint activities develop strategies, achieve future goals, and improve performance, and collaboration includes information and commercial exchanges. Other studies saw cooperation as an outcome – a specific joint activity. Cambra-Fierro, Hart, Mur, and Redondo (2011) measured consumer satisfaction, customer loyalty, well-known brands, market share, and economic profit. In contrast, Acquaah (2012) described performance on productivity growth, profit growth, sales and revenue growth, ROA, and ROS.

HYPOTHESIS DEVELOPMENT

The impact of entrepreneurial orientation on SMEs' export performance

Entrepreneurial orientation plays a strategic role in achieving superior performance (Aljanabi & Noor, 2015; Lee & Lim, 2008; Zhang & Zhang, 2012). This study examined entrepreneurial orientation at the organizational level. An organization's process involves considering several internal and external elements (Wiklund, 1999).

Organizations can use a proactive approach, innovation, and enterprise risk-taking. Therefore, entrepreneurial orientation belongs to the management framework shown that organizations must develop an entrepreneurial orientation to perform better. Entrepreneurial orientation positively affects business performance (Nuryakin, 2021). In addition, the study explained that entrepreneurial orientation also influenced relational abilities and led to business improvement.

Madsen (2007) found that an organization's long-term link to business performance improvement, as gauged by marketing performance (sales growth) and financial performance, was favorable (profitability). The following hypothesis is developed through a thorough literature assessment and earlier studies.

H1: Entrepreneurial orientation influences SMEs' export performance positively.

The impact of entrepreneurial orientation on innovation capability

Wadood et al. (2022) found that entrepreneurial orientation influenced innovation. Meanwhile, Krauss and Michale (2005) explained that entrepreneurial orientation involves autonomous orientation, learning orientation, innovation orientation, competitive aggressiveness, risk-taking, achievement orientation, and proactively seeking opportunities and personal initiatives. Li, Huang, and Tsai (2009) explained that entrepreneurial orientation involves innovation, risk-taking, proactiveness, autonomy, and competitive aggressiveness.

Zhang and Zhang (2012) explored the influence of network capabilities on entrepreneurial orientation and business performance. The results showed that entrepreneurial orientation affected business performance and networking ability. According to Soininen et al. (2012), entrepreneurial orientation consists of innovativeness, proactiveness, and risk-taking. The following hypothesis is developed through a thorough literature assessment and earlier studies.

H2: Entrepreneurial orientation influences innovation capability positively.

The impact of entrepreneurial orientation on the accessibility of international networks

Arif et al. (2013) explained that entrepreneurial orientation involves being innovative, proactive, and taking risks. Lumpkin and Dess (1996) developed indicators of innovation orientation, risk orientation, proactive orientation, aggressive competition, and independence in entrepreneurial orientation.

Kajalo and Lindblom (2015) showed that entrepreneurial orientation is the basis for organizations to improve business performance through the strength of marketing capabilities in opening up rankings and creating value among companies in business networks. At the same time, Knight (2000) explained that entrepreneurial orientation can be realized in autonomy, innovation orientation, risk orientation, proactive orientation, and aggressive competition.

Ramachandran and Ramnarayan (1993) stated that one of the drivers of the company's creation and growth process is interpersonal networks. Networking makes companies strive to increase existing resources, so companies dare to take risks and be proactive in building networking capabilities. Network capability will enable the company to anticipate opportunities in the market and more quickly identify competitors' movements. Randmaa (2011) stated that companies

with a proactive nature seek to integrate the capabilities, behavior patterns, and skills possessed by partner companies by generating relationships between organizations. The following hypothesis is developed through a thorough literature assessment and earlier studies.

H3: Entrepreneurial orientation influences the accessibility of international networks positively.

The impact of innovation capability on international network accessibility

Tsai and Ghoshal (1998) examined the relationship between the relational, structural, and cognitive dimensions of social capital on patterns of resource exchange and product innovation within firms. Social interaction, a manifestation of social structural capital, and trust dimensions, a manifestation of the relational dimension, are significantly related to the resources exchange level, influencing product innovation in the company's network.

Lawson and O'Keefe (2006) described inter-organizational relationships as the process by which an organization builds long-term customer relationships so sellers and buyers work towards a set target. The following hypothesis is developed through a thorough literature assessment and earlier studies.

H4: Innovation capability influences the accessibility of international networking positively.

The impact of innovation capability on SMEs' export performance

Chang and Huang (2022) revealed that a positive global mindset affected relational skills and innovation capabilities, thereby increasing export performance. Market-oriented organizational resources and innovation capabilities are vital to building customer relationships (Milfelner, Gabrijan, & Snoj, 2008). Companies can innovate if their company is successful in utilizing creative ideas in products (Amabile et al., 1996). Khin, Ahmad, and Ramayah (2010) argued that the innovations created by the company provide various benefits, such as the ability to carry out new designs, functions, and features to improve performance.

Khan et al. (2022) showed that innovative capacity significantly impacts a company's agility and improves performance. Organizations need strong learning and innovation capabilities to gain a competitive advantage (Calantone, Cavusgil, & Zhao, 2002). Learning orientation influences company innovation, which in turn affects company performance. The following hypothesis is developed through a thorough literature assessment and earlier studies.

H5: Innovation capability influences SMEs' export performance positively.

The impact of international networking accessibility on SMEs' export performance

Singh and Garg (2008) examined export SMEs and found that SMEs faced many obstacles due to a lack of resources and innovative capabilities. SMEs need to develop strategies to keep their competitiveness. SMEs must build networks and supply chain provision as a process and achieve performance about the advantages of the best products in their industry (Gurau, 2004). Cao et al. (2022) found a relationship between the internationalization of networking and performance. In addition, social networks play an essential role in the relationship between internationalization and company performance.

Meanwhile, Chew, Yan, and Cheah (2008) concluded that core capabilities and competitive strategies affect the performance of SMEs. In adverse conditions, with global economic sanctions on the continuity of exports, it is important for organizations to proactively participate in trading activities on global markets (Le & Review, 2022). In their study, Farida and Nuryakin (2021) found that the ability of business networking positively affects innovation and business performance. Furthermore, relational ability can improve innovation and business performance.

Morgan and Hunt (1994) studied and developed the commitment-trust theory. It asserts that cooperation between interwoven organizations will be created if built based on relational commitment, mutual trust, and the desire to cooperate in business networks for the long term. Dependability, knowledge, and expectations significantly influence performance achievement (Troy et al., 2008). Zhou, Wu, and Luo (2007) also said that networking influenced the performance of SMEs to compete in the international market. Networks in international markets also affected financial and export performance.

Carvalho and Reis (2012) explored information technology's role in analyzing organizational views on creativity in business management. Furthermore, they found a relationship between companies in information technology in business

networks on company performance and the creation of innovative products in the market. The following hypothesis is developed through a thorough literature assessment and earlier studies.

H6: Accessibility of international networks influences SMEs' export performance positively.

This research empirically examined the important mediating role of innovation ability and access to international networks on the effect of entrepreneurial orientation on performance. Although entrepreneurial orientation has been widely studied in the scope of SME research, only a few have examined the mediating role of innovation ability and accessibility of international networks in improving SMEs' performance. This study contributes to the knowledge of resource-based view theory and explores how entrepreneurial orientation affects performance through the mediating role of innovation ability and accessibility of international rankings. Figure 1 shows an empirical research model, an in-depth literature review, and previous research.

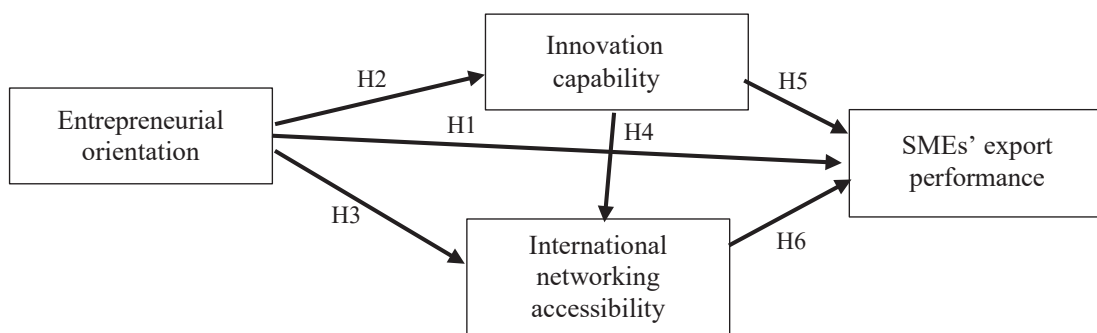


Figure 1. Empirical research model

RESEARCH METHODS

Research design and sample

This study implemented a quantitative approach in testing six hypotheses. Respondents in this study were collected through questionnaires distributed to 208 brass industry managers in Boyolali, Indonesia. However, only 184 samples were considered complete for data processing. The researcher used the purposive sampling method. The returned questionnaire with complete answers was tested further to predict the research construct.

This study used a Structural Equation Modeling (SEM) approach with the AMOS program in testing modern and research hypotheses. A quantitative approach to data analysis with Structural Equation Modelling in the AMOS 21 program was used for this study. Data analysis tested each indicator model and evaluated the parameters of goodness of fit (Anderson & Gerbing, 1988). This study also employed Maximum Likelihood Estimation (MLE). Multivariate normality requirements in SEM testing are needed to estimate structure coefficients (paths). MLE requires endogenous variables that are normally distributed (Hair, Babin, & Anderson, 2019). The measurement model implemented convergent validity to ensure the validity of indicators in measuring the variables being tested. The significance of the indicators assessed the suitability of the indicators in forming latent variables. Therefore, SEM analysis was carried out by testing the parameters of goodness of fit and the research hypothesis on the causal relationship in the model. SEM assumptions expected to be met include the Chi-Square value expected to be small, Probability \geq , $CMIN/DF \leq 2.00$, $GFI \geq 0.90$, $AGFI \geq 0.90$, $TLI \geq 0.95$, $CFI \geq 0.95$, $RMSEA \leq 0.08$ (Arbuckle, 2011).

The reason for choosing this region was that there is currently a cluster of brass industry SMEs that uses a production process with basic ingredients made from the local area. Second, regional economic growth experienced relatively good growth reflected through product sales in the brass industry cluster's export market. Third, the local government supported the brass industry cluster to encourage economic growth in the vicinity. This study empirically aims to prove the independent variable's impact on the dependent variable. The author collected data by distributing questionnaires to the research sample. The characteristics of the sample in this study are provided in Table 1.

Table 1. Respondents of the research sample

Sample characteristics	Number of sample	Percent
Gender		
Male	177	96.2%
Female	7	3.8 %
Age		
< 25	56	30.4%
26 - 30	27	14.7%
31 – 35	23	12.5%
36 – 40	30	16.3%
41 – 45	30	16.3%
> 45	18	9.8%
Education level		
Elementary	55	29.9%
Junior high school	52	28.3%
Senior high school	68	37%
Diploma	5	2.7%
Bachelor's degree	4	2.2%
Family background		
Entrepreneur	50	27.2%
Non-Entrepreneur	134	72.8%
Business operation (years)		
1 – 5	70	38%
6 – 10	50	27.2%
11 – 15	26	14.1%
16 – 20	36	19.6%
> 20	2	1.1%
Number of employees		
< 25	156	84.8%
26 – 50	18	9.8%
51 – 75	6	3.3%
76 – 100	4	2.2%
Market Coverage		
Asia	125	67.9%
Europe	43	23.4%
Middle East	16	8.7%

Variable and measurement of construct

This research used a quantitative research design. The quantitative research design tested the hypotheses and empirical research models. This study used a sample of SME brass industry clusters by identifying five relevant constructs: entrepreneurial orientation, innovation capability, accessibility of international networks, and SME performance. An in-depth literature review identified research variables. Furthermore, reliability and validity tests were carried out. Each construct of entrepreneurial orientation, innovation capability, international network accessibility, and SME performance was measured using a 7-point Likert scale (1 strongly disagree – 7 strongly agree). The endogenous constructs in this study are innovation capability, access to international networks, and export performance of SMEs. In contrast, the exogenous construct in this study is entrepreneurial orientation.

Entrepreneurial orientation is a process based on proactive action, innovation, and risk-taking by the company (Wiklund, 1999). Entrepreneurial orientation in this study was measured by four statement items: (1) Support for the discovery of new ideas, (2) Proactive in seeking new opportunities, (3) New technology in production, (4) Courage to take risks in new product launching.

Innovation capabilities are the organization's ability to optimize innovation activities through information technology (Aljanabi & Noor, 2015). Innovation capabilities in this study were measured by five statement items: (1) Ability to create new products, (2) Ability to respond to market demand quickly, (3) Ability to create products according to market demand, (4) Adaptation of technology in the production process and (5) Ability to create attractive product designs for the market.

Network access is a company-specific ability to handle, use, and utilize inter-company relationships (Ritter et al., 2002). Access to networks in this study was measured by four statement items: (1) Close relationships with international

networks, (2) Mutually beneficial relationships with buyers in international markets, (3) Mutually solutive relationships with relations in international markets, (4) Support relations in the international market in expanding the market.

Overall business performance can be reflected in the financial and non-financial measures of the company (Varadarajan & Clark, 1994). Export market performance was measured using four statement items: (1) Increase in profit, (2) Increase in total assets, (3) Increase in product sales, and (4) Growth in income.

RESULTS

Descriptive statistics and correlations

Table 2 describes descriptive statistics and matrix correlations on entrepreneurial orientation, innovation capability, international networking accessibility, and SMEs' export performance. Table 2 also describes the standard deviation, average value, and correlation matrix between research variables that support testing models for H1 to H6.

Table 2. Mean, standard deviation, and correlation of the construct

Construct	Mean	Std. Dev.	EO	IC	INA	SEP
Entrepreneurial orientation (EO)	4.772	0.769	1.000			
Innovation capabilities (IC)	4.723	0.848	0.369**	1.000		
International network access (INA)	4.563	0.886	0.291**	0.404**	1.000	
SMEs' export performance (SEP)	4.295	0.874	0.331**	0.514**	0.494**	1.000

Note: *p <0.05, **p<0.01.

Validity and reliability testing

This study tested validity using confirmatory factor analysis (CFA) testing, while reliability testing used construct reliability testing by looking at the Critical Ratio (CR) value. Further testing determined Construct Reliability (CR), Average Variance Extract (AVE), and Discriminant Validity (DV) values on each exogenous construct and endogenous construct. Validity and reliability testing was conducted by looking at the CR value for each construct.

The validity and reliability of each construct based on Table 3 reveals the construct of entrepreneurial orientation, innovation capability, international networking accessibility, and SME performance of more than 0.7, thus fulfilling the required criteria. While the test results on the average variance extract value showed a value of more than 0.5. The Discriminant Validity value of each construct revealed more than 0.7. Table 3 shows the calculations with the AMOS Program on validity and reliability.

Table 3. Scale item for measures

Construct	Items	Standardized factor loading	CR	AVE	DV
Entrepreneurial orientation	EO1	0.775	0.854	0.583	0.764
	EO2	0.713			
	EO3	0.716			
	EO4	0.643			
Innovation capability	IC1	0.747	0.918	0.559	0.748
	IC2	0.750			
	IC3	0.842			
	IC4	0.831			
	IC5	0.765			
International networking accessibility	INA1	0.728	0.881	0.553	0.744
	INA2	0.886			
	INA3	0.845			
	INA4	0.748			

Construct	Items	Standardized factor loading	CR	AVE	DV
SMEs' export performance	SEP1	0.731	0.881	0.549	0.741
	SEP2	0.933			
	SEP3	0.624			
	SEP4	0.913			

Note: AVE = average variance extracted; CR = construct reliability; DV = discriminant validity.

The reliability and validity of the four constructs, entrepreneurial orientation, innovation capability, international network accessibility, and SMEs' export performance, showed the loading factor value. The loading factor value of entrepreneurial orientation for items EO1, EO2, EO3 and EO4, respectively, are 0.775, 0.713, 0.716, and 0.643. The loading factor value of innovation capability for items IC1, IC2, IC3, IC4, and IC5, respectively, are 0.747, 0.750, 0.842, 0.831, and 0.765. The loading factor value of international networking accessibility for items INA1, INA2, INA3, and INA4, respectively, are 0.728, 0.886, 0.845 and 0.748. The loading factor value of SMEs' export performance for items SEP1, SEP2, SEP3, and SEP4, respectively, are 0.731, 0.933, 0.624, and 0.913.

The results of construct entrepreneurial orientation, innovation capability, international networking accessibility and SMEs' export performance show construct reliability with a value of more than 0.7. The average variance extracted value is more than 0.5, and discriminant validity is more than 0.7.

Table 3 concludes the validation testing on entrepreneurial orientation, innovation capability, international network accessibility, and SMEs' export performance. Hair et al. (1998) explained the required criteria, called the loading factor value of more than 0.6. Hence, the five constructs were valid.

Structural model

Figure 2 shows the model fit, estimating the path in the proposed model. Table 3 describes the results of individual tests on the significance of the relationship between variables and the standard coefficient of the path to be proposed in testing the hypothesized model. Based on the five hypotheses, all statistically significant relationships went in the expected direction, supporting H1 (impact of entrepreneurial orientation on SMEs' export performance), H2 (impact of entrepreneurial orientation on innovation capability), H3 (impact of entrepreneurial orientation on international network accessibility), H4 (impact of innovation capability on international network accessibility), H5 (impact of innovation capability on SMEs' export performance), H6 (impact of international network accessibility on SMEs' export performance).

Before AMOS, varimax rotation testing was carried out to check the validity of the construct model (Gerbing & Hamilton, 1996). Acceptable test criteria are loading factor > 0.60 and loadings are more than cross-loadings. All items are retained based on these criteria. The results of the factor analysis are in Table 4.

Table 4. Factor analysis in this research

Construct	Number of items	Number of factors	Accumulated percentage of explained variance
Entrepreneurial orientation	5	1	49.190
Innovation capability	5	1	70.191
International networking accessibility	4	1	73.101
SMEs' export performance	4	1	74.020

Hypotheses test

Structural Equation Modelling explains two categories: measurements in the research model and structural equation models. Table 2 describes the structural equation model. Overall, the measurement of the fit model on the structural equation modeling indicates a pretty good fit model value with TLI = 0.955, CFI = 0.963, GFI = 0.901, RMSEA = 0.056, AGFI = 0.866, as explained in Table 5. The Amos SEM test shows the goodness-of-fit value for the model in Table 5. The fit index in Table 5 indicates that the model fits the data well. Table 5 also shows the structural model in this study.

Table 5. Model fit test

	CMIN/DF	GFI	AGFI	NFI	CFI	RMSEA
Structure model	1.565	0.901	0.866	0.904	0.963	0.056
Recommended value	< 3	> 0.9	> 0.8	> 0.9	> 0.9	< 0.1

This research implemented a quantitative approach to data analysis with Structural Equation Modelling in the AMOS 21 program. Structural Equation Modelling explains two categories of analysis: measurements in the research model and structural equation models. Table 6 reveals the structural equation model to testing empirical research model:

Table 6. Hypothesis model testing

Interaction variables	Proposed effect	Coefficient	t value	Significant	Result
Entrepreneurial orientation – SMEs’ export performance	Positive	0.139	1.465	0.143	Rejected
Entrepreneurial orientation – innovation capabilities	Positive	0.497	4.719	0.000	Accepted
Entrepreneurial orientation – international networking accessibilities	Positive	0.222	2.087	0.037	Accepted
Innovation capabilities – SMEs’ export performance	Positive	0.309	3.551	0.000	Accepted
Innovation capabilities – international networking accessibilities	Positive	0.380	4.092	0.000	Accepted
International networking accessibilities – SMEs’ export performance	Positive	0.287	3.486	0.000	Accepted

Note: Significant at $p \leq 0.10$; if $(t) \geq 1.96$.

- The statistical testing on hypothesis 1 found a significance value of 0.143 and a path coefficient value of 1.465, indicating that entrepreneurial orientation had no significant impact on SMEs’ export performance. Thus, hypothesis 1 was rejected.
- The statistical testing on hypothesis 2 regarding the influence of entrepreneurial orientation on innovation capabilities found a significance value of 0.000 and a path coefficient value of 4.719, indicating that entrepreneurial orientation positively influenced innovation capabilities. Thus, hypothesis 2 was accepted.
- The statistical testing on hypothesis 3 found a significance value of 0.037 and a path coefficient value of 2.087, indicating that entrepreneurial orientation had a significant positive effect on international network access. Thus, hypothesis 3 was accepted.
- The statistical testing on hypothesis 4 examining the impact of innovation capabilities on SMEs’ export performance found a significance value of 0.000 and a path coefficient value of 3.551, indicating that innovation capabilities had a significant positive impact on SMEs’ export performance. Thus, hypothesis 4 was accepted.
- The statistical testing of hypothesis 5 examining the effect of innovation capabilities on international market network access found a significance value of 0.000 and a path coefficient value of 4.092, indicating that innovation capabilities had a significant positive effect on international market network access. Thus, hypothesis 5 was accepted.
- The statistical testing on hypothesis 6 found a significance value of 0.000 and a path coefficient value of 3.486, indicating that international network access had a significant positive effect on the export performance of SMEs. Thus, hypothesis 6 was accepted.

Figure 2 illustrates the model of the relationship between international networking accessibility, entrepreneurial orientation, innovation capabilities, and SMEs’ export performance.

Mediation role testing

The author tested the mediating effect of innovation capabilities and international networking accessibility through data processing results on the AMOS SEM path coefficient as studied (Baron & Kenny, 1986). The role of mediation was tested by seeing the significant relationship between independent and dependent variables:

- The findings explained that the direct relationship between entrepreneurial orientation and SMEs’ export performance was not statistically significant ($\beta=0.139$, $p=0.143$). Thus, Baron and Kenny’s (1986) test was not met.

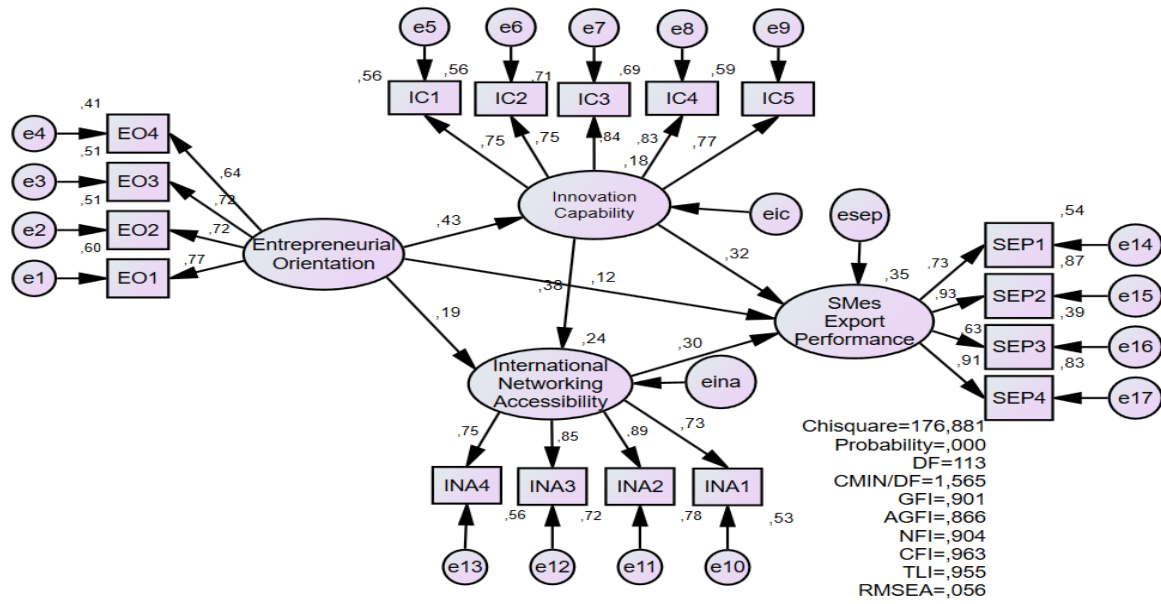


Figure 2. Full model

- The first mediating role of the indirect relationship of entrepreneurial orientation on SMEs' export performance through innovation capabilities was statistically significant ($\beta=0.309$, $p=0.000$) and ($\beta=0.497$, $p=0.000$). Thus, the first mediation test of Baron and Kenny (1986) was met. Innovation capabilities mediated the relationship between entrepreneurial orientation and SMEs' export performance.
- The mediating role of the two indirect relationships of entrepreneurial orientation on SMEs' export performance through international networking accessibility was statistically significant ($\beta=0.222$, $p=0.037$) and ($\beta=0.287$, $p=0.000$), so the second mediation test of Baron and Kenny (1986) was met. International networking accessibility mediated the relationship between SMEs' export performance and entrepreneurial orientation.
- The mediating role of the three indirect relationships of entrepreneurial orientation on SMEs' export performance through innovation capabilities and international networking accessibility were statistically significant with values ($\beta=0.287$, $p=0.000$) and ($\beta=0.222$, $p=0.037$). Thus, the third test of Baron and Kenny (1986) was met. International networking accessibility mediated the relationship between SMEs' export performance and entrepreneurial orientation.

DISCUSSION

Entrepreneurial orientation had no significant influence on SMEs' export performance. They found that entrepreneurial orientation supported SMEs' performance. This study also debated previous findings about entrepreneurial orientation affecting SMEs' export performance (Kalinic & Brouters, 2022). This study also did not align with the theory that business-oriented organizations will be characterized by innovative behavior, dare to take risks, and always trying to produce new products through proactive behavior to capture market opportunities (Covin & Slevin, 1989; Wiklund Shepherd, 2005). This study proved empirically that entrepreneurial orientation had no significant effect on the performance of SME exports. The SMEs selected for the sample in this study were export-oriented SMEs based on industrial clusters in one area where the interaction pattern built was based on social kinship and kinship. This interaction pattern did not fully demonstrate the three characteristics of entrepreneurial orientation: proactive, risk-taking, and innovativeness, so the findings were insignificant.

Entrepreneurial orientation had a significant influence on innovation capability. This finding differs from previous studies revealing that entrepreneurial orientation was positively related to innovation ability (Makhloufi et al., 2021). However, this study supported (Lee et al., 2019), explaining that entrepreneurial activity increased through a skilled and competitive workforce to provide business opportunities through innovative capacities.

Entrepreneurial orientation had a significant influence on the accessibility of international networks. Similarly, Ramachandran and Ramnarayan (1993) showed that one of the drivers of the process of creating and growing companies was to use corporate networks so that these networks increased organizational value (Kurniawan, et al., 2020). Also, companies with a proactive nature sought to integrate the capabilities, behavior patterns, and skills possessed by partner companies by generating relationships between organizations Randmaa (2011).

Innovation capability significantly affected the accessibility of international networks and SMEs' export performance. This finding is similar to previous studies concluding that the development of innovation capabilities would affect marketing capabilities and relational capital (Sulistyo & Siyamtinah, 2016). Companies willing to share information, share specific assets, and build business networks will create products in the global market (Konsti-Laakso, 2012). Landry, Amara, and Lamari (2002) also found that relational and network assets positively impacted increasing innovation.

The accessibility of international networks had a significant influence on SMEs' export performance which resembles where networks built with relational relationships became an important resource for organizations (Jian & Wang, 2013). Cao et al. (2022) highlighted the importance of social networks in international marketing. Luo et al. (2004) also found that relational resources such as customer relations and social capital determined performance. Sin et al. (2005) also revealed that the relational marketing orientation effectively improved performance.

CONCLUSION

This paper draws several conclusions based on a literature review and empirical studies. First, entrepreneurial orientation focused on export-based SMEs in this study did not significantly affect the performance of export-based SMEs. This study was conducted on 208 brass industry managers in Boyolali, Indonesia, and found that entrepreneurial orientation with the characteristics of innovation, risk-taking and proactivity had no significant effect on performance. Second, entrepreneurial orientation had a significant positive effect on innovation capabilities. Third, entrepreneurial orientation had a significant positive effect on international networking accessibilities. The four innovation capabilities significantly and positively affected SMEs' export performance. The five innovation capabilities had a significant positive effect on international networking accessibility. The six international networking accessibilities significantly and positively affected SMEs' export performance. These findings provide some interesting and important implications, theoretically and practically.

Theoretical implications

This study provides the following theoretical implications. First, this study contributes to addressing the research gap. It explains previous research investigating the determinants of the performance of export-based SMEs by exploring the relationship between entrepreneurial orientation through the mediating role of innovation capability and access to international networks. Previous researchers argued that there were inconsistencies in research findings on the effect of entrepreneurial orientation on performance so a mediating variable was needed to be able to improve performance through innovation capabilities (Konsti-Laakso et al., 2012; Phuong et al., 2022; Sulistyo & Siyamtinah, 2016) and access to international market networks (Kurniawan et al., 2020; Linehan & Scullion, 2008; Mu, 2013)

Second, this study contributes to research investigating the effect of entrepreneurial orientation on performance by conducting in-depth studies on innovation capabilities and access to international networks, in contrast to most previous studies, which only focused on the direct effect of entrepreneurial orientation on performance (Akbar et al., 2020; Hove & Vambe, 2014; Kalinic & Brouthers, 2022; Nuryakin, 2021; Semrau, Ambos, & Kraus, 2016; Wiklund & Shepherd, 2005).

Third, many studies have been on the mediating role of innovation capability and access to international networks. However, only a few have conducted studies on export SMEs, showing the importance of the characteristics of respondents and objects studied empirically. The results showed that the two constructs could improve performance, so SMEs need to adjust their strategy to increase sales of export products in international markets. In addition, with the development of technology, the use of the internet to access international networks needs attention for SMEs when entrepreneurial orientation does not directly affect export performance.

Practical implication

This study's results can guide export-based SMEs to optimize their innovation capabilities and benefit from their position of accessibility in international market networks to improve SMEs' export performance. Besides, the results can help owners or managers of SMEs better understand and find optimal solutions through increasing innovation capability and access to international networks to be instilled in the characteristics of SME actors in improving performance. An entrepreneurial orientation with the characteristics of support for the discovery of new ideas, proactive in seeking new opportunities, new technology in production, and courage to take risks in new product launching cannot directly affect improving export performance. Therefore, SMEs must gradually increase their innovation capabilities and expand access to international networks to achieve performance.

SMEs players must actively build innovation capabilities and access to a strong and high-quality international network and ensure frequent interaction with partners in international markets so that it will support increased product orders, market coverage and sales. Lastly, these findings also show that export-based SMEs need to consider other appropriate strategies to increase the number of their customers when companies have access to international market networks. Thus, companies can apply innovation capabilities and access to international networks.

Limitation and recommendation

The results of this study have some limitations. The next studies should consider adding other variables, including networking competence, relational capabilities, social capital, and competitive advantage, as a company strategy closely related to product sales performance in the export market. In addition, this study also has other limitations related to the level of this research, which cannot be generalized to other studies. Future researchers need to realize that the results of this study are limited to cluster-based industrial SME brass products where the products are marketed in only a few export areas and still focus on developing countries as export destinations. Therefore, it is necessary for future researchers to exercise caution in sampling research and extending findings that explain export performance in the scope of SMEs

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Authorship contribution statement

Nuryakin: Conceptualization, Formal Analysis, Investigation, Methodology, Validation, Visualization, Writing - Original Draft, Writing - Review & Editing.

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Relationship between knowledge transfer and sustainable innovation in interorganizational environments of small and medium-sized enterprises

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Abstract

PURPOSE: The trends promoted for the strengthening of capacities that allow the interaction and valuation of knowledge as an intangible asset, deserve a management based on its transfer as a basis that drives innovation. Based on this, the purpose of the study is to examine the relationships between knowledge transfer (KT) and sustainable innovation (SI) in interorganizational contexts of small and medium-sized companies. **METHODOLOGY:** A process was carried out through the application of a questionnaire addressed to managers and owners of 109 small and medium-sized companies of activity in management and the development of information and communication technologies in two regions of Colombia. To show the significant differences between the two selected populations, a non-parametric Mann-Whitney test for independent samples was applied. Likewise, an application of the K-means algorithm was used to group the variables into subsets. The study of the data was complemented with the multivariate technique and the principal components analysis (PCA) to validate the contrasting of the declared hypotheses. **FINDINGS:** The results determine that by means of the Mann-Whitney non-parametric test for independent samples there are significant differences between the two selected populations. Likewise, the positive correlation between the variables of knowledge transfer and innovation is confirmed, as well as designing the interactions and the flow of processes between the components that support the aforementioned variables from the theoretical and empirical approach, whose interaction capacity between them has to promote the innovative potential under sustainability principles in small and medium-sized enterprises. **IMPLICATIONS:** Based on the results of the research carried out, scenarios are promoted through which it is sought to strengthen the interorganizational management of small and medium-sized enterprises, minimizing the barriers that weaken their stability. As well as promoting new ways of valuing knowledge as an intangible asset that, when transferred, generates effects in innovation management as part of the strengthening and interorganizational sustainability of small and medium-sized enterprises. **ORIGINALITY AND VALUE:** It is based on the generation of value through the proposal of a design of a system of relations between the components that promote the transfer of knowledge and sustainable innovation. Its structure is based on empirical results that allowed defining five strategic stages that show the relationships between the components that promote interorganizational and competitive management of tangible and intangible assets available in small and medium-sized enterprises.

Keywords: knowledge transfer, sustainable innovation, interorganizational environments, knowledge management, Small and Medium-sized Enterprises, SMEs, intangible assets, Colombia

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INTRODUCTION

The socio-productive transformations and the advent of emerging markets in the global environment have promoted the renewal of capacities associated with knowledge and sustainable innovation in the environment of small and medium-sized enterprises. The relevance of these capabilities prevails in generating value and promoting new ways of strengthening interorganizational relationships, as well as reconfiguring resources and capabilities to adapt to new business dynamics (Centobelli, Cerchione, Maglietta & Oropallo, 2023; Teece, 2018). In this regard, knowledge as an intangible asset and the relevance of projecting its transfer are highlighted among capacities (Grant, 1996). Effective processes are required to promote both the production of the resource and its management (Nonaka & Takeuchi, 1999). Key aspects of business direction are the projection of the knowledge transfer (KT) that promotes the innovative potential and the changes towards interorganizational sustainability of companies.

Belderbos, Gilsing, Lokshin, Carree, and Fernández (2018) state that, despite its importance, there is still a limited understanding of how companies adapt their collaborative portfolio in innovation and R&D development, and which are the drivers of such adaptations. Meanwhile, the strengthening of interorganizational relations is considered as part of the strategy for production, appropriation, knowledge transfer and its development. Therefore, it is necessary to highlight the main types of knowledge: a) explicit; formal and structured, which can be shared; and b) tacit knowledge, conceived as experiential (Nonaka & Takeuchi, 1999). The latter is decisive for distinguishing the capabilities of human talent, as a way to put them into practice and the corresponding appropriation of those talents mediated through projects and programs for problem solving or new developments, which contribute to the dynamics in business environments.

Regarding the interorganizational and organizational environments represented by small and medium-sized enterprises (SMEs), it is determined that research on the subject is scarce or inconclusive despite the requirements on how to promote the stability of these companies, prioritizing innovation between other actions. Meanwhile, among the contributions of KT, new ways to strengthen the potential and human capacities of an efficient organization internally are considered (Ferraris, Giachino, Ciampi & Couturier, 2019), and from the outside, the projection on the socialization and social appropriation of knowledge to promote innovation in organizational environments (Liao & Wu, 2010).

Likewise, to generate advantages that promote sustainable innovation in addition to adopting culture, the use of environmentally friendly resources and ideation-creation through intangible assets knowledge are required. In this way, the consolidation of the so-called sustainable organizations is foreseen among the priorities. The effects of these allow transformations from interorganizational and organizational environments in small and medium-sized enterprises (SMEs). Above all, due to the belief that ecological-environmental policies and initiatives increase corporate success, only if they are implemented in all areas, with the confirmation and support of all partners (Shahzad, Qu, Rehman & Zafar, 2022). In the same order, recognizing the strategic importance of knowledge as a basis for innovation is associated with the cycle of its management for its accessibility. This is in addition to considering, among others, the social and economic factors associated with the dimensions of sustainability (Smuts & Van der Merwe, 2022). Regarding eco-innovation, from the interorganizational vision, the direction of SMEs has been strengthened through the use of green technologies, in addition to business relationships, which are decisive in service areas of scarcely consolidated companies (Fernando, Chiappetta Jabbour & Wah, 2019).

In this regard, research on the variables of KT is presented in a scarce or inconclusive manner despite requirements on how to promote the stability of these companies prioritizing sustainable innovation, among other actions. Although the greatest reference in research is developed on the factors that influence the decisions of companies linked to environmental, social, and governance (ESG) policy (Ahmad, Yaqub & Lee, 2023). Undoubtedly, promoting renewed ways of consolidating interorganizational capacities allows the generation of value and reconfiguration of resources to adapt to new business dynamics that project innovation (Centobelli et al., 2023; Teece 2018).

As for the contributions of the study, the design of the relationship system between the components that promote the transfer of knowledge and sustainable innovation is mentioned, whose practice from the context of SMEs contributes to boost business management. Likewise, alternatives are exposed to the components that must be the foundation of public and business policies that strengthen the potential for the transfer of knowledge and sustainable innovation. Added to the need to mitigate risks in the social and natural aspects of innovation activities, the strengthening of business capacities and resources is warranted (Teece, Pisano & Shuen, 1997), highlighting human, material, and technological resources (tangible and intangible).

Regarding the interorganizational capacity of SMEs, the ways of valuing the production of knowledge driven by business policies that strengthen their production and management and the transfer supported by methods, techniques, and technologies that guarantee their effectiveness in the business environment are mentioned associated with team management.

Given the trends on the importance of transforming and generating strategies that promote trends for the stability of SMEs, the objective focused on examining the relationships between knowledge transfer (KT) and sustainable innovation (SI) in interorganizational contexts of small and medium-sized companies in Colombia. These are characterized by development associate activities such as the management of equipment, computer programs, applications, networks and media, which allow the compilation, processing, storage, transmission of information such as voice, data, text, video, and images (Law on the Modernity of the Information and Communication Technologies Sector -ICT 2019 and Law that defines principles and concepts on the information society and the organization of Information and Communication Technologies -ICT, 2009).

The theoretical foundation was based on the review of the literature, in addition to the statement of the hypotheses. Followed by the application of the deductive method and the correlation technique, the structure of the article was developed, whose rigor is based on obtaining the data that support the analysis of results and the discussion is based on the correlation and contrasting of hypotheses. The conclusion explores the design and argumentation of the system of relationships between the components that promote the transfer of knowledge and innovation, conceived from the theoretical approach and the empirical study developed in two regions of Colombia, the Pacific: Santiago de Cali and the Atlantic: Barranquilla.

LITERATURE REVIEW

Knowledge transfer and approximation of the components that support it

KT is considered to be one of the processes that seeks to strengthen assets and renew interorganizational and organizational capabilities from the production of knowledge. Regarding the production and management of knowledge promoted since the 1990s, it is defined as a resource capable of capturing the diversity of phenomena and interdependence with natural and social approaches that determine socio-environmental changes (Lef, 1994). Thus, the generation of advantages that promote sustainable innovation through the use of environmentally friendly resources and intangible assets knowledge, is considered as part of the priorities for the so-called consolidation of sustainable organizations.

Undoubtedly, the valuation of intangible assets (knowledge) is considered part of the actions that should be defined to promote research and innovation (Cardoni, Zanin, Corazza & Paradisi, 2020). Among business assets, knowledge is based on theories and principles that contribute to understanding the origin of causes-effects based on logical reasoning of the origin of causes-effects that arise in environments. As an intangible asset, knowledge has a high tacit component, is stored and is the domain of people, making it scarcely tangible and unstructured for its transfer (Landry, Amara & Ouimet, 2007).

Given the above, the main components that support the transfer of knowledge are highlighted: a) production of knowledge, promoted according to the competencies and the role of human talent (Ferraris et al., 2019; Nonaka & Takeuchi, 1999); b) information technologies conceived as strategic mediation resources to transfer and guarantee the accessibility of knowledge in a global environment (Ode & Ayavoo, 2019; Beesley & Cooper, 2018; Mardani, Nikoosokhan, Moradi & Doustar, 2018; Castellano, Davidson & Khelladi, 2017; Lyu, Zhou & Zhang, 2016; Nonaka & Takeuchi, 1999); and c) knowledge management, for the adoption of techniques, procedures and systems (Nonaka & Takeuchi, 1999; Sytnik & Kravchenko, 2021). Its purpose guarantees both the registration of the knowledge produced: tacit knowledge and implicit knowledge, and is strengthened through the theory of capabilities and resources (Centobelli et al., 2023; Teece 2018; Lef, 1994). For effective adaptation in business environments, it is necessary to understand and define strategies to make these components viable.

Regarding management, it implies the mediation of information technologies. Resources become part of the guarantees about IT effectiveness in a global environment (Beesley & Cooper, 2018; Mardani, et al., 2018; Lyu et al., 2016); as well as valuing intangible assets (knowledge), and support to promote actions that project the capacity to enhance research and innovation (Cardoni et al., 2020). In addition, productive projection, which promotes greater economic stability, strengthens contributions to the entrepreneurial fabric of the regions. This economy is decisive for understanding the importance of the valuation and types of knowledge, as well as its effects on the dynamics of organizations (Foray & Lundvall, 1998). In turn,

the human factor is highlighted, as a strategic actor that promotes SMEs management. The interactions of the collaborators are associated with the culture of strategic and differentiating organizational practices that promote the so-called intelligent organizations (Paredes, 2011) and their effectiveness is based on collective learning, production, knowledge transfer, as the utility to promote innovation (Espinoza & Marín-González, 2019; Flórez & Lugo, 2019; Romera, 2016).

Knowledge transfer and sustainable innovation in interorganizational environments of SMEs

The practices of knowledge transfer and sustainable innovation in SMEs deserve to be made viable by defining the adoption of structured and integrated process flows and systems. For their dynamization, the design, the adoption of process flows, and structured systems are essential for the creation, socialization and use of knowledge that support decision-making (Nonaka & Takeuchi, 1999). From the perspective of systematizing relationships, the stages of creation-production, methods, measurement capacity and ways of transferring and socializing knowledge are prioritized, using information technologies (Nonaka & Takeuchi, 1999). In this regard, the interest of companies to promote new ways of innovating under the dimensions of the socio-economic and environmental dimensions (sustainability) that promote the projection of sustainable companies (Marín-González, Senior-Naveda, Narváez Castro, Inciarte González & Paredes Chacín, 2021; Yin, Ming & Zhang, 2020).

The effectiveness of these organizations is based on collective learning, the production of knowledge, transfer, and utility to promote innovation (Espinoza & Marín-González, 2019; Flórez & Lugo, 2019; Romera, 2016). However, for its verification, the creation-production stages, methods, measurement capacity and the ways of transferring and socializing knowledge through the optimal use of information technologies are considered within the framework of the relationship system (Nonaka & Takeuchi, 1999). The same reference is made to the interest of companies to promote renewed ways of innovating considering sustainability based on the framework of the 2030 agenda (WCED-World Commission on Environment and Development 1987), which is highlighted as part of the emphasis on innovation and its projection towards the consolidation of sustainable companies.

The ability to promote sustainable innovation in companies is recognized as something weakly achieved in management, and is little considered for business stability (Sytnik & Kravchenko, 2021), in addition to a low culture to value intangible resources such as knowledge to enable innovative practices. From this perspective, notable differences prevail between R+D collaboration from an interorganizational (universities and research institutes), vertical (buyer and supplier), and horizontal (competitor) vision (Belderbos et al., 2018). Relationships that are fundamental for the projection of SMEs based on the dynamics of sustainable innovation are also known as green innovation based on eco-friendly resources to consolidate a sustainable business (Guo, Cui, Sun & Zou, 2020).

In the same order, the mastery of information technologies, human capital differentiated by its abilities, and ways of reconfiguring competencies within organizations to respond to changes in the environment are mentioned (Teece et al., 1997). Followed by the raw material to innovate and generate distinctive characteristics that give way to competitiveness and socio-productive development based on knowledge and its usefulness (Ode & Ayavoo, 2019; Preikschas, Cabanelas, Rüdiger & Lampón, 2017). The interactions between the aforementioned components promote the effectiveness of knowledge management, through which its transfer enhances innovative development (Abu-Mahfouz, Halim, Bahkia, Alias & Tambi, 2023; Baker & Yusof, 2016; Vajjhala & Vucetic, 2013). Additionally, the incidence of ignorance about the global nature of technology, and the transfer of knowledge to the weaknesses or failure of well-established companies, is raised (Castellano et al., 2017).

What has been described is proposed to highlight the importance of developing skills and the ways to reconfigure the competencies of human talent within organizations, in order to respond to changes in the environment (Teece et al., 1997). This is in addition to achieving the effectiveness of the systematization and flow of knowledge, whose standards must be governed by metrics that determine the effective transfer of knowledge from an interorganizational perspective. Likewise, the human factor is considered as a strategic actor of its production, management and promoter in SMEs, which deserves to interact under the culture of strategic and differentiating organizational practices to promote the so-called intelligent organizations (Paredes, 2011).

Hypotheses development

For the contrasting of the hypotheses, the behavior of the variables was analyzed from the review of the literature and the results of the empirical study. Likewise, the interrelation capacity between the components that support the management

for the transfer of knowledge is highlighted; which is supported by the development of a process, whose measurement indices are linked to the production of knowledge, information technologies and knowledge management systems, techniques and processes (Nonaka & Takeuchi, 1999), see Figure 1, a graphical representation of the conceptual model.

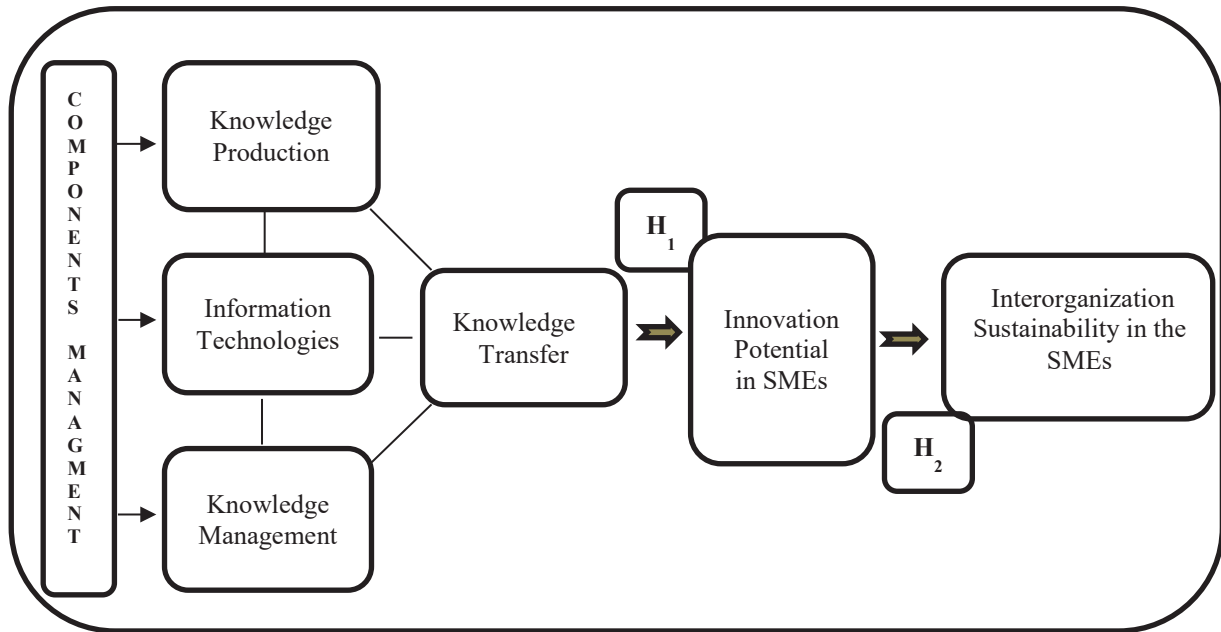


Figure 1. Graphic representation of the conceptual model

The relationship presented between the management components required for knowledge transfer supports the testing of the hypotheses.

H1: Knowledge transfer significantly affects sustainable innovation in small and medium-sized enterprises.

H2: The components that support the relationship system between KT and innovation potential strengthen the interorganizational sustainability of SMEs.

This is how the need to formalize the link between knowledge transfer and sustainable innovation in SMEs arises as one of the practices that merit knowledge about a structured system and the dynamics of the components for its management. Their systematization capacity provides for the interorganizational sustainability of SMEs, as represented in the model. In the function of which, the contrast between theory and practice are analyzed to determine their feasibility from the context of the SMEs under study, as well as from other related sectors. In this way, the effective transfer of knowledge as a basis for promoting sustainable innovation becomes part of the business challenges (Yin et al., 2020; Belderbos et al., 2018), from a vision focused on interorganizational transformation directed towards than business sustainability (Guo et al., 2020; Yin et al., 2020).

MATERIALS AND METHOD

To verify the hypotheses related to the variables of knowledge transfer and sustainable innovation, the deductive method is applied (Hammersley, 2023; Rodríguez Jimenez & Pérez Jacinto, 2017; Cisterna, 2005). Its scope made it possible to systematically articulate the behavior of the variables, which contributed to the analysis of the study context to generate propositional and renewed alternatives to promote transformations based on ideation, creation on the phenomenon studied and complemented from existing knowledge. From this perspective, it contributes to generating processes of appropriation of knowledge that allows promoting innovation on pre-established conditions. Likewise, from a documentary

review, logical reasoning on the designed conceptual model is achieved, which gives way to the grounded theory approach (Wuelser & Pohl, 2016).

Next, the development of the correlation study between the variables is continued through the analysis of principal components (PCA), allowing through the covariances to know the degree of association that exists between the transfer of knowledge and sustainable innovation from the context of the small and medium businesses.

For the selection of the sample, the non-probabilistic technique was applied, which led to the interaction with 109 small and medium-sized enterprises (SMEs). The geographical location of the companies under study is in Colombia, South America. Specifically in the city of Santiago de Cali, Pacific region; Colombian South West, 76 companies participated, distributed 11.8% in medium-sized and 88.2% small companies. And in the city of Barranquilla, Atlantic region, it is located in the north of Colombia, see Figure 2, with 33 participating companies, 18.2% corresponded to medium-sized and 81.8% small companies.



Figure 2. Location of the two selected cities in Colombia

Regarding the size and classification of companies, it is established in Article 2 of Decree 957 (2019) that these are classified into micro, small, medium and large companies, and they are determined by criteria associated with the total number of workers, value of total assets and value of annual gross sales. The latter is considered decisive for the granting of government benefits.

The commercial activity of SMEs, those dedicated to the development and management of information and communication technologies (ICT) were considered. Their selection was based on the worldwide projection of this business activity and its effects on the global order. Its management, the growth experienced by the aforementioned companies in the global growth of 2.6% in 2016, generating a business volume of approximately 3 million euros; considering that the United States occupied the highest percentage of billing in the sector with 31.3%, followed by Europe and the BRIC countries (Brazil, Russia, India and China) with 21.8% and 18.2% respectively.

In the case of Latin America, the results determine a 4.4% growth (National Observatory of Telecommunications and the Information Society of Spain, 2017). Regarding Colombia, the National Association of Financial Information (NAFI, 2019) states that, for the first semester of 2020, the current situation and perspectives of SMEs were analyzed, given the economic situation caused by COVID-19. A significant deterioration was determined by the evolution of their

businesses and the demand in the indicated period. However, the annual growth rate in volume due to economic activity in information and communications during 2020 (provisional) - 2021 (preliminary), had an annual growth rate of 11.2%, which shows a recovery trend regarding the period 2019 - 2020, which was represented at -2.6%.

For the application of the instrument, the observational units were intentionally selected, according to the inclusion criteria: a) interaction capacity of the researchers in the geographical contexts: Santiago de Cali and Barranquilla, b) a number of companies characterized as small and medium-sized in the selected cities, c) business units with activity concentrated in the management of information and communication technologies, with more than three years in the market d) characteristics of the analysis units with positions of manager, administrator or owner of the business, regarding age and gender, it is omitted, as it is not considered a priority for obtaining information, e) a company with potential in the production of knowledge and innovation, as well as, f) the willingness of the analysis units to respond to the instrument during the second quarter of the year 2022.

The instrument used consisted of a questionnaire made up of 45 items arranged on a 7-point Likert-type scale (1 = total disagreement, 7 = total agreement), from which aspects related to the following were evaluated with knowledge transfer, information technologies, knowledge management, innovation potential in SMEs, interorganizational sustainability in the SMEs.

The content validity of the instrument was measured through the judgment of three experts, for each of the cities in which the research is carried out: Santiago de Cali and Barranquilla. Experts were selected considering their expertise and trajectory that shows the domain associated with the research variables, as well as the roles that these professionals play in the sector under study.

Regarding the evaluation criteria of the instrument, aspects such as: a) objective of the research, theory-sufficiency, b) clarity-reactive, c) coherence, and d) relevance of the items that study the variables were measured. Expert analysis was calculated using the original coefficients of agreement (BN) and the weighted coefficients of agreement (BWN) (Bangdiwala, 1988). Likewise, to establish the differences in the perception and study of the variables between the two territorial entities, and to establish the differences between the two cities, a non-parametric Mann-Whitney U test was applied.

From a quantitative approach, the data processing was carried out by applying the RStudio Desktop software version 2022.07.1. This process allowed us to contrast the theory with the empirical reality. Initially, the reduction of dimensions was carried out by means of a principal component analysis (PCA) with the objective of grouping the items or characteristics used to evaluate the different SMEs. This process allowed retaining the most relevant information and corroborating whether the components that support knowledge transfer management are identified in the sample, as reported in the literature (Nonaka & Takeuchi, 1999). Subsequently, it was tested whether the identified components showed statistically significant differences between the SMEs of the two cities analyzed, for which the Mann-Whitney U statistic was used and the magnitude of the effect was calculated with the rank biserial correlation coefficient (r_{Glass}). To ensure that the retained components presented a correct fit, Harman's test was applied, using confirmatory factor analysis (CFA), and finally, a model of functional relationships between the variables represented by the components was tested in order to test the hypothesis of influence between the elements that support knowledge transfer management.

The development of mediation models was chosen as a method of analysis because they facilitate the construction of explanations about the level of influence of an independent variable (X) on a dependent variable (Y), by means of the decomposition of the direct and indirect effects generated by the participation of a third variable (Z) that acts as an intervening or mediating variable ($X \rightarrow Z \rightarrow Y$) (Fiedler, Schott & Meiser, 2011; MacKinnon, 2008). In summary, the logic of the model involves the transmission of the effect of the independent variable to a dependent through the mediating variable. These models have been designed to understand causal mechanisms in the phenomena studied by disaggregating the total effect from that produced by the participation of other variables. This makes them preferable to other models, such as those generated using structural equation modeling (SEM), among other reasons, because SEM is a technique considered for large sample sizes given that its default estimation method is based on the asymptotic theory of large samples (Hayes, Montoya & Rockwood, 2017).

RESEARCH RESULTS

The results on the consistency of the instrument, according to expert judgment, determine the reliability of the instrument obtained from the calculation of the concordance coefficients (Bangdiwala, 1988). The data presented in Table 1 specify the original coefficients that take into account only the agreements.

Table 1. Criteria for interpreting the agreement coefficients

Matching strength	Poor	Weak	Moderate	Good	Very good
Coefficient value	0.0 – 0.20	0.21 – 0.40	0.41 – 0.60	0.61 – 0.80	0.81 – 1.0

The values of the original agreement coefficients ranged between 0.782 and 0.948, while the values of the weighted agreements ranged between 0.934 and 0.994. In this sense, it was found that only one of the coefficients had a value for strength of agreement classified as “Good,” and all the other coefficients presented a value for strength of agreement classified as “Very good.” In general aspects, the dimension that had the greatest original agreement among the expert judges was relevance (BN=0.924), followed by coherence (BN=0.873), then sufficiency (BN=0.865), and finally the clarity criterion (BN=0.851), in general, the reliability margin is 94% of the instrument.

Likewise, Principal Component Analysis (PCA) was performed, for which the data matrix showed acceptable performance in the Kaiser-Meyer-Olkin test ($KMO = 0.766 \mid > 0.70, < 0.80 \mid$), and appropriate performance in Bartlett’s test of sphericity ($\chi^2[df = 136] = 660.004, p = 0.0009 < 0.001$). The analysis retained 17 characteristics of the 45 evaluated, which were grouped into three components that explain 54.6% of the total variance, a modest result. The first component (PC1) groups seven indicators and explains 26.5% of the variance, the second (PC2) groups five indicators and explains 17.7%, while component 3 (PC3) also groups five indicators and explains 10.4%.

The quality of the representation was analyzed by calculating the squared cosines (cos²), the visualization of which is described in Figure 3. This presents the relative importance of the variables retained in the PCA, showing that the correlations between the variables and components are well defined. This graph shows the best represented variables for the first two components, which together explain 44.2% of the variability of the data.

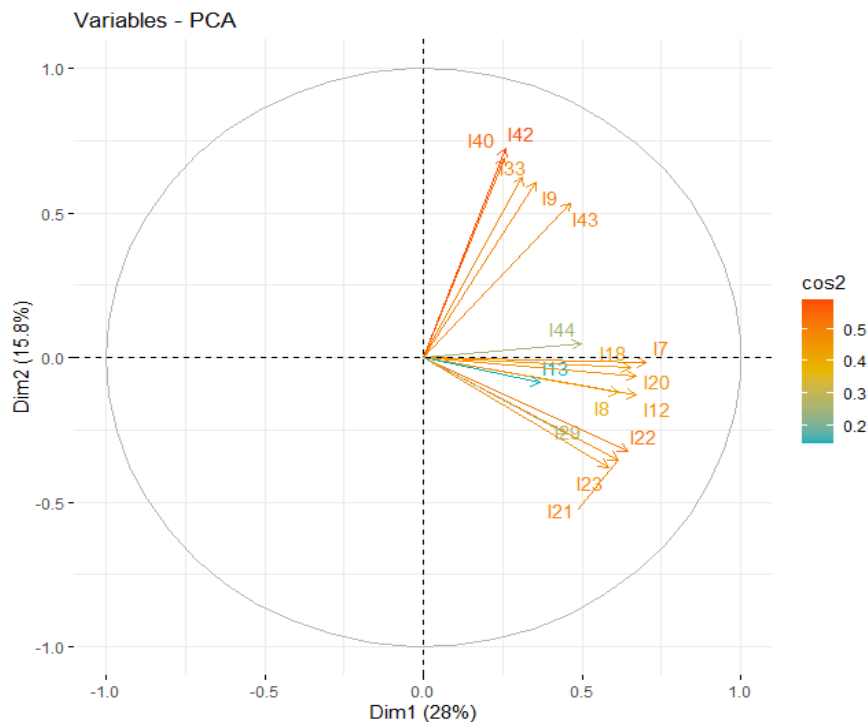


Figure 3. Graph of cosine squares of the variables retained in the PCA procedure

Table 2 contains each of the items or characteristics retained in the components, as well as their descriptive data. PC1 has integrated seven items and is called Knowledge Management and Sustainable Innovation. According to the content of the items, it is observed that they group aspects related to knowledge management, investment in information technologies, the valuation given to knowledge as an organizational asset and the application of knowledge through research and innovative strategies. This component responds to the Knowledge Transfer approach, but integrating sustainable innovation strategies in the context of SMEs.

The second component is called Competitive Management and Responsible Innovation, because it integrates elements related to competitive management, the development and promotion of innovation through teamwork and the articulation between responsible innovation processes and knowledge management in response to corporate governance guidelines. In other words, it integrates innovation, competitiveness and sustainability, which responds quite well to the notion of Innovation Potential in SMEs described in the conceptual model considered by the experts, see Figure 1.

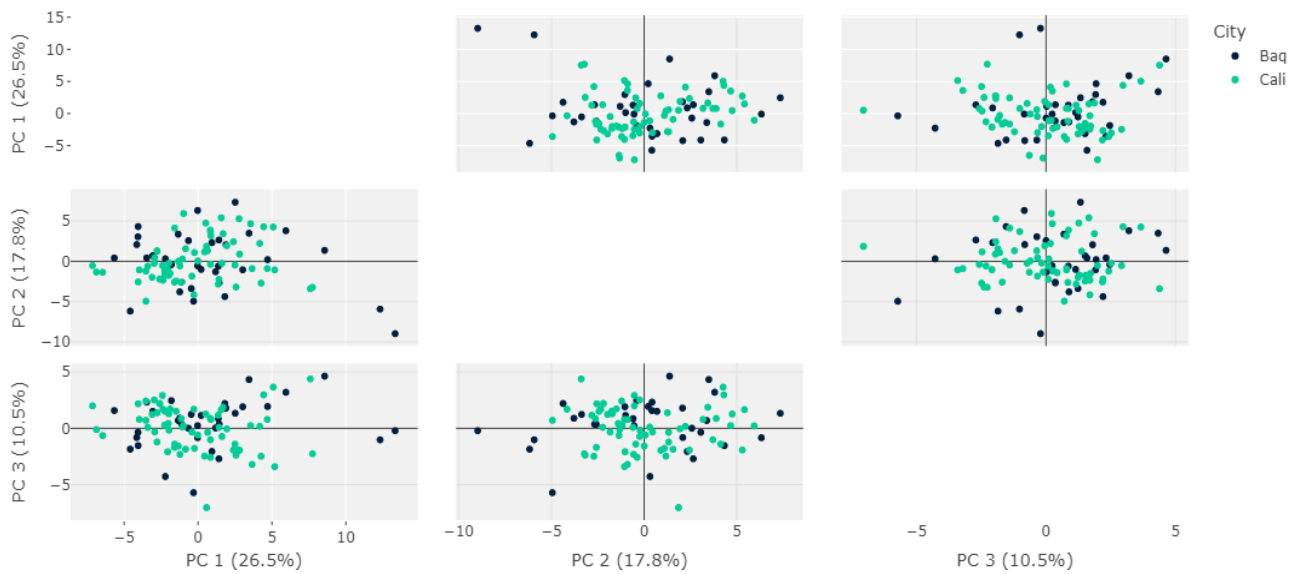
Finally, the third component was named Innovative Management and University-SME cooperation, which is based on the establishment of cooperative relations between SMEs and institutions of the university sector, to the extent that the latter are agents of innovation and development that offer valuable contributions to companies, such as the application of technology in monitoring processes, the dissemination of innovation in the international scenario, the generation of communication circuits and cooperative business networks. In this sense, the component responds well to the element of Intergorganzation Sustainability in the SMEs proposed in the conceptual model of the study.

Table 2. Descriptive data of the items and characteristics retained in the components

Component 1: Knowledge management and sustainable innovation	M	SD	Perceived Importance
I7. Information and knowledge are systematically recorded using information systems.	5.74	1.47	84.4
I8. Organizational policies in the SME recognize knowledge as valuable assets.	5.76	1.49	87.2
I12. Financial investments support knowledge transfer by providing technological resources.	5.81	1.26	88.9
I13. All members identify various types of knowledge (empirical, technical, procedural, scientific, logical) within the SME.	5.54	1.46	82.6
I14. The SME promotes research and innovation as a strategy for enhancing product and service quality.	5.58	1.51	84.4
I18. Sustainable innovation management plans, considering economic, environmental, and social aspects, are established in the SME.	5.24	1.35	81.6
I20. Regular economic investments ensure technological support for innovation processes in the SME.	5.51	1.44	81.6
Component 2: Competitive management and responsible innovation	M	SD	Perceived Importance
I21. The SME excels in competitive management with ample resources dedicated to innovation.	5.56	1.15	85.2
I22. Teamwork dynamics, including Coworking, are fostered to drive innovation.	5.47	1.54	82.5
I23. Innovation in products or services is aligned with the concept of responsible consumption.	5.47	1.50	85.3
I29. Sustainable innovation management significantly enhances knowledge transfer processes in the SME.	4.92	1.82	71.5
I44. Knowledge management and sustainable innovation in the SME adhere effectively to Corporate Governance principles for optimal and transparent organizational management.	4.90	1.77	69.8
Component 3: Innovative management and University-SME cooperation	M	SD	Perceived Importance
I9. Management results (dashboards) are tracked using ICTs.	4.66	2.02	62.4
I33. Sustainable innovation outcomes are shared internationally.	4.06	2.04	51.4
I40. Indicators capture the University-SME relationship, focusing on degree projects, programs, and university research.	3.23	2.10	36.4
I42. The SME forges connections with universities through effective communication, facilitating knowledge and innovation accessibility.	3.82	2.01	44
I43. SMEs strategically plan to enhance interaction processes using technology, fostering networking among entrepreneurs, innovators, businessmen, and professionals for effective business promotion.	4.89	1.67	65.1

The behavior of the components was also identified according to the city where the SMEs are located; this result is described in Figure 4, which makes it possible to recover all the components by ordering them according to the variance that they are capable of explaining according to the sector of the organizations evaluated. The subplots of PC1 and PC2 are similar to those obtained in PC3, so that the division by sector does not seem capable of separating the SMEs by city, an indicator of similarity in the processes they assume.

To corroborate what was initially evidenced in the PCA, a comparison of the values of the components between the SMEs of the two cities (Santiago de Cali, Barranquilla) was carried out using the Mann-Whitney U statistic. The analysis showed the absence of values indicating differences in the comparison of PC1 ($U = 1375.500$, $p = 0.423 > 0.05$) and PC2 ($U = 1195.500$, $p = 0.701 > 0.05$) between the two cities; However, PC3 did show differences and large effect size ($U = 2045.500$, $p = 0.0001 < 0.001$, $r_{Glas} = 0.63$) with values favoring the SMEs of Barranquilla.



Note: Baq = Barranquilla.

Figure 4. Visualization of the main components according to the city where the SMEs are located

Model testing

In order to ensure that the retained components responded sufficiently to the measurement model, the procedure known as Harman's Test was applied to rule out the existence of Common Method Variance Bias, that is, that variance that is not attributable to the study variables but to the measurement method used, which in this case corresponds to the survey used for data collection, since it measures both the independent variables (PC1, PC2) and the dependent variable (PC3).

To comply with Harman's test, Confirmatory Factor Analysis (CFA) is applied, initially calculating a unidimensional model and then the theoretical measurement model that corresponds to the one identified with the PCA (three dimensions). Subsequently, the fit indices of both models are compared. The theoretical model is expected to show a better fit to rule out the existence of the Common Method Variance Bias. Table 3 summarizes the outcome of this procedure, whose results support the solution obtained with the PCA procedure.

Table 3. A Harman test to discard the variance bias of the common method in the two-component model calculated with PCA

Fit statistics	Acceptable threshold	Models	
		One-dimensional	Three dimensions
χ^2	$p > 0.05$	331.188, $p > 0.05$	146.231, $p > 0.05$
gl	—	119	116
χ^2/gl	≤ 3	2.78	1.26
Comparative Fit Index (CFI)	≥ 0.95	0.838	0.977
Tucker Lewis Index (TLI)	≥ 0.95	0.815	0.973
Normed Fit Index (NFI)	≥ 0.95	0.771	0.899
Non-normed Fit Index (NNFI)	≥ 0.95	0.815	0.973
Goodness of Fit Index (GFI)	≥ 0.95	0.977	0.990
Root Mean Square Error of Approximation (RMSEA) [IC90%]	≤ 0.08	0.128 [0.112 - 0.145]	0.049 [0.017 - 0.072]
Root Mean Square Residuals (SRMR)	≤ 1.0	0.142	0.094

Only the NFI metric does not meet the expected values. However, the rest of the measures support that the model's fit statistics are good. Average Variance Extracted (AVE) was also calculated for each component, whose results were below the expected fit by obtaining values < 0.50 . These values were 0.443 for PC1, 0.467 for PC2 and 0.439 for PC3, which indicate

that the levels of variance explained by the variables obtained are not high, which we already noticed when showing the overall percentage of variance corresponding to the PCA. However, the three-component model showed discriminant powers as reported by the Heterotrait-monotrait ratio (HTMT), where all off-diagonal values are < 1 (HTMT = PC1↔ PC2 = 0.465, PC1 ↔ PC3 = 0.239, PC2 ↔ PC3 = 0.163).

Model of functional relationships between variables

The hypotheses guiding the study proposed, on the one hand, that knowledge transfer (in this study PC1) affects sustainable innovation (in this study PC2) in SMEs (H1), and on the other hand, the system of relationships between knowledge transfer and innovation potential reinforces the interorganizational sustainability (in this study PC3) of SMEs (H2). Table 4 summarizes the data resulting from testing these assumptions by designing a predictive functional model between PC1 and PC3 mediated by PC2.

Table 4. Model of functional relationships between knowledge transfer and interorganizational sustainability mediated by the innovation potential of SMEs

Mediation estimators					95%CI				
Effect				Estimate	SE	Z	p	Lower	Upper
Directs	PC1	→	PC3	0.255	0.109	20.345	0.019'	0.042	0.468
Indirects	PC1	→	PC2 → PC3	-0.002	0.049	-0.045	0.964	-0.099	0.094
Totals	PC1	→	PC3	0.253	0.090	20.794	0.005''	0.075	0.430
Path coefficients					CI 95%				
				Estimate	SE	Z	p	Lower	Upper
	PC2	→	PC3	-0.005	0.117	-0.045	0.964	-0.235	0.224
	PC1	→	PC3	0.255	0.109	2.345	0.019'	0.042	0.468
	PC1	→	PC2	0.422	0.121	3.476	0.0005''''	0.184	0.660

Note: ' $p < 0.05$, '' $p < 0.001$, SE = Standard Error; CI = Confidence Interval. PC1 = Knowledge management and sustainable innovation, PC2 = Competitive management and responsible innovation, PC 3 = Innovative management and University-SME cooperation.

The procedure shows that PC1 (analogous to Knowledge Transfer in the conceptual model) predicts PC3 (analogous to Intergorganization Sustainability in the SMEs), as it also directly predicts PC2 (analogous to Innovation Potential in SMEs), however, PC2 does not predict PC3 nor does it mediate the initial relationship of this with PC1. Figure 5 summarizes the relationship paths and shows that the percentage of variance explained by the model is modest, reaching 18% for PC2 and 6% for PC3.

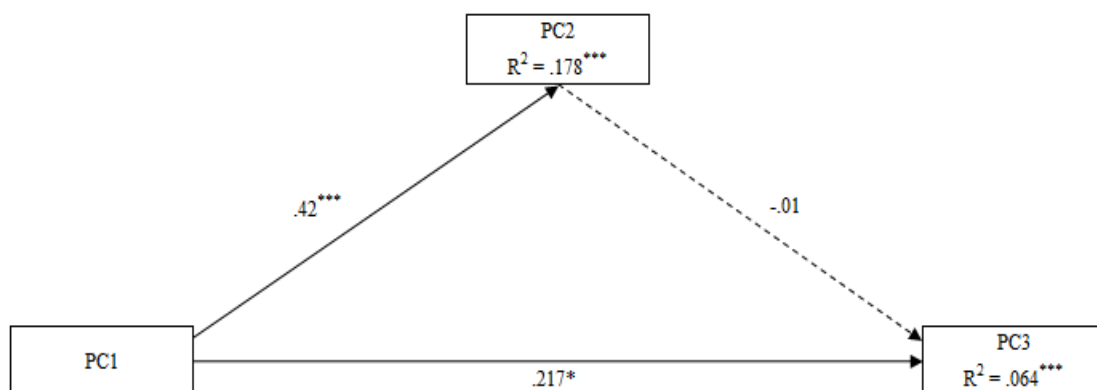


Figure 5. Patch diagram

In this sense, we see how the elements that involve knowledge management can influence the development of innovation in SMEs as well as their interorganizational integration with actors that serve as collaborative support to generate a favorable impact on innovation and sustainability. According to Grabowski and Stawasz (2023) the benefits

of using new knowledge depend on the knowledge absorption capacity of enterprises. Consequently, the design of the relationship system between the components that promote knowledge transfer and sustainable innovation is based on the results described, see Figure 5. Its design was based on a four-stage structure to promote the strengthening of potential innovative under principles of sustainability. The process flows highlight each stage. These make it possible to determine the interactions that have to project the innovative potential in small and medium-sized companies from a sustainability and interorganizational projection approach.

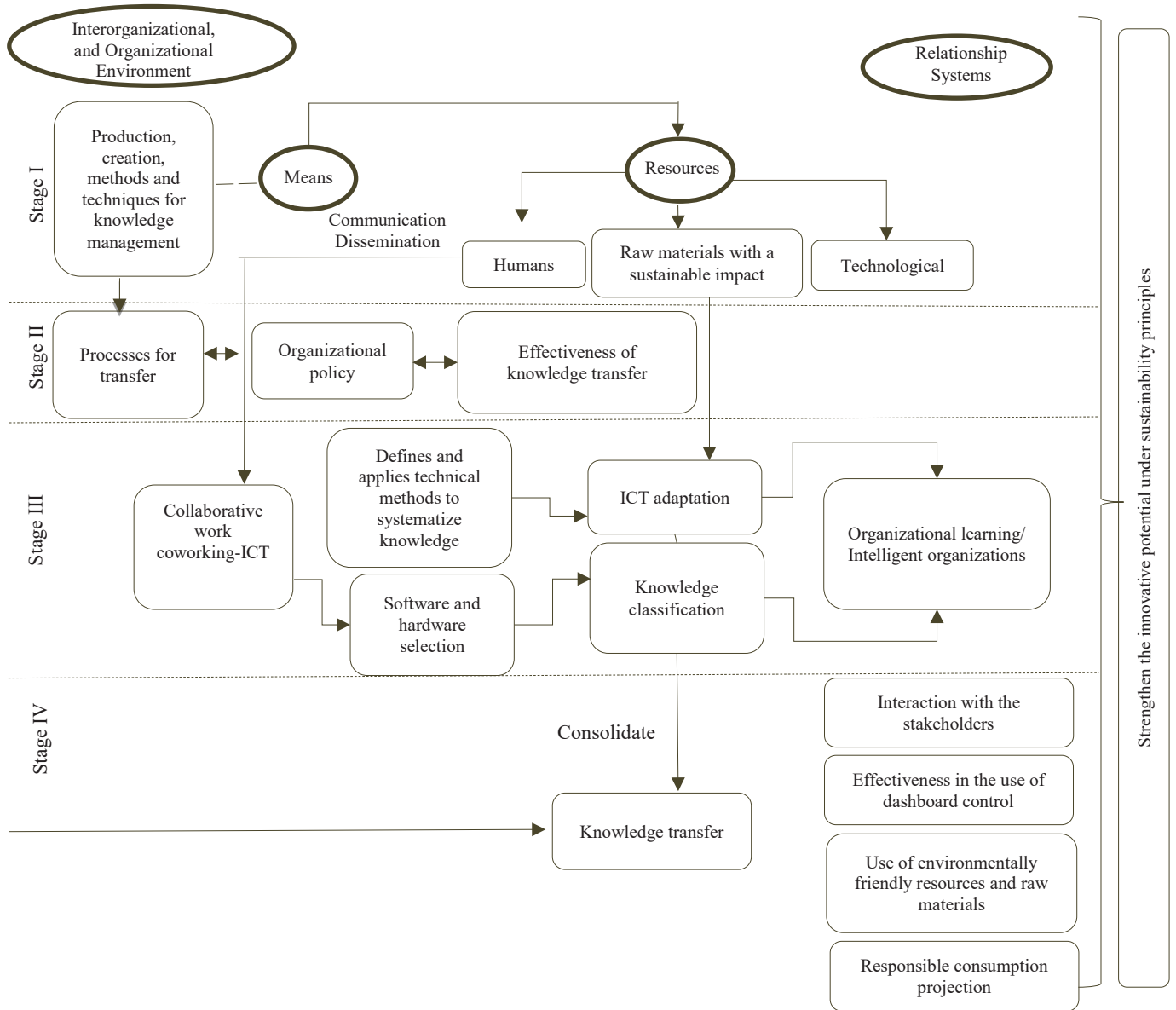


Figure 6. System of relationships between the components that promote the transfer of knowledge and innovation

The scope of the relationship system in stage I shows the importance of strengthening interorganizational capacities in SMEs, starting from production, such as knowledge management for its transfer. Stage II is conceived within the framework of two classifications, the capacity for appropriation and production of new knowledge, considered as the basis for achieving both the production or absorption, and the organization-resources necessary for knowledge management, which is consistent, as stated by Anjaria (2020) as well as the importance of viability of the definition of policies that govern the process.

Stage III shows the relationship between resource management: human and teamwork (coworking). Their interrelation promotes added value, the development of tangible and intangible capacities as long as the transfer and appropriation of knowledge consolidates a culture to innovate and undertake (Méndez-Picazo, Galindo-Martín, & Castaño-Martínez, 2020).

On the other hand, it is proposed to understand how IT flexibility, collaboration with partners, and environmental business factors lead to improved innovation capabilities oriented towards sustainability (Van de Wetering, Mikalef, & Helms, 2017). The relationships of the first three stages give viability to the effectiveness of the system flows in stage IV, based on the empirical vision in which the work and projection of SMEs prevail in the face of the need to renew their management to transcend the use of information technologies to maximize the transfer and appropriation of knowledge as part of the capacities to innovate.

DISCUSSION

The results obtained allowed, from the initial phase of the study associated with the validation of the instrument, to obtain a concordance in each stated construct, which guaranteed the measurement of the study variables, as for the application of principal component analysis (PCA). Likewise, the data facilitated the grouping of relevant items or characteristics for the evaluation of SMEs, in order to identify the key components that support the management for knowledge transfer, aligning with the principles established by Nonaka and Takeuchi (1999). The relative importance of the variables retained in the PCA is added, observing that the correlations between the variables and the components are well defined. Thus, the model obtained with the PCA allowed the identification of three relevant components for the analysis of knowledge transfer and, therefore, of knowledge management, understood as crucial elements in the framework of the development of SMEs in the cities under study, as well as in the advances associated with the knowledge society.

In the same order, the data derived from the comparison of each of the components identified in the study according to the city of origin of the SMEs analyzed were relevant, since the data indicate variations in the local contexts related to the proximity and cooperation with the innovative sector of the academy, which is crucial to understand the effects on the transfer of knowledge in the regional context. An aspect that is exposed to the need to promote favorable interactions with the actors that make viable and have to strengthen innovative development as part of the distinctive characteristics of companies (Franco & Pinho, 2019; Belderbos et al., 2018; Del Giudice, Carayannis & Maggioni, 2017).

As for the result of H1, the data from the model studied show the existence of functional relationships between knowledge transfer and sustainable innovation. At the same time, the model proves that these effects are direct, indicating that a greater transfer of knowledge predicts higher levels of sustainable innovation. However, the adoption of practices that add to the strengthening of integrated knowledge management as a strategic basis for promoting innovation under sustainability principles from the business contexts is required. From this perspective, to mitigate the risks associated with the weak development and stability of SMEs. Thus, it is foreseen from the literature that knowledge management is developed as a voluntary and conscious act between individuals and organizations, in addition to having as a result the joint acquisition of intellectual property between the source and the recipient (Del Giudice et al., 2017; Franco & Pinho 2019; Fukugawa, 2016; Rossi, Rosli & Yip, 2017).

These approaches suggest agreement with the information obtained; however, it is evident that the SMEs studied in the two cities differ in terms of performance in terms of innovative management and University-SME cooperation, as shown by the analysis of comparison between groups, a situation that generates significant gaps in terms of ways to promote innovation and undertake new developments. Similarly, anticipate the importance of generating potential in human talent to adopt technological trends that contribute to business sustainability, which implies a marked differentiation among the rest of these companies, in terms of developing innovation and development capabilities, learning, and strategic direction.

Undoubtedly, innovation is relevant as a priority activity that deserves to be granted in modern organizations (Ferraris et al., 2019), in addition to characterizing ways to promote innovation to overcome barriers that limit the adoption of sustainable practices. On the other hand, the results that allow contrasting H2, confirm, on the one hand, that knowledge transfer directly predicts Interorganizational Sustainability in the SMEs, but this relationship is not mediated by the effect of sustainable innovation. Thus, although KT affects the integration potential of SMEs with organizations from other sectors, no complete connection between the elements of the conceptual model is identified, insofar as sustainable innovation does not contribute to interorganizational integration. In view of the above, it is important to overcome the gaps that weaken the aforementioned interaction. To this end, it is necessary to emphasize that the synergistic relationships of companies, with and among different actors, allow boosting innovative capacity and development (Dukic, Ljiljana & Vinko, 2015).

In addition to understanding the critical role of innovation in the generation of competitive advantages, as well as the improvement of operational performance (Zhou, Zhou, Feng & Jiang, 2019) and the direction of their productive activity towards sustainability (Hansen, Grosse-Dunker & Reichwald, 2009).

Given the above, determining the components that underpin the system of relationships from the empirical study became the basis for the design of the system, whose interactions are determined by process flows that give greater meaning to the correlating components. From this perspective, it helps to overcome barriers in the management of SMEs based on practices associated with knowledge transfer and sustainable innovation. Both are represented in stage I, which shows the importance of strengthening interorganizational capabilities in SMEs. In turn, it considers the production and management of knowledge according to the results of the empirical study, prioritizing the understanding of the behavior of business environments and the impact on the viability of the resources associated with the variables.

In stage II, organizational policies and the strengthening of human capacities are priorities. The human factor is highlighted as a promoter of knowledge (Ode & Ayavoo, 2019; Rossi et al., 2017). As such, the human resource management practice of empowered leaders and knowledge-intensive teams can significantly promote team knowledge sharing (Han, Ren, Yang & Han, 2021). In this way, the knowledge transfer and its exchange through the use of information technologies are the basis for the development of skills and abilities of collaborators (Fink & Ploder, 2009). Regarding the process of capturing and transferring knowledge, it still represents one of the barriers to be overcome. Among the reasons that determine them are the weak importance given to the investment required to create mechanisms that support KT from the organizational environment and its interorganizational projection. Besides requiring the production of knowledge, through which research, new developments, innovations, and ventures are promoted (Giraldo-Pinedo, Paredes-Chacín & Núñez-Velasco, 2021). Then in stage III, the emphasis is centered on collaborative work and information technologies are shown from two strategic nodes - soft and hard. The former tends to transfer tacit knowledge, through the interface that allows person-to-person interaction. The second mainly transfers explicit knowledge, allows codification - management - and the transfer of knowledge using this grounded resource (Jasimuddin & Zhang, 2009).

The flows described, and the information technologies in a transversal way, are conceived as a base that facilitates the systematization and transfer of knowledge. In addition to considering their transformation to strengthen the intangible asset - knowledge - as a determining factor for organizational competitiveness (Grant, 1996); also promote their practice for the projection of the so-called intelligent organizations, characterized by promoting research and innovation to generate permanent and systematic transformations, in which the management and intelligent use of knowledge and technologies support the development of processes and products as a determining part to innovate (Romera, 2016; Liao & Wu, 2010; Paredes, 2011).

Giving priority to the ways of dynamizing knowledge transfer management is considered as one of the strategies to promote sustainable innovation from a comprehensive vision, which is complemented, in addition to the results presented, by the definition of metric standards that determine the progress in the execution of the proposal and therefore the effects of these on the goals of sustainable development; for which the adoption of green technologies by SMEs is decisive (Hilkenmeier, Fichtelpeter & Decius, 2021; Jahanshahi, Al-Gamrh & Gharleghi, 2020), and in turn leads to the strengthening of capacities to direct strategies focused on new ways of appropriating knowledge from an interorganizational vision and innovate the transforming reality of SMEs. The results obtained from the empirical perspective and its statistical basis, project valuable implications from the functional, technical and operational aspects of the business contexts, regardless of their size, as well as for the scientific-technical development in a global order.

CONCLUSION

Determining the relationships between knowledge transfer (KT) and sustainable innovation (SI) in interorganizational contexts of small and medium-sized enterprises responds to the objective of the research. Its development was based on an empirical descriptive correlational study in 109 enterprises in Colombia. The results represent the positive contrast of the hypotheses, which determine the favorable incidence of knowledge transfer on innovation, for which the representation of a system of relationships between the components that determine it, promotes the need to renew ways of transferring knowledge, as well as promoting its production and management. It is a situation that implies overcoming gaps that minimize the innovative potential of SMEs. On the other hand, consolidating an interorganizational vision in these enterprises is considered as part of the challenges that have to stimulate the management and sustainability of resources in SMEs in Colombia.

Although the valuation of knowledge is rarely conceived as a determining asset for the transformation of business management, today it requires effective processes that promote its production and transfer mediated by ICTs. From an empirical perspective, the trend is focused on overcoming weaknesses arising from ignorance of ways to transfer and achieve the appropriation of knowledge with impact towards innovative management in SMEs. In addition to the low or null interaction between the knowledge that promotes interorganizational relationships for the use of intangible assets in an assertive way and according to the nature of the markets in which they participate.

Therefore, the ability achieved to demonstrate the correlation between the components described in the system of relations between KT and SI, allows promoting sustainable innovation management that deserves to be strengthened or, failing that, created to generate differentiating characteristics and promote the competitiveness of SMEs in the sectors that participate. Likewise, it is considered among the priorities to put into effect the practice of the relationship system that prioritizes renewed ways of transferring knowledge to promote sustainable innovation in business environments that transcend not only technological activity companies, but also for related sectors that participate in markets in a global order.

Regarding the limitations of the study, it is highlighted that despite studying SMEs whose activity is focused on information technology management, weaknesses were found both in the availability of cutting-edge technologies, with greater emphasis on the small ones, and in the innovative capacity of the collaborators. It is an approach that generates risks to respond to the requirements of business digitization, under disruptive processes that allow mitigating the effects of the 21st century pandemic on SMEs. In addition, the demands of the global market environment, which affects their stability.

From the point of view of the presentation of the results, it is important to consider the functional analysis model applied, based on a mediation analysis, which assumes causal relationships of a sequential nature, which is not necessarily valid for all phenomena; it is possible other causal explanations exist or that the influence on relationships are bidirectional. It is also important to recognize that they do not offer metrics that inform about the level of fit of the models obtained, in deference to SEM procedures in which statistics are obtained arranged for this purpose (CFI, RMSEA, among others.) that indicate how well or poorly the model explains the data analyzed (Hayes et al., 2017). However, mediation models compensate for their certain limitations by adding metrics that contribute to understanding the proper fit of the estimates such as confidence intervals or conditional spillovers, which provide estimates of the effects of the variables based on the hypotheses formulated.

In this sense, it is possible to consider the application of alternative methods such as PLS-SEM (Partial Least Squares Structural Equation Modeling) models; however, mediation and PLS-SEM models are guided by different approaches to perform causal and structural relationship analysis. Consequently, these models do not overcome the sensitivity related to sample size, since they can provide estimates that are less accurate when the data set analyzed is small, whereas mediation models have been shown to perform quite well even with small samples such as the one considered in this study. In view of the above, promoting the development of future research linked to SMEs in various activities in Latin America becomes a reference that, as an empirical study, can generate added value, both for business decision-making and for the management of public policies in the regions.

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Authorship contribution statement

Ana Judith Paredes-Chacín: Conceptualization, Methodology, Supervision, Validation, Formal Analysis, Writing – Original Draft, Investigation. **Sebastián Díaz-Bejarano:** Data Curation, Investigation. **Freddy Marín-González:** Formal Analysis, Methodology, Investigation, Visualization, Finish Review. **Elmer Vega-Ramírez:** Formal Analysis, Finish Review, Investigation, Resources, Software.

Conflicts of interest

The authors declare no conflict of interest.

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Comparative analysis of national innovation systems: Implications for SMEs' adoption of fourth industrial revolution technologies in developing and developed countries

Lebogang Mosupye-Semenya¹ 

Abstract

PURPOSE: This study aims to identify the differences and similarities in the innovation systems of developing vs. developed countries that influence SMEs' adoption of Fourth Industrial Revolution (4IR) technologies. There is a notable absence of comparative research between National Innovation Systems (NIS) of developing and developed countries. Additionally, the current scholarly conversation lacks a holistic view of NIS. Our study aims to fill these gaps by employing Lundvall's framework to explore both developed and developing countries' systems comprehensively. **METHODOLOGY:** The data was collected through a Systematic Literature Review, identifying a total of 695 publications from SCOPUS, Web of Science (WoS), and ProQuest. The PRISMA process was adhered to, resulting in 32 papers undergoing quality evaluation using Gough's 'weight of evidence' guidelines. Twenty-nine primary papers were selected, comprising twelve from developed countries, another twelve from developing countries, and the remainder from both categories. Using Qualitative Meta-synthesis (QMS) with ATLAS.ti, a systematic alignment of codes with research inquiries pertaining to NIS ensued, revealing a multifaceted spectrum of findings across these scholarly investigations. **FINDINGS:** We found that there are similarities and differences between the innovation systems of developed and developing nations. The similarities include the intra-firm interactions taking place between managers and workers, inter-firm relations between the SMEs and Academia and other SMEs, as well as the role of the government in providing funding and regulation (albeit at significantly varying degrees). The most significant differences observed were in the funding mechanisms, the role of the government, and the R&D systems. It was found that governments in developed countries provided SMEs with substantial incentives, tax credits, and subsidies to adopt 4IR technologies, which appears to positively impact the adoption rate. We conclude by developing a conceptual framework for the NIS necessary for the adoption of SMEs' 4IR technologies in developing countries. **IMPLICATIONS:** This study contributes to the literature on innovation systems by examining the NIS of both developed and developing countries. This analysis allows us to gain deeper insights into how specific aspects of each country (developed or developing) affect (positively or negatively) SMEs' adoption of 4IR technologies. Practically, it informs governments in developing countries on which aspects to focus on in their NIS to increase the rate of the adoption of 4IR technologies by SMEs. **ORIGINALITY AND VALUE:** A distinctive aspect of this study lies in the creation of a comprehensive conceptual model delineating the essential components of the innovation system pivotal for the successful integration of 4IR technologies within SMEs. This model is designed to serve as a practical tool for governments in developing countries, providing a structured framework to facilitate and enhance the strategic development of their innovation landscapes.

Keywords: national innovation systems, fourth industrial revolution technologies, SME, adoption, developed countries, developing countries, comparative analysis, government policies, Lundvall's framework, qualitative meta-synthesis

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INTRODUCTION

Developing countries are faced with a myriad of challenges ranging from access to housing, water, energy and the internet, as well as poverty, inequality and unemployment. These form part of the United Nations' Sustainable Development Goals, and the World Economic Forum (2020) recommends using Fourth Industrial Revolution (4IR) technologies as tools to overcome these challenges. Small and Medium Enterprises (SMEs) on the other hand are generally viewed as key drivers of job creation, poverty alleviation and economic growth (Adelowotan, 2021; Serumaga-Zake & van der Poll, 2021), meaning they have the potential to solve the above-mentioned social challenges, especially through the adoption of 4IR technologies to develop innovative solutions.

Several scholars have defined 'innovation' as a process of introducing new or existing knowledge to a context, such as a country, firm, or region (Alexander, 2021). To foster innovation, an appropriate innovation system is required in developing nations to enable SMEs to continue to solve social challenges. An innovation system is a network in which actors interact to exchange knowledge to undertake innovative activities (Kraemer-Mbula & Wamae, 2010). This study is concerned with the National Innovation Systems (NIS) of developed and developing countries that influence SMEs' adoption of 4IR technologies; in other words, which elements of the innovation system positively or negatively influence SMEs' adoption of 4IR technologies in developing vs. developed countries. We find various studies in this respect. Dosso et al. (2021) discuss the readiness of such a system in Sub-Saharan Africa. They observe the system from four lenses: infrastructure, skills, governance and R&D potential. In South Africa, Alexander (2021) analyzes the key concepts and abilities of the innovation system. She observes the system from three lenses, namely contextual factors, key actors, and key domestic and global networks. Similar studies were also conducted in developed countries. For instance, Lee and Lee (2018) investigated the impact of innovation systems on economic growth between Korea and four European countries. Before that, Nelson (1993) compared the innovation systems of various high-income and low-income countries.

While this scholarly conversation is insightful, there are two noticeable gaps. One is the holistic and comprehensive view of an NIS. Dosso et al. (2021) and Alexander (2021) touch on various aspects of an NIS that do not necessarily encompass the whole picture, hence their completely different lenses of observation. This study utilizes Lundvall's NIS framework to scrutinize developed and developing nations' innovation ecosystems. Developed by Bengt-Åke Lundvall in the 1980s, this conceptual framework generally prompts an examination of how different actors, institutions, policies, and structures interact and contribute to innovation processes within a specific economic context. Our focus encompasses critical components like intra-firm and inter-firm interactions, the public sector's role, the financial system's institutional setup, and R&D intensity. This approach allows a comprehensive analysis of how firms organize internal innovation, collaborate externally, and engage with governmental policies and financial structures. By examining these elements within the innovation systems of diverse economies, we aim to discern their varying impacts on SMEs' adoption of 4IR technologies, offering insights into innovation dynamics across different economic landscapes.

Secondly, a noticeable gap persists in research concerning the comparative analysis of NIS across developed and developing nations. This gap specifically revolves around the exploration of differences and similarities between these distinct systems, aiming to identify which strategies prove effective within each context. Essentially, there is a scarcity of comprehensive studies that scrutinize and contrast the innovation frameworks of developed and developing countries, emphasizing the need to uncover not just the differences but also the shared elements that facilitate or hinder SMEs' adoption of 4IR technologies. While the study mentioned above by Nelson (1993) comes close, he did not compare high income to low income. He compared countries within the high-income category and then proceeded to compare those within the low-income category. Understanding what works optimally within each setting is pivotal for devising tailored and effective approaches to innovation enhancement.

Therefore, this study aims to identify the differences in 4IR technologies adoption by SMEs in developing vs. developed countries, using Ludwig's NIS framework. In this way, we can attempt to understand which aspects of a country (developed or developing) influence (positively or negatively) SMEs' adoption of 4IR technologies. In this study, the classification of countries as 'developed' or 'developing' is based on income levels, aligning with the World Bank's criteria. This approach ensures consistency in comparisons and establishes a clear economic context for exploring the diverse adoption patterns of 4IR technologies. The data is collected through a Systematic Literature Review (SLR) and analyzed through a meta-synthesis. A conceptual framework for the NIS necessary for SMEs' adoption of 4IR technologies in developing countries is then generated.

The rest of the paper is organized as follows: Section 2 expands on the Theoretical Framework, focusing on explaining the different aspects of NIS. This is followed by a detailed description of the methodology used to conduct the SLR. The results and discussion are presented next, together with the development of the conceptual framework. The paper ends with a conclusion.

THEORETICAL FRAMEWORK

Innovation systems

Innovation systems literature comprises several subsets. NIS (Lundval, 2016) concentrates on a nation's interconnected institutions and policies to drive innovation and foster economic growth. In contrast, Regional Innovation Systems (RIS) prioritize innovation within specific geographical areas by aligning local industries, research centers, and governmental entities. Sectoral Innovation Systems (SIS) (Malerba, 2002), delve into innovation dynamics among entities within industries, aiming to enhance competitiveness and spur technology development. Additionally, Global Innovation Systems (GIS) (Binz & Truffer, 2017) involve international collaborations, enabling the exchange of knowledge and technology on a global scale to elevate competitiveness and facilitate overall progress. In the context of SMEs' adoption of 4IR technologies, NIS provides a holistic view, considering the national-level factors that shape the overall innovation landscape. While RIS, SIS, and GIS focus on more specific contexts, they contribute to the broader NIS by influencing innovation at regional, sectoral, and global levels, respectively. Understanding these interrelated systems is crucial for comprehensively assessing how SMEs navigate and benefit from the opportunities presented by 4IR technologies within different contextual frameworks.

SMEs and innovation systems

The correlation between entrepreneurship and innovation systems, encompassing diverse 'helix' concepts such as the Triple Helix, delves into how business, government, and Academia interact (Kochetkov, 2023). Isabelle et al. (2023) exemplify this connection in their study, where they developed an SME 4IR ecosystem framework by merging the triple helix with a dynamic perspective on the entrepreneurial ecosystem concept. Entrepreneurial ecosystems, building upon the foundations of innovation system literature, pivot their emphasis toward cultivating entrepreneurial knowledge rather than solely focusing on innovation creation (Cao & Shi, 2021). It specifically concentrates on nurturing an environment conducive to entrepreneurial activities, knowledge exchange, and the development of entrepreneurial skills and mindsets. In contrast, innovation systems encompass a broader framework involving interconnected elements such as institutions, organizations, and policies to foster innovation within a socio-economic context.

Alexander (2021) investigates the role of South Africa's NIS in either supporting or impeding 4IR-related innovations, examining how this system influences businesses' abilities to adopt and develop 4IR technologies. While the study discusses NIS through contextual factors, key actors, and network characteristics, it does not explicitly emphasize interactions among actors, institutions, and policies to foster innovation for the adoption of these technologies.

In this context, this study seeks to expand upon these approaches by applying Ludval's NIS lens. This lens emphasizes the interconnectedness of actors, institutions, and policies to drive innovation, providing a comprehensive framework for understanding how these elements interact and impact the adoption of 4IR technologies.

National Innovation System (NIS)

This study adopts NIS due to the following reasons. Firstly, Nelson (1993) highlights the significance of NIS, emphasizing a nation's technological prowess as pivotal for competitiveness. Countries like Japan, Korea and Taiwan thrived due to their advanced technical capabilities (Nelson, 1993). Developing nations historically lagged in previous revolutions (Marwala, 2021), facing hurdles in accessing electricity and the internet (3IR). Amid the 4IR, it is crucial for these nations to position themselves for its benefits. SMEs, often facing exclusion from the 4IR due to documented challenges (Isabelle et al., 2023; Serumaga-Zake & Van der Poll, 2021), should be at the forefront of adoption, as this should lead to improved technological capabilities and, therefore, improved competitiveness of the nation.

Secondly, Lundvall (2016) asserts that governments must understand how to foster innovation at the national level. Identifying challenges and opportunities on a national scale becomes vital for making informed policy recommendations to governments, especially in developing countries.

Thus, this study is concerned with those elements in the innovation system of a country that influence positively or negatively the adoption of 4IR technologies, on a national level. We chose Lundvall's framework as it offers a comprehensive and systemic way of understanding how innovation takes place within a country. It highlights the interactions among different actors and institutions, emphasizing the role of the public sector and financial sector in shaping a country's innovation performance. This framework is widely adopted by policymakers, researchers and practitioners to guide their strategies for innovation.

Lundvall (2016, p. 86) defines NIS as "constituted by elements and relationships that interact in the production, diffusion, and use of new and economically useful knowledge ... located or rooted inside the borders of a nation state." Nelson (1993, pg. 4) defines a system as "a set of institutions whose interactions determine the innovative performance of national firms." In simpler terms, NIS may be taken as a set of elements that interact in the process or lifecycle of innovation. Lundvall (2016) describes the elements of NIS as follows:

Table 1. Elements of NIS

Element	Description
Intra-firm interactions	This element is worth examining because, as pointed out by Lorenz and Kraemer-Mbula (2021), it is individual firms that adopt 4IR technologies. It is, therefore, important to understand the innovation and learning processes that take place within a firm (Kraemer-Mbula & Wamae, 2010). Inside the firm, Lundvall (2016) suggests observing the interaction between the various departments such as sales, production and R&D. In our study, we will examine the interactions within SMEs that influence the adoption of 4IR technologies.
Inter-firm interactions	Relationships between firms are an important aspect to consider when examining innovation systems (Lundvall, 2016). These relationships affect competition and could include technical knowledge exchange, industrial districts, and user-producer interactions. Therefore, our study will examine the interactions between SMEs and other external parties that influence the adoption of 4IR technologies.
Role of the public sector	The public sector, specifically the government, plays an important role in innovation. This could be through science and development, regulations and standards, which are said to influence the rate and direction of innovation. Therefore, in our study, we will examine issues that have to do with the role of the government in influencing the adoption of 4IR technologies.
The institutional set-up of the financial system	It appears from the literature that there is a connection between the financial system of a country and the system of innovation. One aspect of this element is the role of Financial Institutions as funders of innovation (Lundvall, 2016). In this study, we will examine the issue of finance more broadly, seeking to understand the funding mechanisms and instruments that influence the adoption of 4IR technologies.
R&D intensity and R&D organization	According to Lundvall (2016), these include the R&D system, its resources, competencies, and organization. In this study, we will be examining the R&D systems of developing and developed countries to understand how they influence the adoption of 4IR technologies.

Source: Lundvall (2016).

Based on the elements in Table 1, we ask the following research questions (RQs) about SMEs in developing vs. developed nations:

RQ1: What are the interactions taking place between the various departments in SMEs that influence the adoption of 4IR technologies?

RQ2: What are the interactions that are taking place between SMEs and other actors that influence the adoption of 4IR technologies?

RQ3: What is the role of government in influencing the adoption of 4IR technologies by SMEs?

RQ4: What financial mechanisms/instruments are used to influence SMEs' adoption of 4IR technologies?

RQ5: What R&D systems are in place to influence SMEs' adoption of 4IR technologies?

METHODOLOGY

This study adopts a Systematic Literature Review (SLR) to select relevant literature for data collection. This is then followed by a Qualitative Meta-Synthesis (QMS) for data analysis. We use the PRISMA (Preferred Reporting Items for Systematic Literature Reviews and Meta-Analyses) flow diagram (Page et al., 2021) to perform and report on our SLR and QMS, as shown in Figure 1. PRISMA is utilized in this study for its transparency, standardization, and quality assurance in reporting systematic reviews.

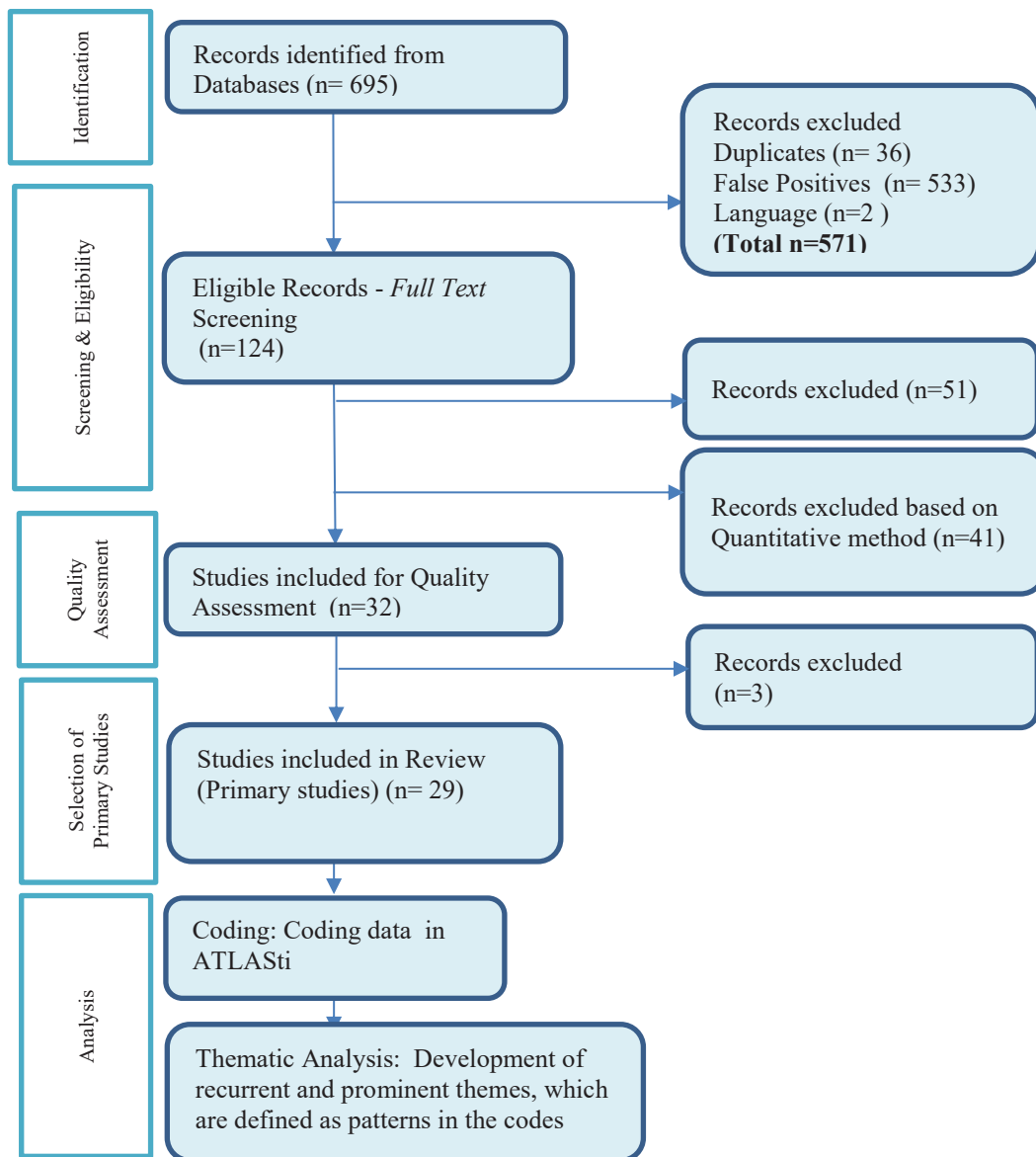


Figure 1. Systematic Review PRISMA process

Source: Page et al. (2021).

Identification

All records available on the topic of SMEs' adoption of 4IR technologies and related innovation systems were identified as follows:

Search engines – Data was collected from SCOPUS and Web of Science (WoS). These databases are widely accessible by researchers globally and have a reputation for indexing high-impact literature, contributing to the study’s academic rigor. Furthermore, these journals cover academic literature across various disciplines including technology adoption, innovation, and the Fourth Industrial Revolution. The researcher further consulted ProQuest Central, which has coverage in a wide variety of topics, specifically Business Studies and Entrepreneurship.

Type of literature – We reviewed scholarly literature such as peer-reviewed journal articles, conference proceedings, books, and book chapters.

Literature timeframe – All literature from 2011 to 2023 was reviewed. This timeframe was chosen because the 4IR was first deliberated at the Hannover fair held in Germany in 2011 (Schwab, 2017).

Search terms – The key terms were “SMEs”, “adoption” and “4IR technologies.” These were used with a combination of supplementary terms (see Table 2). “SME” is pivotal as it defines the study’s target entities, while “adoption” is crucial as it signifies the primary variable of interest. The term “4IR technologies” broadens the search, encompassing the full spectrum of innovations related to 4IR. Notably, the terms “developing country” and “developed country” were avoided to prevent the exclusion of papers where specific countries are named. The researcher classified countries as “developed” or “developing” after reviewing the included literature. The same applied to “innovation systems” as most papers would not normally refer to this term but rather to an aspect of it. In total, 695 publications were identified as follows:

Table 2. Search strings, the quantity of identified and selected papers (last searched on 20 February 2023)

SCOPUS	
Search string	TITLE-ABS-KEY (SME OR „Small and Medium Enterprise”) AND Adoption AND („4IR technolog*” OR „Fourth Industrial Revolution technolog*” OR „Industry 4.0 technolog*” OR „Smart Manufacturing”)
Result quantity	39
WEB OF SCIENCE	
Search string	ALL FIELDS (SME OR „Small and Medium Enterprise”) AND Adoption AND („4IR technolog*” OR „Fourth Industrial Revolution technolog*” OR „Industry 4.0 technolog*” OR „Smart Manufacturing”)
Result quantity	21
PROQUEST	
Search string	(SME OR „Small and Medium Enterprise”) AND Adoption AND („4IR technolog*” OR „Fourth Industrial Revolution technolog*” OR „Industry 4.0 technolog*” OR „Smart Manufacturing”)
Result quantity	635

Screening and eligibility

Once the data was collected, screening and eligibility ensued. The data was screened for duplicates, language, and false positives, as reported in Figure 1.

Duplicates – A manual de-duplication method similar to that of McKeown and Mir (2021) was used, whereby data from all databases was exported to an Excel spreadsheet and then sorted alphabetically by author. Where a ‘duplicate’ author was found, the title of the study was looked at next to check whether the documents were the same article. If it was found that the articles were the same, one was eliminated. As a result, 36 papers were removed.

Language – Only articles written in English were included. In that regard, therefore, two papers written in Russian and Polish were excluded.

False positives – These are articles that contain the keywords searched but are of an unrelated topic (Linnenluecke et al., 2020). Articles that focused on 4IR technologies, but in relation to other topics such as labor or education (instead of SME adoption), were categorized as false positives. In this study, based on the review of the abstracts, 533 false positives were excluded.

The total number of excluded articles at this point was 571, leaving 124 for full-text screening.

Full-text screening – At this stage, all 124 articles were read in full, and the following inclusion and exclusion criteria were applied to select primary studies:

Inclusion criteria – Articles that focused on SMEs and their adoption of 4IR technologies. Articles that answered one or more of the research questions.

Exclusion criteria – Articles that did not answer any of the research questions. Articles that referred to the adoption of 4IR technologies by companies, projects, individuals (such as students), corporations, industries, sectors, enterprises,

or firms that were not necessarily Small and Medium. Articles that focused on other technologies that are not 4IR related (for instance, social media). Articles that focused on other aspects of SMEs in relation to 4IR technologies such as the identification of reasonably priced 4IR technologies for SMEs. Bibliographies, although other types of systematic literature reviews were included. Quantitative studies – A meta-synthesis exclusively relies on the synthesis of qualitative studies (not quantitative), extracting and interpreting themes and patterns from qualitative data.

As a result, thirty-two (32) primary studies were selected. The assessment of their quality is discussed next.

Quality assessment

The selected papers were checked for quality, as this appears to be an important and contended feature of Qualitative Meta-Synthesis (Finlayson & Dixon, 2008; Gough, 2007). Numerous methods can be employed for this purpose. However, for this study, Gough's (2007) 'weight of evidence' guidelines were followed. It is used in fields such as law where evidence is weighed for decision-making (Gough, 2007) and therefore, considered more rigorous than the others. Furthermore, it allows for a nuanced assessment by considering various dimensions of study quality, such as methodological rigor and relevance to the research question, providing a comprehensive understanding of the evidence landscape. The weight-of-evidence approach employs the use of separate judgments made on various criteria, which are then combined for an overall judgment, as shown in Table 3.

Table 3. Quality assessment of primary studies

Weight of Evidence (WOE)	To check for	Primary study characteristics
WOE A: Quality of Execution of Study	Transparency, Accuracy, Accessibility, Specificity	The primary study must have a clear purpose or aim of study (Liu et al., 2021).
WOE B: Appropriateness of Method	Fit for purpose method	The primary study must have a methodology for data collection and analysis (Gjaltema et al., 2020)
WOE C: Focus/Approach of Study to Research Questions	Utility – provides relevant answers	The Primary study must have an answer to one or more research questions (Gough, 2007), in other words, one or more aspects of the NIS framework

Source: Gough (2007).

Some scholars, such as Liu et al. (2022), calibrated the answers from the selected studies with yes (1), 0.5 (partially), and no (0), then calculated the weights accordingly. Based on the final score, the papers were then ranked into three categories, namely good (score of 3.5 and above), fair (score of between 2.5 and 3), and poor (score of 2 and below). This study followed the same procedure. Only the papers in the good and fair categories were deemed of good quality and included in the final review. Three papers were excluded, leaving a total of 29 primary studies for analysis.

Data analysis

A Qualitative Meta-synthesis (QMS) is described as an integration or merging of information and results from carefully selected qualitative studies (Finlayson & Dixon, 2008). Finlayson and Dixon (2008) explain that this method is more than a summary or description of the literature but an interpretation of the findings to build a theory. It is appropriate for this study as we seek to develop a conceptual model for the innovation system necessary for SMEs' adoption of 4IR technologies. The following section describes the process, which is followed by an analysis of the data collected.

Extracting and coding data – All 29 publications were transferred to ATLAS.ti for extraction of data through coding. In the initial coding phase, structural coding, a top-down approach, was used where data was coded according to the research questions (Saldaña, 2013). In other words, the coded text answered one or more aspects of the NIS of the country studied in the publication (see Figure 2). Subsequently, similar codes were organized into categories or higher-order themes. In collaborative efforts, three researchers maintained consistency through regular ATLAS.ti meetings.

Name	Grounded	Density	Groups
○ ◆ Inter-firm SME and solution provider			[RQ2_Inter-Firm]
○ ◆ Inter-firm SME and supplier - d			[RQ2_Inter-Firm]
○ ◆ Inter-Firm SME d and university			[RQ2_Inter-Firm]
○ ◆ Inter-firm SME to SME			[RQ2_Inter-Firm]
○ ◆ Inter-firm Supply chain			[RQ2_Inter-Firm]
○ ◆ Inter-Firm unions			[RQ2_Inter-Firm]
○ ◆ Intra -Firm d departments			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-Firm			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-firm - d			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-Firm d managemen and workers			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-firm generation to generation			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-firm Management and personnel			[RQ1_Intra-Firm Interactions]
○ ◆ Intra-Firm R&D and workers			[RQ1_Intra-Firm Interactions]

Figure 2. Partial list of initial codes in ATLAS.ti Code Manager

Initial coding aims to find and label what is in the data. This process resulted in 53 codes, which consisted of 218 quotations.

Method of qualitative meta-synthesis – A thematic analysis method was adopted for this study, as it allows for the analysis of patterns and themes in the codes (for each research question), to show the picture that is being portrayed in the literature (Castleberry & Nolen, 2018; Dixon-Woods et al., 2005). Themes were identified by exporting the codebook for each research question to Microsoft Excel and grouping the subcategories according to commonality. For Research Question 1, a sample is provided in Figure 3.

ID	Quotation Content	Codes	Theme
5:7	RP1: An organisational structure characterised by a wide span of control and a low number of hierarchical levels is associated with the adoption of I4.0 technologies.	Intra-Firm	Structural change
9:13	While in Italian large companies the knowledge transformation and application occur in dedicated units separate from any functional unit or division (Gramolati et al., 2018), in innovative SMEs it occurs mainly “on the job.” Rold has created an intergenerational team to develop smart products inside the new sensors division. Seasoned technicians with great experiences, deep competences on the development of the	Intra-Firm	Intergenerational teams between young and old
11:8	A key consideration was the top management support, organisational resistance across ranks, and a culture shift focusing on managing its mindset. The vision and direction provided by the CEO and senior management was an extremely critical aspect. In the case of family-owned companies, it was felt that the younger generation’s engagement	Intra-firm generation to generation Intra-firm Management and personnel	Management and workers
1:1	Planning & scheduling: There is no planning or scheduling taking place other than the rough manual prioritization of the jobs in progress. Senior engineers and management have a deep understanding of each	Intra-firm Management and personnel	Management and workers

Figure 3. Partial list of thematic analysis using the ATLAS.ti codebook in Microsoft Excel

Each research question varied in terms of the number of levels of thematic analysis and the findings are presented in the next section.

RESULTS

Developed and developing countries represented in the primary studies

In this section, the findings from the selected studies concerning the five research questions are presented. The selected primary studies are tabulated in Annexure A. They span several countries, as shown in Figure 4. As shown in Figure 4, 12 out of 29 papers were from developed countries, 12 were from developing countries and the rest were from both developed and developing countries. The most represented were from Italy (17%), India (14%) and South Africa (10%). In the remainder of this section, the key findings of the innovation systems between these countries are discussed.

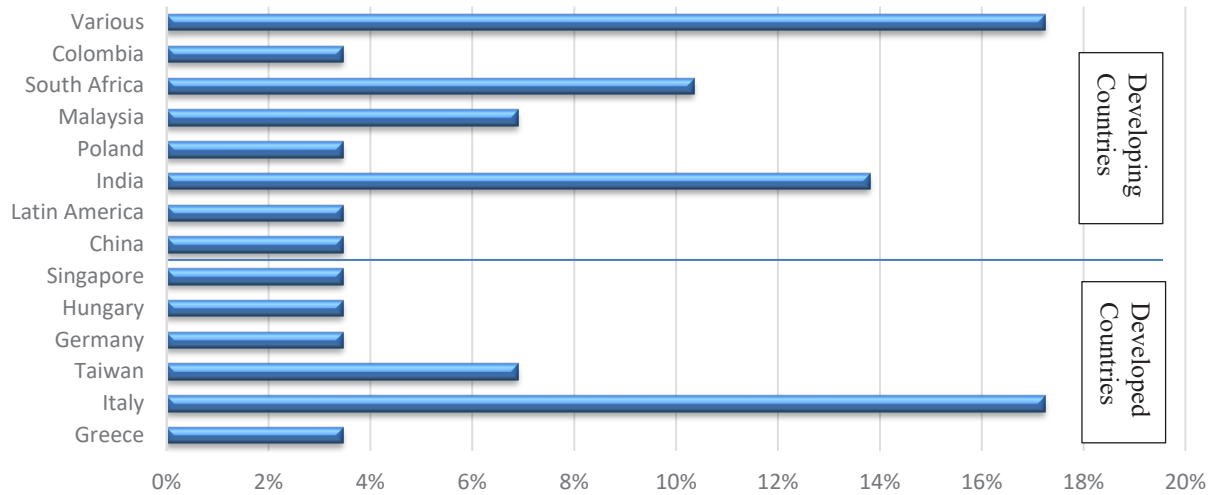


Figure 4. Developed and developing countries represented in the selected primary studies

RQ1: What are the interactions taking place between the various departments in SMEs that influence the adoption of 4IR technologies?

This section reports the findings of the interactions taking place within SMEs that influence the adoption of 4IR technologies in developing and developed countries. These are summarized in Table 4.

Table 4. Intra-firm interactions

Interaction by theme	Developed Countries	Developing Countries
Management and workers	1, 2, 5, 6, 9, 10, 11, 12	13
Structural change – Reduction of hierarchical levels	5	
Intergenerational teams between young and old	9, 11	
Departmental interactions		13, 15, 18
Management and workers	1, 2, 5, 6, 9, 10, 11, 12	13

It can be seen from Table 4 that there are interactions within SMEs that positively and negatively influence the adoption of 4IR technologies as follows:

Management and workers – The first similarity noted is the interaction between management and workers that influenced the SMEs' adoption of 4IR technologies. This interaction is mentioned in n=9 studies. We observe this interaction more in literature from developed than in developing countries. Several studies point to the positive mindset of the managers first, which then cascades to the workers. Surianarayanan and Menkhoff (2020) state that in Singapore, the vision and direction set by the leadership of the SME are key and critical to adoption.

Another key aspect of 4IR technology adoption in SMEs hinges on worker involvement. Da Roit et al. (2022, pg. 14) emphasize that “people give their best when they are involved”. This sentiment is echoed by Arcidiacono et al. (2019),

who stress the pivotal role of fieldwork operators in developing suitable technological solutions for successful adoption. Garbellano and Da Veiga (2019) highlight the significance of involving workers, including blue-collar workers, in digital transformation project kick-off meetings to address concerns, costs, and risks.

Wang et al. (2022) propose integrating the adoption of 4IR technologies, such as AI, into the key performance areas of workers to encourage active involvement and adoption. However, the literature indicates that a lack of vision, support, and direction from leadership adversely affects 4IR technology adoption. Arcidiacono et al. (2019) suggest that leadership may struggle to quantify the benefits, face resource optimization challenges in SMEs, and grapple with data security fears, leading to a company culture that impedes technology adoption. This unfavorable environment negatively impacts workers, causing resistance to change and sluggish acceptance of these technologies.

Additionally, a lack of awareness, guidance, and information from leadership regarding the adoption of 4IR technologies result in non-adoption (Shaikh, 2021). This underscores the crucial role of effective interaction between leadership and workers in fostering a conducive environment for successful technology adoption.

In developing countries, a lack of adoption within an SME appears to be due to fear of job loss (Joshi et al., 2022). Therefore, Joshi et al. (2022) encourage support at all levels of management, specifically towards the workers' development, involvement, and engagement.

Structural change – An observation made in Italy is a change in the organizational structure when 4IR technologies are adopted. It appears there is a relationship between the adoption of 4IR technologies and the structure of interaction between management and workers. In particular, Cimini et al. (2020) highlight the hierarchical level reduction that is taking place in organizations. Traditionally, there is a hierarchy, a pyramid within firms that depicts how management interacts with employees. In the current digital revolution, Cimini et al. (2020) explain that the organizational structure in Italy is changing from a pyramid to a network. In other words, it appears there is a widening span of control given to the workers when 4IR technologies are introduced to the SME, to promote agility and responsiveness to the 4IR (Cimini et al., 2020).

Intergenerational teams – Another observation made only in developed countries is the interactions between employees of different generations. It appears a few firms are intentionally putting together teams consisting of workers who are old and experienced and workers who are young and techno-savvy. Garbellano and Da Veiga (2019) found that in developing smart products, Italian SMEs combine the expertise of seasoned technicians with young recently graduated software engineers. They also found that in family businesses, the adoption of 4IR technologies is driven by the children of the founders, successfully invigorating the sluggish business and its competitive position. Surianarayanan and Menkhoff (2020) also observed that the successful adoption of 4IR technology was largely driven by the engagement of the younger employees to harvest the benefits of 4IR technologies in Singaporean SMEs. This suggests that the younger generation has the potential to influence positively the adoption of 4IR technologies within SMEs.

Departmental interaction – We find that this interaction is only mentioned in the literature from developing countries. Joshi et al. (2022) highlight the importance of a supportive learning environment in SMEs in India, where learnings are captured and shared between departments, ensuring an understanding of how their work affects the rest of the organization. Also in India, Mittal et al. (2020) found that input was sought from different departments such as sales, design, and production when a particular technology was being designed in their selected manufacturing SMEs. On the contrary, De Lucas et al. (2022) found that in Latin America, there is a lack of such an environment, which they opine is required for innovation and knowledge sharing, especially for employees who are unfamiliar with the 4IR process within the company. They found that there are no documented models regarding the relationship between the different departments and collaboration between different areas of the SME. However, there is an intention by departmental managers to develop a communication plan for employee information. Mittal et al. (2020) found that input was sought from different departments such as sales, design, and production when technology was being designed.

RQ 2: What are the interactions that are taking place between SMEs and other actors that influence the adoption of 4IR technologies?

This section reports the findings of the interactions taking place between SMEs and other external parties that influence the adoption of 4IR technologies, in developing and developed countries. These are summarized in Table 5 below.

Table 5. Inter-firm interactions

Theme	Actors influencing adoption	How they are interacting with SMEs to influence adoption	Developed country studies	Developing country studies
Innovation intermediaries	<i>Competence Centre</i>	Bring together Academia, government and private sectors to support SMEs toward a human-centered implementation of 4IR, rather than a techno-centric one.	10	
Academia	<i>Universities</i>	Partnerships with SMEs to develop new products provide knowledge to SMEs and train human resources in the use of 4IR technologies.	9	21, 27
Supply and value chain partnerships	<i>Customer</i>	Far ahead in technology adoption, forcing SMEs to adopt technologies to meet their needs	6, 9	13
Supply and value chain partnerships	<i>Solution provider</i>	Provide technology solutions to SMEs	2, 27	
Supply and value chain partnerships	<i>Supply chain</i>	Receive products/services from SMEs in the value chain	3, 6	
Other SMEs	<i>Other SMEs</i>	Collaboration, networking, sharing knowledge, best practices, information and solutions	3,4,9	18

We see from Table 5 that several actors interact with SMEs and influence their adoption of 4IR technologies.

Innovation intermediaries – These are viewed as critical and key to the innovation system (Vidmar, 2021). The role of innovation intermediaries is well documented in the literature and it includes knowledge brokering (De Silva et al., 2018) and providing innovation stakeholders with infrastructure and tools (Vidmar, 2021). In this study, an observation is made about developed countries which appears to be absent in developing countries; and that is Competence Centers. Ietto et al. (2022) point to the technocentric approach prevalent in business when adopting 4IR technologies and opine that a more human-centric approach is needed. Therefore, the role of Competence Centers is to bring together key actors in the innovation ecosystem, namely Academia, government, and private sectors, to support SMEs towards a human-centred implementation of 4IR. This includes activities such as:

- worker skill enhancement through training;
- customized robotics that focuses on worker safety in the workplace, and
- workers' well-being whereby automation of tasks is encouraged as well as wearables for analysis of workers' vital parameters.

Competence Centers are also used by SMEs to acquire 4IR competencies. Ietto et al. (2022) stated that although SMEs are aware of the competencies they need, the gap between the competency provider and the SME is so wide that they are unable to find the right provider without intermediaries.

Academia – The interaction between SMEs and Academia is also noted in the literature. In developed countries such as Italy, we observe SMEs partnering with universities for the development of new digital products, which in turn positively affects the firm's competitive position (Garbellano et al., 2019). However, the literature appears to suggest that this interaction is not necessarily taking place in developing countries. Rojas-Berrio et al. (2022) found that technological development is slow in LATAM countries because of the non-existent relationship and interaction between Academia and SMEs. This is echoed by Ghobakhloo et al. (2022), who pointed to the lack of access to external digitalization experts in universities by SMEs as a critical barrier to the adoption of 4IR technology in developing countries such as Brazil. Rojas-Berrio et al. (2022) stress the importance of Academia and SME partnerships, in that Academia provides knowledge to SMEs and trains human resources in the use of 4IR technologies.

Customers – Da Roit and Iannuzzi (2022) and Garbellano et al. (2019) found that customers are a significant driver of 4IR technology adoption by SMEs in Italy. Both studies reveal that this interaction with customers is more important to SMEs than government incentives as SMEs believe that customers are further ahead in technology than they are. Therefore, to meet their needs, these SMEs had to transform digitally. In LATAM countries, De Lucas Ancillo et al. (2022) demonstrate that there is a lack of interaction between the SME and the customer; not even efforts by the SME to get to know the customer better.

Solution providers – The interaction between the SME and the solution provider appears to be a complex one in both developed countries. In some instances, SMEs form bonds with solution providers to co-develop the best technology

solutions for the firm, such as in Italy (Arcidiacono, 2019; Ghobakhloo et al., 2022). In other instances, we see information asymmetries between the two parties resulting in the exploitation of SMEs, whereby solution providers present solutions beyond SME needs and recommendations of obsolete technology solutions (Arcidiacono, 2019). This behavior creates fear within SMEs and hinders the adoption of 4IR technologies on their part. Another factor discussed by Ghobakhloo et al. (2022) is the monopolistic nature of 4IR technologies, which creates a lack of competition, resulting in apprehension in SME technology adoption. This aspect does not appear to be a point of discussion in the literature from developing countries.

Supply chain – It appears most SMEs act as suppliers to large companies (Chen, 2020) and other customers and, therefore, are determined to not be the weakest link in the supply chain. This has led to the adoption of various technologies. Arcidiacono et al. (2019) give an example of an Italian factory that was forced to automate their warehouse as the manual system was causing delays to the customers. At times, they would not be able to fulfill customer requests because the stock was hidden so far in the warehouse that it could not be physically reached. Again, in Italy, Da Roit and Iannuzzi (2022) interviewed a company that adopted 4IR technology because of an explicit request from the large company they serve as an SME. This aspect does not appear to be a point of discussion in the literature for developing countries.

Other SMEs – In developing countries, the literature indicates that there are interactions taking place between SMEs. Some interactions occur at conferences and with competitors (Mittal et al., 2020), where SMEs learn new knowledge and implement it in their businesses. However, we note the difficulty of SMEs collaborating with other SMEs to learn and share knowledge in both developed and developing nations. Chen et al. (2021) highlight this issue in Taiwan, explaining that the interaction has not matured in the country, while in Italy, there is significant interaction between SMEs, forming networks, sharing knowledge, best practices, information, and solutions among each other.

It appears that the government is another key actor in the adoption of 4IR technologies by SMEs, and this is discussed in the next research question.

RQ 3: What is the role of government in influencing the adoption of 4IR technologies by SMEs?

The literature reveals that the government has various roles to play in influencing SMEs to adopt 4IR technologies, as shown in Table 6.

Table 6. The role of the government

Role of government by theme	Developed country studies	Developing country studies
Funding/Incentives/Subsidies	2, 4, 6, 11	21, 22
Training	4, 6, 8	
Regulation/Law/Standards	4	22, 27
Create Ecosystems/Networks	4	
Provide Infrastructure		22, 24

It can be seen from Table 6 that the role of the government is vast and influences adoption in various ways, as discussed below:

Funding/incentives/subsidies – Funding (or lack of it) was mentioned in n=6 articles. In developed countries, Arcidiacono et al. (2019) highlight the positive impact of government funding through the I4.0 National Plan in Italy. This plan, they assert, encourages SMEs to adopt and implement 4IR technologies by offering them incentives and tax credits to do so. The same trend is observed in another developed country, Singapore, where Surianarayanan and Menkhoff (2020) point out that the adoption of 4IR technologies by SMEs is largely driven by government incentives, financial assistance, and subsidies available to them. This trend is unfortunately not witnessed in developing countries. In the Sub-Sahara, Serumaga and Van der Poll (2021) state that government funding towards digital infrastructure, R&D, and training is low and negatively impacts the adoption of 4IR technologies in the manufacturing sector. The same appears to be true in Columbia, where Rojas-Berrio et al. (2022) report that one of their interviewees sought funding from the government, which turned out to be a process that took six months to a year, while the need for the technology was immediate and unmet.

Training – Governments are also expected to assist in training and skills development of 4IR technologies. In both developed and developing countries, SMEs generally do not have the finances to train and upskill their employees and, therefore, require assistance from the government, otherwise, their digital capability will worsen (Chen et al., 2021). Chen

et al. (2021) go on to say the assistance that SMEs need from the government is the provision of digital platforms and programs to help them find qualified talent and/or train their employees, as well as funding for these. Some governments in developed countries, such as Italy, appear to support training activities by offering tax credits for SMEs. The Hungarian government has also developed programs to assist SMEs in improving their skills and innovation capabilities to adopt 4IR technologies.

Regulation/law/standards – In developing nations, it appears there is a lack of regulation on 4IR technologies, and this negatively affects the adoption by SMEs. Even though this is the case, Serumaga and Van der Poll (2021) demonstrate that some African countries including Kenya, Rwanda, and Uganda are beginning to consider this issue by initiating programs and policies that address economic growth. India on the other hand is guided by the National Manufacturing Policy and most importantly, the Make-in-India Directive (Dutta et al., 2020). It appears it is not so in developed countries. Germany and governing bodies in Europe have comprehensive policies that support and promote SMEs' adoption of Industry 4.0 technologies (Ghobakhloo et al., 2022). Italy is guided by the I4.0 policy (Da Roit & Iannuzzi, 2022)

Create ecosystems/networks – Chen et al. (2021) studied the role of the Taiwanese government in digital transformation and suggested that the government build a collaborative ecosystem that assists SMEs in connecting and collaborating with others. In this way, SMEs overcome a lack of financial and human resources as well as a lack of knowledge (Chen et al., 2021).

Provide infrastructure – This is an aspect observed only in developing countries. The governments in these countries appear to be lax in installing or upgrading digital infrastructure. Serumaga and Van der Poll (2021) argue that the lack of high-speed internet technology infrastructure limits information access and business performance. This is echoed by Wankhede and Vinodh (2022) who raised data rate transfer concerns (the speed at which data is transferred) in India. They explained that the slow rate of data transfer harms the manufacturing sector and their adoption of cyber-physical systems. In contrast, countries such as Hungary have launched programs to develop SMEs' digital infrastructure, as the national digital infrastructure is sound, unlike in developing countries.

RQ 4: What financial mechanisms/instruments are used to influence SMEs' adoption of 4IR technologies?

This section reports the findings of the existing funding mechanisms, instruments, and funding actors that influence the adoption of 4IR technologies in developing and developed countries. These are summarized in Table 7.

Table 7. Funding mechanism for adoption of 4IR technologies

Funding mechanism	Developed country studies	Developing country studies
Government Funding (subsidies/incentives)	2,4, 6, 9, 11, 15	
External funding (bank loans, private funder)		19, 21
Internal funding		27, 28

SMEs in developed and developing countries do not generally have sufficient funds and human capital to adopt 4IR technologies (Chen et al., 2021). In acquiring 4IR technologies, they have to consider direct and indirect costs that include hardware and software costs, maintenance expenses, and ongoing training. Due to a lack of resources, SMEs then opt to invest in what they know rather than in digital technologies that have no guarantees of success in their firms (Chen et al., 2021). Nevertheless, digital transformation literature tells us that the cost of implementation is a primary barrier to digital technology adoption in SMEs (Chen et al., 2021).

Government funding – As previously discussed, government funding appears in more papers (n=6), indicating its importance. In the literature, we note that the governments in developed countries have made provisions for incentives (Arcidiacono et al., 2019; Da Roit & Iannuzzi, 2022); tax benefits (Da Roit & Iannuzzi, 2022; Garbellano et al., 2019) and subsidies (Surianarayanan & Menkhoff, 2020) to SMEs to encourage adoption. In developing countries, it appears government funding is available, however, it is insufficient and takes longer to acquire, as explained by Serumaga and Van der Poll (2021) and Rojas-Berrio et al. (2022).

External funding – Perhaps the lack of government funding in developing countries is the reason for approaching other funders, such as banks and private funders, as these only appear in papers from developing countries. In terms of banks, Rojas-Berrio et al. (2022) found that in Colombia, SMEs have a negative perspective of banks in that they have

encountered barriers and impediments to accessing loans to purchase 4IR technologies. This could be because banks are generally apprehensive about lending to SMEs. In terms of autonomous vehicles, Mokonyama et al. (2022) opine that funding should be easier to obtain from external funders as these vehicles record and keep historical data on how the asset was utilized. They add that this type of information is important to funders as they use it to calculate matrices such as Return on Capital and that if an SME keeps this data, they are more likely to access that funding.

Internal funding – This sort of funding may be making an appearance in developing countries to avoid the barriers SMEs have to overcome to access external funding. Another reason could be that the costs of 4IR technologies have dropped significantly of late, making them more affordable to SMEs (Ghobakhloo et al., 2022).

RQ 5: What R&D systems are in place to influence SMEs’ adoption of 4IR technologies?

This section reports the findings of the existing R&D systems, resources, competencies, and organizations that influence the adoption of 4IR technologies in developing and developed countries. These are presented in Table 8 below.

Table 8. R&D systems

R&D systems	Developed country studies	Developing country studies
R&D systems	7,8	22, 29

Table 8 reveals that R&D systems are not frequently discussed in the literature. Nevertheless, we found that there are some differences in the R&D systems in developed and developing countries. In developed countries, it appears the systems are strong. Dressler and Paunovic (2021) found that on German wine farms the practical use of 4IR technologies such as AI and Big Data appeared absent, however, R&D was ongoing. A few of their interviewees were wine farm managers/owners who are involved in R&D in one way or the other. For instance, they had one interviewee who is a winery owner and wine software developer, another who runs experimental wine software development at a university and finally a professor of robotics and geoinformatics in the wine industry. In Hungary, we note the abundant availability of R&D resources, which Endrődi-Kovács and Stukovszky (2022) emphasize are only slightly below the EU average. However, SMEs do not participate in these research projects (Endrődi-Kovács & Stukovszky, 2022) for reasons that include a lack of skill on their part.

In developing countries, we note that R&D appears to be poor. This is attributed to the lack of investment by the government (Serumaga & Van der Poll, 2021). Serumaga and Van der Poll (2021) proceeded to put forth a proposition in their study that increases in R&D investments by the government may facilitate the adoption and implementation of 4IR technologies in sub-Saharan countries.

DISCUSSION

The findings indicate that there are similarities and differences in the NIS of developed and developing countries. These are shown in Table 9.

Table 9. NIS of Developed and Developing Countries – Similarities and Differences

Innovation system element	Similarities	Differences	
		Developed country	Developing country
Intra-firm interactions	Manager-Worker	Organizational structural change Intergenerational teams	Departmental interactions
Inter-firm relationships	SME-Academia SME-SME	SME-Competence Centers SME -Customers SME-Solution provider	
Role of the government	Provide Funding Develop Regulation	Provide Training Create ecosystems	Lack of digital infrastructure provided
Funding mechanisms	Government Funding		External funding (bank loans, private funders) Internal funding
R&D systems		R&D systems	

Intra-firm interactions

The literature suggests that departmental interactions are taking place within SMEs to capture and share knowledge for accountability purposes, where each department understands how their work affects the rest of the organization (Joshi et al., 2022) and for input in technology solution design (Mittal et al., 2020). This finding was only observed in studies from developing countries. However, the researcher opines that this interaction must be taking place in developed countries, albeit not recorded in the primary studies used for this research. It is generally accepted that knowledge and its flow are important for innovation to take place. As explained by Edquist (2006), the innovation process is complex and involves the emergence and diffusion of knowledge. Furthermore, Lundvall (2016) explained that innovation requires dialogue, an exchange of information, and knowledge between different people in different departments and at different levels. It follows then that the flow of knowledge would be both internal and external to the firm for innovation to take place in developed and developing countries.

Our findings, aligned with Lundvall's (2016) insights on organizational interactions, highlight that the predominant interaction within SMEs is between managers and workers. Leadership extends beyond vision-casting, encompassing responsibilities for cultivating an innovation-driven environment. This involves guiding, ensuring resource provision, fostering skill development, and notably, dismantling hierarchical structures to encourage open idea exchange among workers. Overlooked is the significance of worker empowerment, which goes beyond seeking opinions to emphasize active engagement. This empowerment involves granting decision-making authority, facilitating skill enhancement, promoting a culture valuing diverse perspectives, and recognizing the pivotal role of workers in technological decisions. The literature suggests that when managers provide vision, leadership, and guidance to workers, and workers are actively involved and engaged in decision-making for 4IR technological solutions, the likelihood of successful adoption increases.

Two striking differences between developed and developing nations were observed in this study. SMEs in developed nations are changing the structure of their organizations by reducing the hierarchical levels and adopting a more 'network' approach, where workers are given more control and power to make decisions about new technologies (Cimini et al., 2020). We see the inappropriateness of high levels of hierarchy in digital transformation literature, where they are considered inappropriate in the sense that they hinder communication and knowledge sharing among organization members, with lower-level workers suffering the most because they have no authority to make decisions (Agrawal et al., 2020). This is detrimental to the adoption of 4IR technologies as it is the worker who works with the technology, and if they have no input in the decision-making process, then adoption would be difficult. Therefore, we make the following research proposition (RP):

RP1: Lowering the levels of hierarchy within the SME may positively influence the adoption of 4IR technologies in developing countries.

We also observed the use of intergenerational teams within organizations in developed countries, where the young and techno-savvy work together with the old and experienced workers for innovation purposes (Garbellano & Da Veiga, 2019; Surianarayanan & Menkhoff, 2020). This is in line with studies performed on intergenerational teams, whereby findings indicate that age difference, amongst other things, positively affects a firm's innovation activities (Zhu & Kang, 2022). Intergenerational teams leverage diverse skills and experiences for innovation. They facilitate knowledge exchange and offer varied perspectives, enhancing problem solving. However, communication barriers and conflicts in work styles can impede collaboration. Understanding contextual influences, addressing resistance to change and promoting inclusive leadership is vital. While intergenerational teams hold potential, effective management of diverse dynamics is crucial for maximizing innovation outcomes. It is on this basis that we make the following research proposition (RP):

RP2: The use of intergenerational teams within the SME may positively influence the adoption of 4IR technologies in developing countries.

Inter-firm interactions

The findings indicate that SMEs in both developed and developing countries interact with Academia and other SMEs. This is in line with Edquist (2006) who stated that firms do not innovate in isolation but through interactions with other firms to develop and exchange knowledge and resources.

Lundvall (2016) echoes the same sentiments and adds that recent innovation models show that firms interact with suppliers, customers, and knowledge institutions (Academia). On that note, our findings further indicate that SMEs in developed countries are the ones interacting with customers and solution providers. In developing countries, it is noted that there is a lack of interaction between SMEs and customers (De Lucas Ancillo et al., 2022). However, of interest are the Competence Centers noted in developed countries. The role of these Centers is to bring together key actors in the innovation ecosystem, namely Academia, government and private sectors, to support SMEs toward a human-centered implementation of 4IR (Ietto et al., 2022). They are also used by SMEs to acquire 4IR competencies. This has proved to be of influence in the adoption of 4IR technologies in developed countries. While innovation hubs and labs exist in developing countries, they facilitate organic skill transfer through interaction and may not always offer structured learning opportunities tailored to particular technological domains. In contrast, Competence Centers provide a focused approach, offering targeted programs and resources to bridge skill gaps in critical areas, enabling a more directed and accelerated acquisition of specialized knowledge and capabilities necessary for technological development. These centers help address the need for structured skill development, ensuring a more efficient and comprehensive transfer of expertise required to leapfrog technological barriers often faced by developing economies. On that basis, we make the following research proposition (RP):

RP3: Introducing Competence Centers to the innovation systems of developing countries may positively influence the adoption of 4IR technologies by SMEs.

The academic discourse appears to lack an in-depth exploration of the societal dimension within these interactions. Specifically, there is a noticeable gap in examining socio-cultural factors, societal perceptions, digital literacy rates, and cultural attitudes toward technology, and their impact on SMEs' inclination to adopt emerging technologies. Alexander (2021) proposes the cultivation of collaborative co-creation involving industry, civil society, research, and government stakeholders, highlighting the need to address this lacuna in academic discussions.

Role of the government

It appears from the literature that the role of the government is to assist SMEs with funding, incentives, and subsidies. However, we note that this is more prevalent in developed nations (Da Roit & Iannuzzi, 2022, Garbellano et al., 2019) than in developing where even though funding is available, it is insufficient and takes long to access (Serumaga and van der Poll, 2021, Rojas-Berrio et al., 2022), negatively affecting 4IR adoption. This could be because developed countries have finances to support SMEs, which developing countries do not necessarily have.

It also appears that the role of the government includes regulation. There is a plethora of literature that echoes these findings and adds that the role further includes the generation, development, and enforcement of national policies, standards, roadmaps, and strategies as well as creating a legal framework that deals with challenges created by 4IR technologies (Burgess & Connell, 2020; Zervoudi, 2020).

Of interest to note is the lack of digital infrastructure in developing nations. It appears this is a pain point that is negatively affecting the adoption of 4IR technologies by SMEs in developing countries (Serumaga & Van der Poll, 2021). As highlighted by Lundvall (2016), the government needs to build infrastructure to contribute to the technical advancement of a country. Nevertheless, we see countries such as South Africa attempting to mend this issue. The Independent Communications Authority of South Africa (ICASA) concluded the long-standing radio frequency auction in March 2022, releasing spectrum for 5G, for use by 2024 (Business Tech, 2022; ICASA, 2022). This is indicative of high-speed internet technology improvements in the country, which should improve adoption. Therefore, we make the following research proposition (RP):

RP4: The improvement of digital infrastructure by governments in developing countries may positively influence the adoption of 4IR technologies by SMEs.

In the context of developing countries, the government's role should encompass considerations of inclusivity and equity in the adoption of 4IR technologies. However, the existing literature seems to overlook this critical aspect. There is an evident gap in understanding how government policies and strategies are formulated to ensure that the adoption of technology benefits a diverse range of SMEs, particularly those operating in marginalized or underrepresented sectors.

This area warrants exploration to gauge the effectiveness of policies in fostering equitable access and opportunities for technological advancement across different segments of the SME landscape in developing nations.

Funding mechanism

Our findings reveal that government funding is important in encouraging SMEs to adopt 4IR technologies in both developed and developing countries. However, it appears that because of the insufficiency of government funding in developing countries, SMEs tend to approach banks and other external funders, who are also of not much help (Rojas-Berrio et al., 2022).

In developing countries, there tend to be numerous issues that governments must deal with, specifically social issues such as poverty, unemployment, public health, and community development. In South Africa, for instance, these take about 40% of the country's income, while only 10% is allocated to economic development. In developed countries, the same appears to be true. For instance, the USA spends about 60 to 70% of its budget on defense, healthcare, pensions, and welfare (<https://www.usgovernmentspending.com>) while China spends almost half of its budget on defense and about 10% on science and technology (<https://chinapower.csis.org>). However, even though the allocated percentages are somewhat similar, what we notice is that the budgets in developed countries are much larger than in developing countries. For instance, the total 2023 budget in China is \$4 trillion while South Africa is \$0.1 trillion. This means that China can spend a significantly larger amount on technology than South Africa can. Therefore, the following research proposition (RP) is made:

RP5: An increase in the total budget of developing countries may positively influence the adoption of 4IR technologies by SMEs.

R&D systems

Our findings suggest that R&D systems in developed countries exhibited greater strength compared to those in developing nations. This aligns with Alexander's (2021) observations, particularly in South Africa, where the research system presents a mix of strengths and challenges. While it excels in research-related domains, deficiencies emerge in education and research output. Challenges within public research encompass restricted knowledge exchange and insufficient engagement between Academia and businesses. Furthermore, the system lacks interdisciplinary research, and sectoral mobility, and emphasizes practical applications and public education to a lesser extent

Serumaga and Van der Poll (2021) further highlight the lack of government investment as another challenge. The World Bank data shows that developed countries spend a larger portion of their GDP on R&D in comparison with developing countries, as shown in Figure 5.

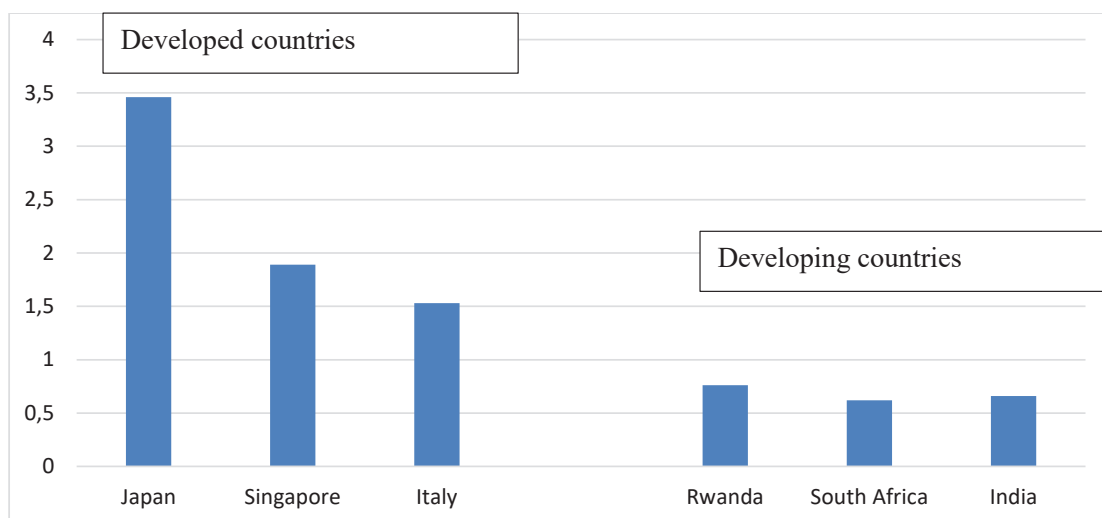


Figure 5. R&D expenditure as a percentage of GDP (developed vs. developing countries)

Source: World Bank (2022).

It can be seen in Figure 5 that developed countries can spend more than 1% of their GDP on R&D while developing countries spend less than 1%. Therefore, similar to Serumaga and Van der Poll (2021), the following research proposition (RP) is made:

RP6: An increased investment in R&D by governments in developing countries may positively influence the adoption of 4IR technologies by SMEs.

Conceptual model

Based on the propositions made in this study, the following conceptual model (Figure 6) is proposed to improve the innovation systems in developing countries and to encourage the adoption of 4IR technologies by SMEs.

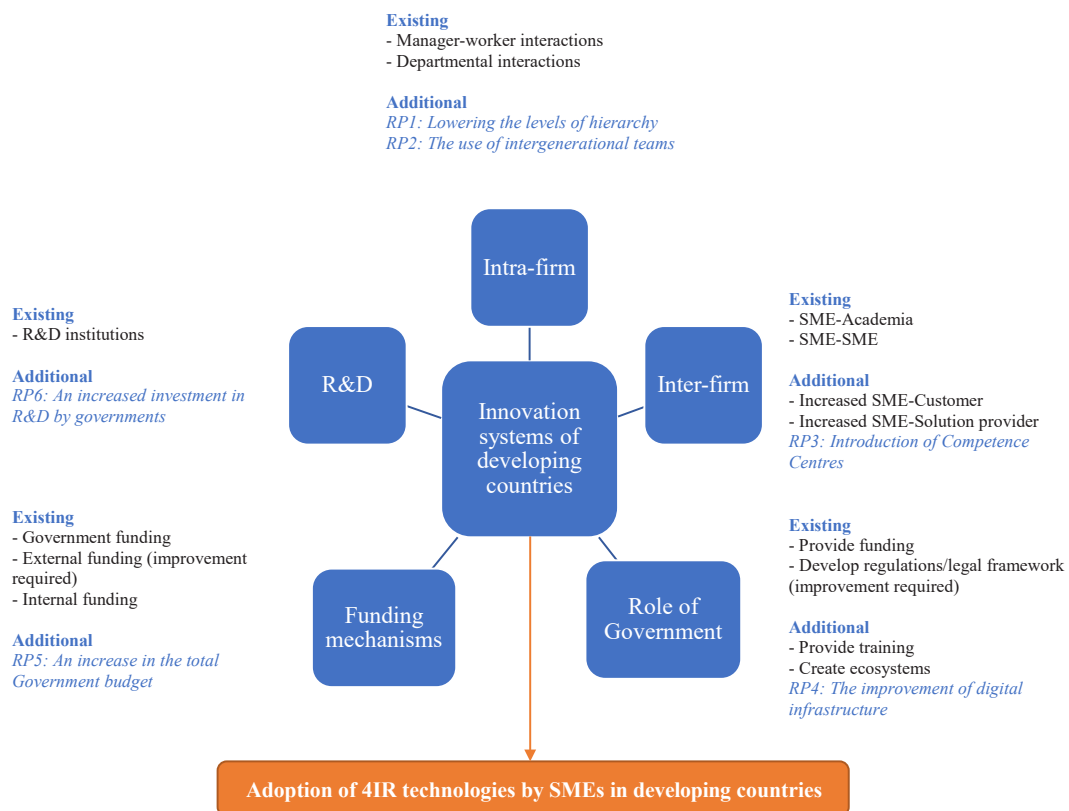


Figure 6. Conceptual model for the innovation system necessary for SMEs' adoption of 4IR technologies in developing countries

CONCLUSION

This study contributes significantly to the field of innovation studies by delving into the comparison of NIS in developed and developing countries. It is concluded that the innovation systems of developed and developing countries are more different than similar. Based on the findings, the intra-firm and inter-firm interactions in developed and developing countries have slight variations. The most significant differences were seen to occur in the funding mechanisms, the role of government, and R&D systems. The differences appear to have their roots in the level of investment made by developed nations vs. developing. Due to the larger budgets that are characteristic of developed countries, it was found that the elements of the innovation systems are stronger than in developing countries. Therefore, several propositions are made that relate to the level of investment and budget allocation.

In terms of practical implications, these findings hold significance for policy development and execution. Policymakers can leverage this study's insights to prioritize intra-firm and inter-firm collaborations, bolster government

support through financial aid and regulatory frameworks, and invest in digital infrastructure and robust R&D systems. The study also presents a conceptual model for innovation systems in developing countries, offering a roadmap for policy formulation. On a theoretical level, this study underscores the pivotal role of intra-firm collaborations, inter-firm relationships, and governmental intervention in shaping innovation systems. It emphasizes the need for further exploration into stakeholder dynamics, hierarchical structures' impact, and the efficacy of diverse funding mechanisms and R&D systems in fostering 4IR technology adoption among SMEs. This suggests a direction for future research aimed at comprehensively understanding the intricate dynamics of innovation ecosystems within different economic landscapes.

It is the opinion of the researcher that to a small degree, the elements of the innovation system limited the reporting of the findings from the literature. A large number of papers mentioned the lack of competencies and digital skills in SMEs, highlighting how this has a significant impact on the adoption of 4IR technologies. The framework does not appear to allow for a discussion around these competencies, except in R&D systems where competencies are referred to in the context of research and development rather than in the adoption and implementation of technology.

Furthermore, the concept of an ecosystem is not clear in the framework and this has hindered the researcher from reporting on aspects of education and the role of Academia in the NIS. In his book, Lundval (2016, pg. 99) notes the national education and training system as “extremely important” but not covered well in the book. He recommends the integration of education with innovation as an aspect to consider for further research. This integration is crucial as it aligns education with the dynamic demands of innovation. Additionally, the collaboration between Academia and industry can facilitate knowledge exchange, research collaboration, and the development of practical solutions. This not only benefits educational institutions by providing real-world relevance to their programs but also empowers SMEs with a workforce well versed in cutting-edge technologies. We recommend the same for future research.

Further research is also essential to explore critical gaps identified in the literature review that could significantly impact SMEs' adoption of 4IR technologies. These gaps encompass socio-cultural elements, societal perspectives, as well as inclusivity and equity. Specifically, investigating how government policies and strategies are crafted to ensure technology adoption benefits a wide array of SMEs, particularly those operating in marginalized or underrepresented sectors, is crucial.

Moreover, it is important to acknowledge the limitations in the data collection. Focusing solely on “4IR technologies” as search terms may have inadvertently excluded relevant papers that discuss similar concepts using different terminology. For instance, some papers may have explicitly mentioned technologies like AI or Blockchain, which fall under the umbrella of 4IR. To address this issue, a broader array of synonymous terms or related keywords should be considered in future research to ensure a more comprehensive scope in the literature review.

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Authorship contribution statement

Lebogang Mosupye-Semenya: The author conducted all aspects of the research, including conceptualization, data collection, analysis, and writing of the manuscript.

Conflicts of interest

The author declares no conflict of interest.

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Social cognitive career theory and higher education students' entrepreneurial intention: The role of perceived educational support and perceived entrepreneurial opportunity

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Abstract

PURPOSE: This study aims to integrate insights from the Socio-Cognitive Career Theory (SCCT) and entrepreneurship literature to develop a research framework of how perceived entrepreneurial opportunities (PEO) and perceived educational support (PES) shape the progression of entrepreneurial self-efficacy (ESE) and entrepreneurial career interests (ECI). Additionally, this study investigates whether ECI mediates the effects of PEO and PES on entrepreneurial intention (EI) and how PEO and PES moderate the effects of ESE and ECI on EI. **METHODOLOGY:** A sample of 888 university students was recruited from Vietnam. Cronbach's alpha and confirmatory factor analyses were adopted to test the reliability and validity of the scales. Structural equation modeling (SEM) is then used to test formulated hypotheses. **FINDINGS:** The current study demonstrates that ESE and ECI directly trigger EI. Although PES and PEO did not directly impact EI, their influence on EI was mediated through ESE and ECI. In addition, PEO was found to act as a positive catalyst for the transformation of ESE and ECI into EI. The greater the entrepreneurial opportunities students perceive, the more likely they are to convert ESE and ECI into intentions to become entrepreneurs. **IMPLICATIONS:** This study makes a significant contribution by emphasizing the relevance of the SCCT framework in understanding entrepreneurship and brings to the forefront the role of PES and PEO in shaping the progression of ESE, ECI and, ultimately, EI. In addition, the findings of this study provide practical implications for nascent entrepreneurs, entrepreneurship educators, and policymakers. **ORIGINALITY AND VALUE:** This study is one of the first to investigate the role of PEO and PES in the development of Vietnamese students' SES, ECI and, ultimately, their intention to engage in entrepreneurship.

Keywords: entrepreneurial intention, social cognitive career theory, perceived educational support, perceived entrepreneurial opportunities, entrepreneurial self-efficacy, entrepreneurial career interests, structural equation modeling, SEM

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INTRODUCTION

In the last few years, there has been a strong interest from entrepreneurship scholars to investigate the drivers of EI, leading to many meta-analyses and systematic literature reviews on the thematic (Donaldson, 2019; Douglas, 2020; Hueso et al., 2020; Liñán & Fayolle, 2015; Meoli et al., 2020; Neves & Brito, 2020; Schlaegel & Koenig, 2014). Based on these compilations, one can see that most of the research relies on two main theories to explain EI: The Entrepreneurial Event Model (EEM) (Shapiro & Sokol, 1982) and the Theory of Planned Behaviour (TPB) (Ajzen, 1991). In one of the latest compilations of research related to EI, Donaldson (2019) concludes that to gain a deeper understanding of the phenomenon, more complex theories should be mobilized just as testing models in more specific contextual situations that interact with the main contributing variables.

Some studies have recently used the Socio-Cognitive Career Theory (SCCT) (Lent et al., 2002) to understand entrepreneurship as a career choice and, more specifically, to study EI (Liguori et al., 2020; Liguori et al., 2018; Tran & Von Korflesch, 2016). SCCT aims to understand how career choices are developed through self-efficacy and outcome expectations, leading to career interest, career intention and choice of actions, in considering the effect of the learning experiences and the contextual factors that could affect the process of career choice. Although very promising in studying entrepreneurial career choice and intention, this theory is silent about the specific nature of entrepreneurship: the role of entrepreneurial opportunities (Davidsson et al., 2019; Sarasvathy et al., 2010; Scheaf et al., 2020; Shane & Venkataraman, 2000). In fact, and surprisingly, the most important theory to study EI, namely TPB (Lortie & Castrogiovanni, 2015; Schlaegel & Koenig, 2014), is also silent about the role of the opportunity to develop the intentions to become an entrepreneur. On the one hand, taking action to become an entrepreneur based on previous intentions requires pursuing an entrepreneurial opportunity (Henríquez-Daza et al., 2019; Schmitt et al., 2018). On the other hand, there is some evidence that the perception of opportunities can interact with self-efficacy and individual characteristics to develop EI (Doanh et al., 2021; Hajizadeh & Zali, 2016; Ko, 2012; Tumasjan & Braun, 2012).

At the same time, entrepreneurship education is also gaining in popularity, with many systematic literature reviews related to its impact on entrepreneurship in general, or on EI and career choice in particular (Ali et al., 2020; Bazan et al., 2020; Brüne & Lutz, 2020; Galvão et al., 2018; Lorz et al., 2013; Nabi et al., 2017; Walsh et al., 2021). As many university students are at the crossroads of their career choice and could potentially start new businesses while they are studying or just after finishing their degree, they constitute a population of interest in understanding how universities can support them to develop this intention and effectively start new ventures. Besides entrepreneurship education in itself, universities can support entrepreneurship through incubators/accelerators, start-up creation support programs, university–industry partnerships and, more globally, inducing an entrepreneurial culture on the campus (Bazan et al., 2019; Walsh et al., 2021). How this support is effective in stimulating EI, and how it interacts with the individual aspects, remain important gaps identified in the literature (Schuhmacher & Thieu, 2020).

This research aims to fill these gaps in our understanding by integrating insights from the SCCT framework and entrepreneurship literature. Specifically, this study developed a research framework to investigate the role of PEO and PES within the university in the development of students' SES, ECI and, ultimately, their intention to engage in entrepreneurship. Additionally, this study investigates whether ECI mediates the effects of PEO and PES on EI and how PEO and PES moderate the effects of ESE and ECI on EI.

With a sample of 888 Vietnamese university students from different faculties, this study used a structural equation model (SEM) to test the research hypotheses. Based on our results, this research contributes to highlighting the relevance of SCCT in entrepreneurship by illustrating how ECI develops upstream to having an EI, and how ESE leads to ECI. Secondly, it contributes to explaining the role of PEO in the process of developing ESE, ECI and EI. This concept appears to be an important missing dimension in models explaining EI.

The next sections will explain the SCCT and the relevant concepts of the study before explaining the hypotheses and presenting the methodology, the results and a discussion about the contributions, the limitations, and the research paths that open for the future.

LITERATURE REVIEW

Social-Cognitive Career Theory and entrepreneurship

Entrepreneurship not only is identified as a career choice, but it is also defined as a process of discovering, evaluating, and exploring entrepreneurial opportunities, by which persons strive to search and produce additional value via new venture creations or other modes of innovation and creativity, referring to the interconnection of opportunities and individuals (Davidsson, 2015; Gartner et al., 2004; Pérez-López et al., 2019). From a psychological aspect, individual behavior is emphasized, and scholars have considered the impact of this behavior on a process of social cognition that individuals employ in building representations of environmental influences, and motivational constructs that influence choice actions (Wang et al., 2019). Social Cognitive Career Theory (SCCT) (Lent & Brown, 2013; Lent et al., 2002), built on Social Cognitive Theory (SCT) (Bandura, 1986) to address how the social influences in which a person is nested complements his/her intention to involve in a certain career and affect this career transition (Lent & Brown, 2013). This theory conceptualizes how environmental influences accompany internal motives in driving a specific decision (Lent & Brown, 2019). According to SCCT, environmental influences can promote task-particular self-efficacy, outcome expectation (motivation), career interests, intention, and career choice as well as performance (Lent & Brown, 2013). Meoli et al. (2020) emphasize that SCCT addresses how a person develops career interest and makes a related career choice decision, allowing us to understand entrepreneurship from a career perspective. Individuals' self-beliefs concerning their ability and capacity to organize and execute specific behaviors, as well as the expected and unexpected results of carrying out those actions, are primarily influenced by that individual's will or intention (Blanco, 2011). Therefore, the SCCT postulates that self-efficacy and interest are precursors of career intentions (Uysal et al., 2022).

Given the growing importance of SCCT in explaining entrepreneurial career choices in various cultural contexts (e.g. Adebusuyi et al., 2022; Pérez-López et al., 2019; Wang et al., 2021), including the higher education context in Vietnam (Duong, 2023a; Duong & Vu, 2023a), this study also aims to investigate the applicability of SCCT to the Vietnamese higher education setting. The SCCT can offer a comprehensive theoretical framework, which helps assess under what conditions a nascent entrepreneur decides to engage in an entrepreneurial career. In the stream of entrepreneurship research, SCCT takes into account the central antecedents of the extended frameworks of EI, such as ESE, entrepreneurial attitudes, or goals (Liguori et al., 2018) and accompanies them with a broad range of start-up components that affect the process followed by persons in considering entrepreneurship as a career choice (Duong, 2021). Indeed, the framework of SCCT highlights the paths in which individuals undergo personal agencies in their process of career development as well as how environmental influencers and motivational antecedents can reinforce or weaken these agencies (Uysal et al., 2022). In the line of entrepreneurship research, generally, scholars believe that the variables of the SCCT are strictly involved in the antecedents forming EI, including ESE (Duong & Le, 2021) and ECI (Segal et al., 2002).

Specifically, we propose that the causal nexus of self-efficacy, expected outcomes, interests, and choice goals within SCCT, influenced by the Vietnamese contextual, personal, and experiential factors, will significantly impact higher education students' EI in Vietnam. Previous studies have demonstrated vocational interests were significantly associated with career intentions (e.g., Chan et al., 2018; Turner et al., 2019) and decisional goals and actions (e.g., Lent et al., 2016). Indeed, Blanco (2011) argues that career interests are statistically predictive of Spanish students' future career intentions, while Chan et al. (2018) reveal that career interests strongly contribute to explaining career intentions among Taiwanese sport management students. Consequently, drawing from prior studies on vocational business venturing interests and intentions as well as considering the unique Vietnamese context (Duong, 2023a; Duong & Vu, 2023a), we posit that positive interests in a future entrepreneurial career (ECI) will emerge as a central determinant in understanding how EI is formed and developed during the initial stages of a person's entrepreneurship career in the Vietnamese higher education context. Thus, the following hypothesis is formulated:

H1: Entrepreneurial career interests (ECI) positively affects entrepreneurial intention (EI).

Self-efficacy, a foundational psychological construct rooted in Bandura's social cognitive theory (Bandura, 2012), delineates an individual's cognitive appraisals of their capability to mobilize motives, cognitive resources, and effective courses of action to exert control over life events. It encapsulates beliefs in one's ability to achieve specific accomplishments. Aligned with Social Cognitive Theory (SCT), individuals shape their attitudes based on expected outcomes, selecting tasks

commensurate with their skills and capacities to confront challenges. ESE, within the entrepreneurial context, is defined as the individual's perceived capability to execute entrepreneurial activities (Burnette et al., 2020; Tsai et al., 2016; Wilson et al., 2007). As posited by SCT, heightened ESE corresponds to a stronger belief in one's ability to succeed as an entrepreneur, consequently fostering intentions to engage in entrepreneurial activities (Nowiński et al., 2020). Noteworthy is the body of evidence demonstrating the pivotal role of ESE in driving EI (Elnadi & Gheith, 2023). In the context of Vietnam, some prior studies also reported that there is a strong correlation between ESE and EI (Duong, 2023b; Duong & Vu, 2023a; Le et al., 2023). Consistent with SCCT, which underscores the role of self-efficacy in shaping career interests (Blanco, 2011; Lent et al., 2016; Scheuermann et al., 2014), we hypothesize a positive correlation between ESE and ECI among university students in Vietnam. This implies that as individuals perceive themselves as more capable of entrepreneurial success, their inclination towards entrepreneurial career pursuits is expected to intensify. Moreover, building on the SCT framework, our second sub-hypothesis posits a positive correlation between ESE and EI among university students in Vietnam. This suggests that heightened entrepreneurial self-efficacy is likely to contribute positively to the formation and intensification of intentions to pursue entrepreneurship as a career path. Thus, the following hypothesis is formulated:

H2: Entrepreneurial self-efficacy (ESE) positively affects (a) entrepreneurial career interests (ECI), and (b) entrepreneurial intention (EI).

Direct, indirect, and moderation effects of perceived educational support and perceived entrepreneurial opportunities

According to SCCT, choice goals and intentions in the entrepreneurial domain are intricately linked to outcome expectations, self-efficacy, and career interests (Lent & Brown, 2008). Of particular importance, Lent et al. (2016) suggest that environmental supports and barriers not only have direct effects on self-efficacy, career interests and intentions, but they also can strengthen or weaken the translations from self-efficacy and career interests into career intentions. In the context of Vietnam, some prior studies also showed that environmental factors either increase or decrease the relationship between entrepreneurial self-efficacy, entrepreneurial intention, and entrepreneurial behavior. For example, Duong (2023a) argued that perceived barriers not only decrease the effect of entrepreneurial intention on action but also negatively moderate the mediation link between entrepreneurial self-efficacy, entrepreneurial intention and entrepreneurial behavior among masters students in Vietnam, whereas Tran et al. (2023) reported that entrepreneurial education can increase the transformation from Vietnamese undergraduate students' entrepreneurial intention to entrepreneurial behaviors.

Existing empirical studies showed evidence that entrepreneurship can be taught through educational programs (Ratten & Usmanij, 2021). Some previous studies tested the value and effects of education programs on EIs (Hassan et al., 2020) at different educational levels, such as primary and secondary schools (e.g., Ni & Ye, 2018; Sánchez, 2013), high schools (e.g., Handayati et al., 2020), and universities/colleges (e.g., Nowiński et al., 2020; Tung et al., 2020). Fayolle et al. (2006) reported that educational programs were instrumental in promoting EIs since they equipped students with the relevant skills, knowledge, and techniques for a business venture, which boosted individuals' motivation for engaging in entrepreneurship.

To support this view, recent studies confirmed that entrepreneurship can be imparted and learnt via training and educational programs (Boubker et al., 2021; Walter & Block, 2016), leading to successful entrepreneurial attempts afterwards and higher business performance (Hoang et al., 2020). Particularly, students who received educational support can have higher EIs (Nowiński et al., 2019; Ratten & Usmanij, 2021). However, the relationship between perceptions of educational support and EIs was not clear when many other scholars claimed that PES was not directly associated with EIs (Iwu et al., 2021; Maheshwari, 2021; Maheshwari & Kha, 2022), and even reduced intentions to become an entrepreneur (e.g., Martin et al., 2013; Sánchez, 2013). Recently, several studies illustrated that perceptions of educational support can increase ESE and ECI (Arifin et al., 2020; Nguyen & Duong, 2021; Shi et al., 2019). This suggests that a supportive educational environment is not only likely to stimulate students' entrepreneurial self-efficacy and interests in pursuing entrepreneurial careers but is also expected to play a constructive role in shaping and strengthening intentions to pursue entrepreneurship as a career path within the specific academic and cultural context of Vietnam. Thus, the following hypothesis is formulated:

H3: Perceived educational support (PES) positively affects (a) entrepreneurial self-efficacy (ESE), (b) entrepreneurial career interests (ECI), and (c) entrepreneurial intention (EI).

Shane and Venkataraman (2000) argue that entrepreneurial opportunities are considered an 'objective' phenomenon that not all people realize, and whose existence relies on personal perceptions. Indeed, Kaish and Gilad (1991) state that "opportunity by definition is unknown until discovered" (p.38). Some persons, therefore, are more alert to adopting and seeking new information instinctively (Mira-Solves et al., 2021), and prospective entrepreneurs who discover entrepreneurial opportunities tend to make analyses and utilize the ability and essential resources to transfer these opportunities into entrepreneurial activities (Alonso et al., 2016). Dutta and Thornhill (2014) assert that entrepreneurs seize entrepreneurial opportunities through a creative process stemming from their efforts and diverse actions, suggesting that entrepreneurial opportunities are created as possibilities through individual analyses and activities. Building on this perspective, we hypothesize that PEO is significantly related to key entrepreneurial career components among university students in Vietnam. Recent studies reported that perceptions of entrepreneurial opportunities act as an important antecedent that contributes to shaping ESE (Henríquez-Daza et al., 2019; Le et al., 2021; Mira-Solves et al., 2021) and EI (Tsai et al., 2016). It is therefore hypothesized that PEO is significantly related to ESE, ECI and EIs among university students in Vietnam. Thus, we proposed the following hypothesis:

H4: Perceived entrepreneurial opportunities (PEO) positively affects (a) entrepreneurial self-efficacy (ESE), (b) entrepreneurial career interests (ECI), and (c) entrepreneurial intention (EI).

Career choice goals and intentions are intricately woven from the threads of outcome expectations, self-efficacy, and career interests/attitudes (Lent & Brown, 2013). The SCCT posits that environmental and contextual factors can act as catalysts or impediments in the development of career attitudes and intentions (Lent et al., 2017). Therefore, based on the lens from SCCT, the paths from self-efficacy and career interests to intention can be reinforced or weakened by contextual influencers (Lent et al., 2016), such as PES and PEO. Examining the cognitive view of entrepreneurship, the translation of individuals' ESE and ECI into EIs can be contingent on the knowledge acquired from educational programs (Shirokova et al., 2016). Individuals, motivated not only by their goals but also by the entrepreneurial knowledge gained through training programs, are inclined to exhibit entrepreneurial behaviors with a practical application in real business life (Hassan et al., 2020). Thus, if these individuals perceive that they receive educational support, they can convert their ESE and initial ECI into intentions to become entrepreneurs. Second, PEO depends on perceived aptitude. Individuals with high perceived aptitude can have higher behavioral controls and outcomes (Tsai et al., 2016). Thus, individuals can transform their ESE and career interests into intentions to become entrepreneurs when they recognize entrepreneurial opportunities (Le et al., 2021). This leads to the next hypotheses:

H5: PES positively moderates the effects of (a) ESE and (b) ECI on EI. As such, the impacts of ESE and ECI become stronger when the level of PES is high.

H6: PEO positively moderates the effects of (a) ESE and (b) ECI on EI. As such, the impacts of ESE and ECI become stronger when the level of PEO is high.

In line with the SCCT framework, self-efficacy and career interests can turn the effects of different antecedents, such as supports and barriers (Lent & Brown, 2019), ability/past performance (Lee et al., 2015) and personality and contextual influences (Lent et al., 2021), into choice goals/intentions. In other words, self-efficacy and career interests can serve as mediators in the links between antecedents and intentions/choice goals within the SCCT framework (Blanco, 2011; Lent et al., 2016; Scheuermann et al., 2014). ESE and ECI therefore can mediate the effects of PEO and PES on EIs. As such, PEO and PES first affect ESE and ECI, and then ESE and ECI transfer these influences on EIs. Recently, several studies illustrated that ESE significantly mediated the effects of precursors on intentions to become entrepreneurs (e.g. Maheshwari, 2021; Nguyen & Duong, 2021; Uysal et al., 2022). Thus, the following hypotheses are formulated.

H7: ESE positively mediates the effects of (a) PEO and (b) PES on EI.

H8: ECI positively mediates the effects of (a) PEO, (b) PES, and (c) ESE on EI.

Figure 1 shows the conceptual framework that will be tested empirically: H7a: PEO -> ESE -> EI; H7b: PES -> ESE -> EI; H8a: PEO -> ECI -> EI; H8b: PES -> ECI -> EI.

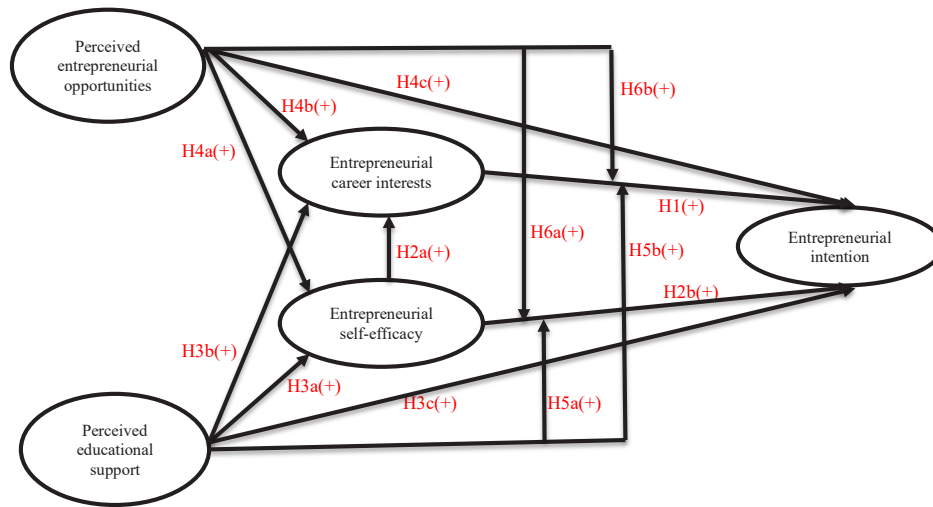


Figure 1. Conceptual framework

METHODOLOGY

Measurement

The measurements of almost all variables in this study were adapted from previous studies. Specifically, *EI* was measured using three items adapted from the study by Fernández-Pérez et al. (2019) and assessed on a seven-point Likert scale. The *ESE* scale was adopted from the study by McGee et al. (2009) and was assessed by asking participants how confident they were in their ability to complete five types of tasks. Respondents indicated their confidence on a scale ranging from 0% to 100%, with increments of 10%. *ECI* was measured using ten items from the scale developed by McNally et al. (2016), using a five-point Likert scale. Respondents are asked to indicate how important these factors are in their entrepreneurial career choice (1= not at all important, 2= a little important, 3= moderately important, 4= somewhat important, and 5= very important). And PES was measured with a six-item scale developed by Saeed et al. (2015), using a five-point Likert scale. In this study, PEO scale was created to be suitable for the research context. It included three items and was assessed by a seven-point Likert scale.

The concept of variables is presented in Table 1.

Table 1. The measurement scale

Variable	Items	Code
Entrepreneurial intention (EI)	I plan to start a new business within 5 years of completing my studies	EI1
	It is one of my career goals to become an entrepreneur	EI2
	I am sure I will start my own business within 5 years of completing my studies.	EI3
Entrepreneurial career interest (ECI)	Not having long working hours	ECI1
	To have fixed working hours	ECI2
	Not to have a stressful job	ECI3
	Independence	ECI4
	To be my own boss	ECI5
	To be able to choose my own work tasks	ECI6
	To create something	ECI7
	To fulfil my creative needs	ECI8
	Improving society to make it better	ECI9
	Improving the environment and ecology	ECI10

Variable	Items	Code
Entrepreneurial self-efficacy (ESE)	Identify new products/services to meet a need	ESE1
	Plan the development and marketing of new products/services	ESE2
	Explain and convince others of your vision or business project	ESE3
	Recruit, train, manage and lead employees	ESE4
	Manage, organize and interpret financial statements	ESE5
Perceived entrepreneurial opportunities (PEO)	There are good start-up opportunities in my area	PEO1
	I identified a business idea that would be a good opportunity for me	PEO2
	I am confident that my business idea would be profitable	PEO3
Perceived entrepreneurial support (PES)	My university offers elective courses on entrepreneurship	PES1
	My university offers project work focused on entrepreneurship	PES2
	My university offers internships focused on entrepreneurship	PES3
	My university offers a bachelor or masters study in entrepreneurship	PES4
	My university arranges conferences/workshops on entrepreneurship	PES5
	My university brings entrepreneurial students in contact with each other	PES6

Sample and data collection

The overall population of this study consists of business and management students in Hanoi. These students are exposed to business and entrepreneurship knowledge within their academic curriculum and should be engaged in extracurricular activities in entrepreneurship. In Hanoi, there are more than 10 general economic universities offering business and management programs. However, entrepreneurship support activities such as extracurricular programs, workshops, orientation sessions, and start up incubators have only been developed in the last 5-6 years, and some universities are still in the early stages of implementing these activities, making it challenging for students to answer questions about entrepreneurship support. Therefore, through preliminary investigation (interviews with program managers), we selected four universities actively involved in entrepreneurship support activities in Hanoi. These are general universities (not vocational or technical ones). Each of these universities enrolls approximately 1000 business and management students annually, resulting in a constant population of around 4000 business and management students (the undergraduate program duration is four years). Entrepreneurship support activities are designed for students with interest and voluntary participation, leading to varying degrees of engagement. Thus, our study sample meets the conditions to test the PES variable.

We conducted a convenient sampling of students based on direct access to classes through personal networks – our colleagues at these universities. Key characteristics of our student population that we identified include gender (male, female), academic year (focused on years 2 and 3 – students with clear career orientation and exposure to the university’s entrepreneurial training), university (those actively involved in entrepreneurship support activities), work experience, and entrepreneurial experience, all of which were considered in the survey sample.

The total number of collected and usable questionnaires for analysis was 888, achieving a response rate of 88.8%. The characteristics of the survey sample are presented in Table 2.

In the collected sample, female students accounted for a higher proportion, at 86.7%, which occurred randomly as a result of the survey approach. An interesting aspect of Hanoi universities is the higher proportion of female students in economic schools (over 60% are female), while technical schools have a majority of male students. Since we surveyed students directly in class, the results show a higher proportion of females than males, reflecting the gender structure. In addition, among respondents, 68.4% were third-year students, 69.9% had part-time work experience, and 35.7% had prior entrepreneurial experience (engaging in small-scale business activities or participating in start-up ventures).

Table 2. Sample demographics (N=888)

Demographic variables		Frequency	%
Gender	Male	118	13.3
	Female	770	86.7
Study years	Second year	281	31.6
	Third year	607	68.4
University	1	241	27.1
	2	177	19.9
	3	237	26.7
	4	233	26.2
Work experience	No experience	267	30.1
	Part-time worker	621	69.9
Entrepreneurial experiences	Yes	317	35.7
	No	571	64.3

Analyses

SPSS 24.0 and AMOS 24.0 software were employed in our research to conduct statistical analyses. Firstly, Cronbach's alpha and confirmatory factor analysis (CFA) were simultaneously utilized to examine the reliability and validity of scales. Secondly, Harman's one-factor test and common latent factor were used to confirm the consistent absence of biasing levels of common method variance (CMV). Finally, structural equation modeling (SEM) was utilized to test the relationships between constructs as well as formulated hypotheses.

RESULTS

Measurement model

The scales used in our study were modified from prior studies, it is, therefore, necessary to examine the reliability and validity of these constructs by utilizing Cronbach's alpha and CFA. Figure 1 illustrates the measurement model, while Table 3 shows the composite reliability and validity of constructs. Cronbach's alpha of scales ranged from 0.785 (PEO) to 0.898 (ESE). Initially, the CFA results reported a poor level of fit indices: $\chi^2(314) = 1809.236$; Chi-square/df=5.762; $p < 0.01$; GFI=0.858 < 0.9; AGFI=0.820 < 0.9; CFI=0.863 < 0.9; TLI=0.846 < 0.9; NFI=0.839 < 0.9 and RMSEA=0.073 < 0.08 (Hu & Bentler, 1999) while standardized regression weights of ECI1 (0.274), ECI2 (0.174), ECI3 (0.271), ECI4 (0.418), ECI5 (0.498), ECI6 (0.437) were much lower than the threshold value of 0.5. Thus, all unsatisfactory items were eliminated from the initial scales, then the CFA was re-performed. Finally, the CFA results illustrated a good level of modeling fitness: $\chi^2(179)=876.697$; Chi-square/df=4.898; $p < 0.01$; GFI=0.911 > 0.9; AGFI=0.885 > 0.8; CFI=0.927 > 0.9; TLI=0.914 > 0.9; NFI=0.910 > 0.9 and RMSEA=0.066 < 0.08 (Anderson & Gerbing, 1988; Hu & Bentler, 1999). Standardized regression weights of all items ranged from 0.564 (PEO1) to 0.874 (ESE2). Table 3 also demonstrated that the composite reliability (CR) of all constructs was higher than the cut-off value of 0.7 while the average variance extract (AVE) of all scales was higher than the threshold value of 0.5 (Henseler et al., 2016). As such, the reliability and validity of the scales were confirmed.

Table 3. Reliability, convergent validity, and discriminant validity

Variable	Code	Mean	SD	λ	α	CR	AVE
Entrepreneurial intention (EI)	EI1	4.13	1.571	0.825	0.842	0.841	0.639
	EI2	4.53	1.549	0.756			
	EI3	4.23	1.609	0.815			
Entrepreneurial career interest (ECI)	ECI7	3.90	0.880	0.760	0.842	0.843	0.574
	ECI8	3.90	0.877	0.797			
	ECI9	3.94	0.866	0.779			
	ECI10	4.00	0.899	0.689			
Entrepreneurial self-efficacy (ESE)	ESE1	5.30	2.082	0.785	0.898	0.900	0.643
	ESE2	4.94	1.936	0.874			
	ESE3	5.02	1.976	0.826			
	ESE4	4.98	2.129	0.774			
	ESE5	5.14	2.151	0.743			
Perceived entrepreneurial opportunities (PEO)	PEO1	4.26	1.465	0.564	0.785	0.794	0.569
	PEO2	4.08	1.502	0.821			
	PEO3	4.25	1.434	0.845			
Perceived entrepreneurial support (PES)	PES1	2.84	1.050	0.630	0.870	0.873	0.535
	PES2	3.13	0.931	0.792			
	PES3	3.10	0.972	0.780			
	PES4	2.89	1.036	0.766			
	PES5	3.31	0.939	0.694			
	PES6	3.19	0.966	0.713			

Common method variance

In order to control for common method variance (CMV), Harman's one-factor test (an unrotated factor solution) was carried out and reported an explained variance of 25.733%, which was much lower than the cut-off value of 50% (Podsakoff et al., 2003). The CFA was also conducted to test Harman's single-factor modelling, the results reported a very poor fitness ($\chi^2(189)=6610.290$; Chi-Square/df=34.975; GFI=0.485; AGFI=0.370; CFI=0.238; TLI=0.253; NFI=0.323; RMSEA=0.196). These results confirmed that the common method bias is not a problem in our study (Jordan & Troth, 2020). To be more evident, the common latent factor was tested, and then, standardized regression weights of all observed variables were compared. The results reported that the difference between these regression weights was very low ($\Delta < 0.2$). Consequently, the common method variance is not a major issue in our dataset.

Hypothesis testing

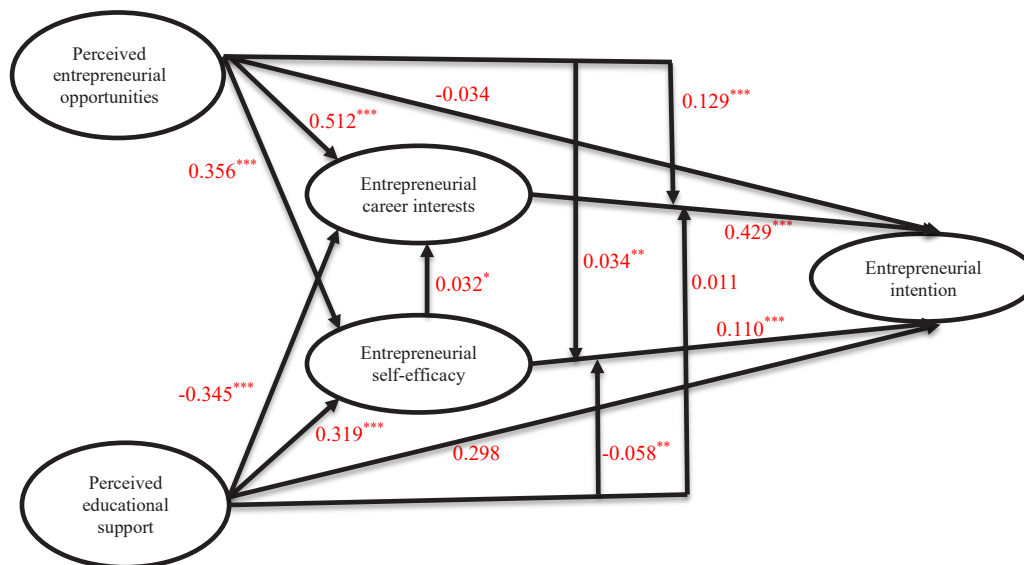
Structural equation modelling (SEM) was utilized to test formulated hypotheses (see Table 4). First, results reported that both ECI ($\gamma=0.429$; p-value < 0.001) and ESE ($\gamma=0.110$; p-value < 0.001) were significantly correlated with EI whereas ESE was found to have an impact on ECI ($\gamma=0.032$; p-value < 0.05). H1, H2a, and H2b were thus supported. Second, perceived education support had a strong and positive effect on ESE ($\gamma=0.319$; p-value < 0.001). However, perceived education support negatively affected ECI ($\gamma=-0.345$; p-value < 0.001) and did not influence EI ($\gamma=0.298$; p-value > 0.05). Consequently, H3a was supported while H3b and H3c were not supported. Third, PEO was significantly and positively associated with ESE ($\gamma=0.356$; p-value < 0.001) and ECI ($\gamma=0.512$; p-value < 0.001), but not with EI ($\gamma=-0.034$; p-value > 0.05). Therefore, while it was supported for H4a and H4b, it was not for H4c.

Table 4. Hypotheses testing results (direct effects)

Hypotheses				Estimate	SE	CR	P-value	Results
H1	ECI	→	EI	0.429	0.090	4.742	***	Supported
H2a	ESE	→	ECI	0.032	0.013	2.500	0.012	Supported
H2b	ESE	→	EI	0.110	0.027	4.139	***	Supported
H3a	PES	→	ESE	0.319	0.074	4.318	***	Supported
H3b	PES	→	ECI	-0.345	0.035	-9.723	***	Not supported
H3c	PES	→	EI	0.298	0.206	1.448	0.148	Not supported
H4a	PEO	→	ESE	0.356	0.044	8.097	***	Supported
H4b	PEO	→	ECI	0.512	0.028	18.298	***	Supported
H4c	PEO	→	EI	-0.034	0.018	-1.855	0.064	Not supported
H5a	PES x ESE	→	EI	-0.058	0.019	-3.092	0.002	Not supported
H5b	PES x ECI	→	EI	0.011	0.027	0.418	0.676	Not supported
H6a	PEO x ESE	→	EI	0.034	0.013	2.635	0.008	Supported
H6b	PEO x ECI	→	EI	0.129	0.014	9.503	***	Supported

Note: N= 888, *** p < 0.001.

Regarding the moderation effects, the link between ECI and EI was not significantly moderated by perceived education support ($\gamma=0.011$; p-value > 0.05), while the link between ESE and EI was negatively moderated by perceived education support ($\gamma=-0.058$; p-value < 0.05), thus H5a and H5b were not supported. Interestingly, the links between ESE, ECI, and EI were significantly moderated by PEO ($\gamma=0.034$; p-value < 0.01; $\gamma=0.129$; p-value < 0.001, respectively). Hence, H6a and H6b were supported.



Note: N= 888. *: p < 0.05; **: p < 0.01; ***: p < 0.001.

Figure 2. The results of direct and moderate effects

PROCESS macro (5000 bootstrap samples and 95% confidence interval) was also approached in our study to test mediation effects (see Table 5). Results revealed that ESE fully mediated the effects of PEO ($\gamma=0.0236$; p-value < 0.05) and perceived education support ($\gamma=0.0610$; p-value < 0.05) on EI. Additionally, ECI fully mediated the impact of PEO on EI ($\gamma=0.0111$; p-value < 0.05), and partially mediated the effect of ESE on EI ($\gamma=0.0146$ p-value < 0.05), yet ECI did not mediate the link between perceived education support and EI ($\gamma=0.0028$; p-value > 0.05). Thus, while H7a, H7b, H8a and H8c were supported by the data, H8b was not.

Table 5. The mediating tests

Hypotheses						Indirect effects	SE	95% confidence interval	
								LLCI	ULCI
H7a	PEO	→	ESE	→	EI	0.0236*	0.0090	0.0167	0.0562
H7b	PES	→	ESE	→	EI	0.0610*	0.0177	0.0307	0.0993
H8a	PEO	→	ECI	→	EI	0.0111*	0.0055	0.0080	0.0429
H8b	PES	→	ECI	→	EI	0.0028	0.0085	-0.0136	0.0210
H8c	ESE	→	ECI	→	EI	0.0146*	0.0051	0.1329	0.2342

Note: N= 888, LLCI: Lower level of confidence interval. ULCI: Upper level of confidence interval. SE: Standard errors. *p < 0.05.

DISCUSSION AND CONCLUSION

Scholars are striving to adopt the SCCT to the entrepreneurial context to explain entrepreneurial career choices (e.g., Adebusuyi et al., 2022; Pérez-López et al., 2019; Uysal et al., 2022). However, almost all previous studies either only consider the direct effects of antecedents on EIs (e.g., Liguori et al., 2018) or ignore the mediation role of ESE and ECI (e.g., Tinoco et al., 2020). Besides testing the direct effects of PEO and PES on EIs, our study examines the moderation effects of these factors on the translations from ESE and ECI into EI. Additionally, the mediating role of ESE and ECI in the links between entrepreneurial opportunities and PES is also tested.

Firstly, we found that ESE and ECI significantly contributed to shaping EI. These findings were consistent with prior studies that adopted the SCCT framework to explain EIs (e.g., Tinoco et al., 2020; Turner et al., 2019). Therefore, our study provides empirical evidence that the SCCT can be effectively utilized to explore EI in the emerging economic context of Vietnam. This result also reflects the fact that to foster entrepreneurial activities, increasing individuals' beliefs related to the ability to create new business ventures and interest in entrepreneurship is necessary.

Secondly, our study reported that while PES significantly increases ESE, it was found to have a negative impact on ECI and have no impact on EI. The positive effect of PES on ESE indicated that when students perceived support from their universities, their confidence in their ability to undertake entrepreneurial tasks was notably strengthened. This finding was in line with previous studies (e.g., Saeed et al., 2015; Bello et al., 2018). However, the unexpected finding that PES negatively affects ECI, implies that when individuals perceive an abundance of support for their entrepreneurial aspirations, it can decrease their enthusiasm and interest in pursuing a career in entrepreneurship. This can be explained by the notion that excessive support could lead to a sense of expectation or conformity, where individuals may feel they have to follow a certain path due to external support, rather than exploring their genuine interests and career aspirations. In addition, unlike our expectations, the results showed that PES did not affect EI. This finding is inconsistent with previous studies (e.g., Sidratulmunthah et al., 2018; Liu et al., 2022).

Thirdly, our study showed that PEO strongly contributes to the formation of ESE and ECI, yet it was not found to directly affect EIs. The positive effects of PEO on ESE and ECI were in line with several previous studies (Henríquez-Daza et al., 2019; Le et al., 2021; Mira-Solves et al., 2021). These findings suggested that individuals' perceptions of the entrepreneurial opportunities in their environment play a substantial role in shaping their confidence in their entrepreneurial abilities and their interest in pursuing a career in entrepreneurship. In contrast, PEO was found to have no impact on EI. This finding was inconsistent with prior studies, such as Hassan et al. (2020) and Mahmood et al. (2019).

Fourthly, it is noteworthy that while PES and PEO did not exhibit a direct impact on EI, their influence on EI was mediated through ESE and ECI. Specifically, PES indirectly affected EI by enhancing ESE, while PEO indirectly increased EI through its effects on both ESE and ECI. These findings implied that PES and PEO first enhance an individual's self-confidence in their ability to undertake entrepreneurial tasks. This boost in self-efficacy then contributes to an increased intention to engage in entrepreneurial activities. In addition to ESE, PEO also positively affects an individual's interest and enthusiasm for pursuing a career in entrepreneurship. This heightened career interest further contributes to an increased intention to engage in entrepreneurial activities.

Finally, this study found that PEO acts as a positive moderator in the effects of ESE and ECI on EI, while PES significantly weakens the translation from ESE to EIs. This means that the greater the entrepreneurial opportunities students perceive, the more likely they are to convert ESE and ECI into intentions to become entrepreneurs. In contrast, when a person perceives higher educational support, the effect of ESE on EI will become weaker. This finding reflects

that, even though educational programs at university can help individuals have high beliefs about their capacities to conduct entrepreneurial activities, the entrepreneurial education program in Vietnam focuses on theoretical perspectives and lacks implications and practices (Hoang et al., 2020) and students feel that entrepreneurial knowledge, which is acquired from the entrepreneurial education program, is difficult to use in real business life. Thus, they can hesitate to transform the initial ESE into EIs. In addition, the interpretation proposes that individuals, especially females, with higher PES and ESE levels may lean towards seeking high-wage employment in corporate environments due to the perceived attractiveness of financial stability, safety, and job security (Duong & Vu, 2023b). This interpretation aligns with existing literature on gendered career choices, where women may prioritize established career paths and financial security over the uncertainties associated with entrepreneurial endeavors. It offers a nuanced understanding of how perceptions and self-efficacy influence career preferences, especially within the context of gender-specific considerations.

In sum, the findings of this research hold particular relevance within the Vietnamese context, offering insights into the intricate dynamics shaping entrepreneurial career components among university students. The nuances of the Vietnamese higher education system, cultural influences, and socio-economic factors contribute to a unique landscape that necessitates careful consideration. The study's validity within the Vietnamese context is supported by the deliberate focus on the experiences of local university students, ensuring the applicability of results to this specific demographic.

Theoretical implications

Our study results make several contributions to the extant entrepreneurship literature. First, this study makes a significant contribution by emphasizing the relevance of the SCCT framework in understanding entrepreneurship. It sheds light on the temporal sequence of factors involved in the development of ECI leading to EI, emphasizing that ECI precedes EI in the entrepreneurial decision-making process. Moreover, it illuminates how ESE plays a crucial role in fostering ECI. Second, this research brings to the forefront the role of PES and PEO in shaping the progression of ESE, ECI and, ultimately, EI. The inclusion of PES and PEO as driving forces in the EI development process fills a notable gap in existing models explaining EI. This expanded understanding underscores the multi-dimensional nature of entrepreneurship.

Practical implications

The findings of this study provide the practical and managerial implications for nascent entrepreneurs, entrepreneurship educators and policymakers, who are responsible for developing and reinforcing the entrepreneurial ecosystem. Indeed, our findings can help recommend national strategies for entrepreneurship for policymakers. Nonetheless, instead of the spread of various solutions, such as stimulating cultural values (Calza et al., 2020), facilitating a more efficient allocation of state funding and capital for ventures (Douglas et al., 2021), using the role models (Nowiński et al., 2019), and so on, our study results recommend a focus on entrepreneurship education programs. This strategy focus will not only help increase ECI and intentions but also help the students recognize entrepreneurial opportunities from business markets. However, it is noticed that this strategy also takes into consideration the pedagogical method of experiential learning and real-life business situations (Cui et al., 2021) as well as increasing extracurricular activities (Nguyen et al., 2021), which can help equip students with the necessary knowledge and ability in real-life entrepreneurship and help them follow their EI.

Limitations of the study and direction for future research

First, in contrast to previous research, this study reveals a nuanced relationship involving PES in the specific context of Vietnam. While PES demonstrates a positive influence on ESE, it surprisingly exerts a negative impact on ECI and does not directly affect EI. This intricate dynamic suggests the need for additional investigations in diverse contexts to fully comprehend the complexities of this phenomenon. Second, it is essential to acknowledge and consider the potential limitation stemming from the over-representation of female students, comprising 86.7% of the study participants. While the proportion mentioned accurately represents the gender distribution of business and management students in Vietnamese economics universities, it also highlights a potential issue. This disparity raises concerns that the research findings may be more reflective of the experiences, perspectives, and behaviors of female students, rather than providing a comprehensive view of the entire student population. Future research endeavours should aim for a more balanced and representative participant composition to ensure a more nuanced and inclusive understanding of the role of PES and PEO in forming EI. Third, while the study contributes valuable insights into the Vietnamese context, caution is advised when

generalizing findings to other contexts. Cultural, economic, and educational variations across different regions and nations may influence the applicability of the observed relationships between variables. Future research endeavors should explore the generalizability of these findings to diverse settings to enhance the robustness and external validity of the study.

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Authorship contribution statement

Duong Cong Doanh: Research Idea, Literature Review, Results Writing. **Van Trang Tran:** Data Collection, Data Analysis, Methodology, Funding Acquisition. **Étienne St-Jean:** Introduction, Conclusion, Review & Editing.

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The authors declare no conflict of interest.

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Entrepreneurial intentions of students from Latvia, Poland, and Ukraine: The role of perceived entrepreneurial education results

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Abstract

Purpose: Our main aim is to establish which factors influence entrepreneurial intentions, with a particular focus on the role of entrepreneurial education and university support in Central and Eastern European countries (CEE). An additional aim is to determine the differences in these perceptions between students from seemingly similar but rather different CEE countries. *Methodology:* We based our study mainly on two theory constructs, namely the entrepreneurial support model (ESM) and entrepreneurial self-efficacy (ESE). Both concepts often appear in research on entrepreneurial intentions, but they are not used together. Moreover, we proposed a new education-related factor – perceived entrepreneurial education results (PEER). To verify hypotheses quantitative research was conducted using surveys among 2,085 first-year undergraduate students from three technical universities in three countries: Latvia, Poland and Ukraine. *Findings:* The results of the study indicate that entrepreneurial self-efficacy, perceived entrepreneurial education results, and perceived educational and relational support all influence the intention of students to launch a venture. The research did not provide support for the hypothesis of an impact of perceived structural support (PSS) on intentions. The impact of perceived educational and relational support appeared to be less important than the impact of ESE and PEER on intentions. Additionally, we identified that there are significant differences between students from the analysed countries. *Implications for theory and practice:* Our research has identified a new factor, not previously used in studies of entrepreneurial intentions, that is, perceived entrepreneurial education results. This new factor can be used in research as a complement to self-efficacy and it refers to hard skills related, in this particular case, to entrepreneurship. The results show the importance of the national context, implying the need to take this into account when modelling support policies at a national level. The findings can be used to remodel how this knowledge is delivered to young people. *Originality and value:* Firstly, we proposed the inclusion of a new education-related component called perceived entrepreneurial education results, which can examine the perceived results of education at any level, in our case, at the secondary school level. Secondly, we showed the stronger influence of factors related to perceptions of one's own skills than perceptions of support from the environment. In addition, we demonstrated that making judgements or recommendations about entrepreneurial support, for rather similar countries, should be considered separately. Furthermore, we conceptualised the three aspects ESE, PEER and ESM in a new way. Finally, we also proved that the role of individual factors varies from country to country, even if the countries belong to the same cultural background and share a similar past experience.

Keywords: entrepreneurial intentions, entrepreneurial education, perceived entrepreneurial support model, entrepreneurial self-efficacy, perceived entrepreneurial educational results, Central and Eastern European Countries, CEE countries, comparative analysis

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INTRODUCTION

Understanding what makes an individual become an entrepreneur is vital to increasing the number of new entrepreneurs. Although a lot of effort has been made to encourage entrepreneurship among people, especially young people, many students who have already graduated from universities do not consider themselves to be entrepreneurial and are not interested in becoming entrepreneurs, thus developing those intentions among young people remains a challenging task (Delanoë-Gueguen & Liñán, 2019). Entrepreneurship is considered to be an intentional behavior; as a consequence, there is a fundamental need to study the reasons why young people choose entrepreneurial careers and how entrepreneurial intentions develop (Napolitano & Riviezzo, 2008; Liñán & Fayolle, 2015).

When looking for factors that shape entrepreneurial intentions, scientists use variables belonging to different categories, most often limiting themselves to one category of factors. According to an analysis of 177 publications conducted by Pérez-Macías, Fernández-Fernández, and Vieites (2022), the share of such research is 54%. Another 36% are studies focusing on a mixture of categories (personal and/or entrepreneurial education and/or institutional and contextual factors), while another 10% are meta-analyses and theoretical articles. Publications that included all three categories (personal and entrepreneurial education and institutional and contextual factors) accounted for only 6 out of 177 articles (3.4%). This is surprising because only a multi-aspect approach to examining entrepreneurial intentions allows for a better diagnosis of the factors influencing it. The fact that few studies are conducted in such a comprehensive way constitutes the research gap that our article fills.

In the pursuit of a better understanding of students' entrepreneurial intentions, we use the theory constructs of Entrepreneurial Self-Efficacy (ESE) (Bandura, 1997) and the Entrepreneurial Support Model (ESM) (Turker & Selcuk, 2009). The influence of ESE on entrepreneurial intentions has been confirmed in many samples, as well as the influence of some aspects of perceived support, from ESM, yet they were not used together in studies. Already representing both the individual category and the institutional category, we have added one more variable, which is related to entrepreneurial education (EE), and we measure the perception of entrepreneurial knowledge gained before entering university.

Turker and Selcuk's ESM is one of the most influential in recent years, according to the systematic literature review by Maheshwari, Kha, and Arokiasamy (2022). ESM views predominantly the influence of contextual factors on entrepreneurial intentions. In this model, entrepreneurial intention is treated "as a function of educational, relational and structural support" (Turker & Selcuk, 2009, p. 142). However, the results of the study conducted by Turker and Selcuk revealed that only educational and structural support factors influence students' EI. ESE is also one of the most frequently and best-studied factors influencing entrepreneurial intentions and almost all studies support its importance (Pérez-Macías et al., 2022). We combined these two elements with perceived educational outcomes. Entrepreneurship education, according to research, is important in shaping entrepreneurial intentions either directly (Feder & Nițu-Antonie, 2017) or indirectly (Camacho-Miñano & del Campo, 2017). The inclusion of these potential determinants in a single study can be considered unique and, so far, unexplored in this way.

Entrepreneurial intentions and their determinants constitute a very well-known relationship (such as ESE and EI) in entrepreneurship research, like a good old marriage. However, we are not only proposing a unique set of determinants but, by referring to the metaphor in the title, we are moving this marriage to a new house, by which we mean the under-researched context of Central and Eastern European countries. The main interest of researchers of intentions was focused on countries with stable market economies (Valliere, 2017). However, more and more papers appear to show the situation in emerging countries (e.g., Pham, Nguyen, Nguyen, Tran, & Nguyen, 2023). Relatively few reports on this topic come from Central and Eastern Europe (Wach & Wojciechowski, 2016; Nowiński, Haddoudb, Lančaričc, Egerovád, & Czeplédie 2019; Gubik 2021). These are countries that have behind them a period of planned economic systems, in which there was no room for entrepreneurship. The entrepreneurial tissue is, therefore, not yet fully developed and perceptions of entrepreneurial action may be distorted by path dependency.

Each country creates an individual entrepreneurial context that includes family, society, business, and institutions (Lin, Rogoff, Foo, & Liu, 2015), as well as the educational system. These elements are the result of historical and cultural conditions and, through stories, anecdotes, jokes, or social models, they influence life decisions made by young people, including those concerning entrepreneurial careers. Cross-country analyses of students' intentions are carried out; however, not so often and seldom in the eastern part of Europe (Liñán & Fayolle, 2015). It turns out that even in countries with similar historical experiences, there are differences in the factors influencing entrepreneurial intentions, as exemplified by research among the Visegrad countries (Czech Republic, Hungary, Poland, and Slovakia) (Nowiński et al., 2019) and

the Iberian Peninsula countries (Spain, Portugal, Andorra, Gibraltar, and a small part of France) (Fernandes, Ferreira, Raposo, Sanchez, & Hernandez–Sanchez, 2020).

Bearing in mind the call for more research in Eastern European countries and the differences among countries from the same cultural and geographical region, we decided to focus on three countries from the same region, with a similar cultural background, and similar, yet not identical, recent history: Latvia, Poland and Ukraine. All three countries underwent a political transformation in the 1990s, building new political, economic, and regulatory systems. However, there is still little information regarding the potential results of this transition. Hence, although all three were dependent on the Soviet Union, the dependence was different. Latvia and Ukraine are former Soviet republics that lost their sovereignty in 1940, regaining it in 1991. Latvia was admitted to the European Union in May 2004. Ukraine, since 2014, has been a country associated with the European Union, waiting to be admitted as a member. Poland functioned as a satellite state, which meant no market economy and a socialist political system. In Poland, however, private ownership was never completely abolished and small artisanal companies survived the period of the centrally planned economy. Poland joined the European Union together with Latvia in 2004. Each of these countries has a slightly different economic and political history, and hence, the attitude to entrepreneurship and its education is different.

Recognizing the research gap of little comprehensive research on entrepreneurial intentions across CEE countries, our aim is to examine the entrepreneurial intentions of students in the realities of CEE countries, taking into account their self-efficacy, perceived external condition and perception of entrepreneurial education results. For this purpose, we questioned 2,085 first-year students from three technical universities from different fields of study. We used correlation, hierarchical regression, and the Kruskal-Wallis test to verify hypotheses. With this study, we make three contributions to the knowledge on entrepreneurial intentions and how this all relates to students. First, we propose a new component called perceived entrepreneurial education results (PEER), which can examine the perceived results of education at any level, in our case, at the secondary school level. Secondly, we prove that ESE, PEER and relational support are good predictors of entrepreneurial intentions. And third, we suggest that despite the similar culture and history in countries from CEE, the impact of factors influencing entrepreneurial intentions may differ.

LITERATURE REVIEW

Entrepreneurship is considered to be a complex process that consists of various phases; one of these phases is the creation of entrepreneurial intentions (Hisrich, 1990). Entrepreneurship is an intentional action and planned behavior (Krueger, Reilly & Carsrud, 2000; Chen, 2014). The preliminary step in developing into an entrepreneur is the fact that a person shows a particular level of entrepreneurial intentions (Bird, 1988). In many different domains, intentions are key to understanding predecessors, correlates, and consequences of intentional behavior (Ajzen & Fishbein, 1977; Ajzen, 2002). This reasoning is also the basis of the Theory of Planned Behaviour proposed by Ajzen and it is often used in the study of entrepreneurial intentions (Doanh, 2021; Baharuddin & Rahman, 2021).

Individuals will initiate entrepreneurship if they indicate a satisfactory level of entrepreneurial intentions. In general, intentions arise somewhat in connection with a sense of the ability to perform certain activities. In the context of entrepreneurship, the intention to start a business is about feeling that the person can carry out the process efficiently, which means that self-efficacy plays an important role in this process. The traditional understanding of self-efficacy, in accordance with the definition of Bandura, is that it is dictated by situational requirements and is domain-specific (Bandura, 1997). People with high self-esteem for a particular job are more likely to both seek and persist in this job (Shane, Locke & Collins, 2003). This is due to the fact that self-efficacy helps people reduce interference and focus on the task (Kanfer & Ackerman, 1996; Bandura, 1997). Boyd and Vozikis (1994) observed that people, even if they perceive social appreciation for particular behavior, may not act because their self-efficacy for a particular task is low. Moreover, ESE moderates the relationship between entrepreneurial education and intentions, which was confirmed in research in the Visegrad countries (Nowiński et al., 2019), as well as in other countries.

Entrepreneurial education at the university level takes place primarily in the fields of business and economics and, to a much lesser extent, in the other fields. Therefore, some studies of entrepreneurial intentions analyze the impact of the field of study, assessing the extent to which the content transmitted during studies, mainly business, influenced entrepreneurial intentions. The analysis of opportunity perception in relation to the field of study (STEM versus business) did not reveal significant differences (Dilli & Westerhuis, 2018), yet research conducted on samples diverse in terms of the field of study is scarce (Teixeira & Forte, 2017). However, the relationship between the choice of field of study and entrepreneurial

intentions is not examined. It can be assumed that young people thinking about starting their own business will choose such fields of study. Therefore, we expect that the chosen field of study can explain the level of entrepreneurial intentions, as new business students should manifest higher EI than other students. As a consequence, we hypothesize that:

H1: The chosen field of study (STEM or business) has an impact on entrepreneurial intentions.

When entering university, young people already have some basic business and economic knowledge, both formal (high school education) and informal (news, observation, etc.). Entrepreneurship education, or education with an entrepreneurial element, is offered at the secondary level in many European countries (Eurydice Report, 2018). Business knowledge can also be acquired by young people during extracurricular activities, e.g. in youth organizations or in social activities in or outside the school. Early exposure to entrepreneurial knowledge fosters later entrepreneurial intentions (Huber, Sloof & Van Praag, 2014), and could lead to more efficient entrepreneurial education at the university level (Nowiński et al., 2019). It also favors the establishment of companies, as proved by Elert, Wennberg, and Sjöö (2020), following 9,731 Swedish pupils who participated in entrepreneurship courses in the mid-1990s. The effect of education at the high school level can be both entrepreneurial intentions and a change in entrepreneurial attitude (Martinez, 2022). Entrepreneurial knowledge not only directly affects entrepreneurial intentions, but also shapes personal attitudes and Perceived Social Norms (Wach & Głodowska, 2019), which has been proven in research conducted in Poland. It should be assumed that when they start their studies, young people already have some knowledge about entrepreneurship, both from high school and from observations of economic life or experience related to seasonal work. Even if this knowledge is incomplete, it will serve as the basis for further entrepreneurial education, during studies.

When examining the entrepreneurial intentions of students, the knowledge acquired at the earlier stages of education is not analyzed. Recognizing this gap, we propose to introduce this component to research on student intentions, and call it Perceived Entrepreneurial Education Results (PEER). PEER refers to the hard skills related to the purely technical aspects of starting and running a business, such as business planning and management. ESE promotes opportunity recognition and evaluation, while PEER can confirm the belief that a given person will cope with the challenges of starting a business. Consequently, the following hypotheses are proposed:

H2: Entrepreneurial self-efficacy has an impact on entrepreneurial intentions.

H3: Perceived entrepreneurial education results (PEER) have an impact on entrepreneurial intentions.

However, young people do not function in a vacuum. They are surrounded by family and loved ones, they are shaped by the university environment, and finally, their decisions can be influenced by the general regulatory and economic environment of a given country. Boter and Lundström (2005) argued that entrepreneurial support should provide motivation for people to start their entrepreneurial career, provide good opportunities to develop start-ups, and offer support structures for potential entrepreneurs to teach them the necessary skills and convey important information. To investigate the influence of these contextual factors, Turker and Selcuk (2009) developed the Entrepreneurial Support Model (ESM), which included perceived relational, educational and structural support. Their first study revealed that only perceived educational and structural support were significant predictors of students' entrepreneurial intentions, while perceived relational support was not statistically significant.

Educational support is the first dimension of the model. It is clear that acquiring professional education at universities is an effective way of receiving the necessary knowledge about entrepreneurship. There are many studies confirming the importance of entrepreneurial education, an example of which is a meta-analysis of 73 studies conducted by Bae, Qian, Miao, and Fiet (2014). The positive significant relationship between entrepreneurship education and entrepreneurial intentions, mediated by self-efficacy, is confirmed in the study of Nowiński et al. (2019). Entrepreneurial education affects EI by increasing self-efficacy but also by changing the attitude towards entrepreneurship (Yousaf, Ali, Ahmed, Usman, & Sameer, 2021). The more substantively prepared students feel, the higher their intentions to start a business (Pinto Borges, 2021). And although there are studies that indicate that entrepreneurial intentions become more realistic as a result of entrepreneurial education, and that they are reduced, the research results that confirm their positive influence predominate (Pérez-Macías et al., 2022).

Entrepreneurial education, however, is not offered to students in all fields of study to the same extent. In such a case, when starting studies at a university, in a field not related to business, students can only rely on knowledge they gained from high school. On the other hand, university support should not be limited only to education (non-cognitive support), because this may paradoxically lead to lower entrepreneurial intentions, as indicated above. For those who do not participate in business studies, targeted cognitive support (Kraaijenbrink, Bos & Groen, 2010) is equally important. Entrepreneurial exposure also plays an important role (Gulzar & Fayaz, 2021), which, through role models, influences entrepreneurial intentions and motivations (Brunel, Laviolette & Radu-Lefebvre, 2017). Both positive and negative examples of graduate careers, as well as publicizing the success of students who set up their start-ups, help to build motivation and make students believe that entrepreneurship can be a good career choice, and running a company is not that difficult. This type of cognitive nature support (Trivedi, 2016) is of great importance, strengthening target non-cognitive support (seed funding, start-up programs, etc.). And perhaps this will also reduce the number of people who, having only received knowledge about running a business, abandon the intention of starting it for fear of failure. Some young people's relationship with their university ends after three years of study, which is why such support should be available for students already from the very beginning of their education process at university.

The second dimension of the model is *relational support*. Turker and Selcuk (2008) took into account family background as a factor influencing entrepreneurial intentions. Families are considered as an important source of psychological support (Renzulli, Aldrich & Moody, 2000), background experience, and motivation to engage in entrepreneurial activities (Laspita, Breugst, Heblich, & Patzelt, 2012; Lingappa, Shah & Mathew, 2020), financing at the beginning of launching a business (Steier, 2003), tutoring (Sullivan, 2000), knowledge and connections (Steier, 2007; Newbert, Tornikoski & Quigley, 2013; Gronhoj, & Thogersen, 2017; Georgescu & Herman, 2020). Not only do families play an important role in the development of young people's entrepreneurial intentions, but also social relations and networks (Pérez-Macías et al., 2019). Belonging to social networks helps in obtaining information and strengthens the sense of being able to gain support (Twum, Kwakwa, Ofori, & Nkukporu, 2021). A friend who is involved in any business can act as a role model (Keat, Selvarajah & Meyer, 2011; Lingappa et al., 2020), and is a trustworthy source of advice (Robson & Bennet, 2000). Therefore, the influence of friends can also affect the decisions of students to become entrepreneurs (Nanda & Sorensen, 2008). In the socialist/communist period in CEE countries, ties, acquaintances, contacts and informal economic relations were significant (Polese & Rodgers, 2012). We can, therefore, expect that relational support is perceived to be very important, even among younger members of CEE societies.

Structural support is the last dimension in the entrepreneurial support model. People live in a wider context of cultural, social, economic, political, and technological factors (Turker & Selcuk, 2009). The present context of entrepreneurship is mostly shaped by political and economic mechanisms governed by private, public, and non-governmental segments (Urbano, Aparicio & Audretsch, 2019). The Global Entrepreneurship Monitor (2021) report emphasizes the importance of an institutional environment and supportive culture for the growth of entrepreneurs. However, the impact of structural support on entrepreneurial intentions can be seen as a controversial issue. A deeper analysis of the Global Entrepreneurship Monitor results from 22 European countries did not confirm the relationship between perceived government support and entrepreneurial intentions (Teixeira, Casteleiro, Rodrigues, & Guerra, 2018). On the other hand, perceived structural support may have a positive impact on the attitude towards entrepreneurship and, at the same time, a negative one on entrepreneurial intentions (Trang & Doanh, 2019).

Despite many studies on the role of support in shaping entrepreneurial intentions, there are still ambiguities (Pérez-Macías et al. 2022), which we diagnosed as a research gap, especially in the context of CEE countries, and which prompted us to put forward the following hypothesis:

H4: Entrepreneurial intentions are influenced by perceived entrepreneurial support in the form of: H4a. Relational support, H4b. Educational support, and H4c. Structural support.

Latvia, Poland, and Ukraine context

More and more research on factors influencing entrepreneurial intentions is being conducted on samples from different countries, allowing for cross-country comparisons (Liñán & Fayolle, 2015; Beynon, Jones, Pickernell, & Maas, 2020). Researchers look for countries representative of different cultures (Engle, 2010; Nowiński, Mohamed, Wach, & Schaefer, 2020; Litzky, Winkel, Hance, & Howell, 2020) or countries with different economic levels (Iakovleva, Kolvereid &

Stephan, 2011). There are also studies covering almost all countries, such as the Global Entrepreneurship Monitor or GUESS, but participation in them depends on the activity of local researchers and the results do not allow full freedom of comparison.

The vast majority of cross-country research is based on Ajzen's theory, confirming the relationship between personal attitude, perceived behavioral control, and entrepreneurial intentions (Liñán & Fayolle, 2015; Gorgievski, Stephan, Laguna, & Moriano, 2018; Stabingis & Raupelienė, 2023). Comparative research is also carried out on ESE and individual elements of ESM. Regardless of the country of research, ESE is always in the first place among the factors shaping EI (Pérez-Macías et al., 2022).

When analyzing the perception of the impact of the environment on entrepreneurial intentions, researchers most often focus on one element of ESM as part of cross-country research. This only allows us to obtain information about one section of the relationship between the perception of structural, educational and relational support and EI. An example of such a study is the analysis of the perceived university environment and support factors among students of India, Singapore, and Malaysia, which showed differences, with the highest values for Malaysia (Trivedi, 2016). Relational support was not the subject of this research.

The analysis of the impact of personal attitude, social environment, closed personal environment, society's opinion, and university impact on EI in Estonia, Finland, Lithuania, Poland, and Sweden showed the lowest impact of the latter (Stabingis & Raupelienė, 2023). However, further comparisons between countries showed no significance of perceived university impact in Lithuania, Finland, and Sweden, and among the other two countries, Poland had a higher rate compared to Estonia. Besides contributions relevant to the development of theory, this study can also contribute to the understanding of factors influencing entrepreneurial intentions in what is still a novel context. Referring to the metaphor used in the title of this article, we place the old marriage of EI and its determinants in a new house, namely the Central and Eastern European research area. Few studies are carried out in CEE countries (Lesinskis, Carvalho, Mavlutova, & Dias, 2022), and descriptions of comparative research conducted in these countries are still lacking. We see insufficient research in CEE as a research gap that our article fills, answering the call to analyze entrepreneurship in various regions of the world in order to obtain a clearer picture (e.g., Valliere, 2017).

Our research was carried out in three countries not compared so far, which have been operating on the basis of market economy principles only since the 1990s. This means that the environment influencing the entrepreneurial attitudes of young people, and above all, their entrepreneurial intentions, has existed for a short time. Recently, entrepreneurial activities have been gaining social acceptance and have begun to function in social awareness as a potential type of professional career. The Global Entrepreneurship Monitor (GEM) allows the level of entrepreneurial intentions in individual countries to be estimated, but this applies to the intentions of the entire population and, unfortunately, there is no data for Ukraine. Looking at the data for Latvia and Poland from the 2017/2018 GEM (the year before our study), there was a higher level of intentions in Latvia (27th out of 54 countries surveyed in the world) than in Poland (44th out of 54) (Global Entrepreneurial Monitor, 2018). Ukraine does not participate in this study, so there is no comparative value for this country.

Poland and Latvia are countries ranking above the European average when it comes to the participation of young people aged 15-24 in entrepreneurship classes (Eurydice Report, 2018). Ukraine, as a country outside the European Union, did not participate in these studies. An analysis of entrepreneurship teaching programs at the secondary school level shows large differences in the content provided. Thus, for example, content related to attitudes to entrepreneurship (self-confidence and a sense of initiative) is present in Polish programs but not in Latvia anymore. Polish programs also cover, to a greater extent, such issues as entrepreneurial skills and entrepreneurial knowledge (Eurydice Report, 2018).

According to the World Bank report, education in Ukraine, especially at the university level, does not meet the modern needs of the economy (Cheney, Zolotarev & Wyne, 2017). A very high level of education in mathematics and science is displayed, but there is a lack of cooperation with the economic environment. The discussion about introducing entrepreneurial content has begun. Nevertheless, there are concerns regarding the success of this project due to staff shortages, rigid regulations and "conservatism typical of the post-soviet system of education with mimicry and pseudo-reforming" (Korzhov & Pasko, 2020). However, the introduction of entrepreneurial education is not the only challenge; this education should be adapted to modern requirements and supported by educational activities, which is also beginning to be noticed in Ukraine (Stavytskyi, Dluhopolskyi, Kharlamova, Karpuk, & Osetskyi, 2020). Therefore, we believe that perceived entrepreneurial education results would be different in these three countries, and analyzing the data above, we expect the highest value of this factor in Poland. The shortage of educational programs at the university level in Ukraine,

in view of the barriers to introducing these programs, presented above, leads us to assume that Ukrainian universities do not conduct cognitive activities supporting students in choosing an entrepreneurial career path.

The small number of studies devoted specifically to support from the family in the process of entrepreneurial intentions has also translated into a lack of research on this subject conducted in the three countries of interest to us, and it can be concluded that this is another research gap worth filling. Certainly, the socialist/communist doctrine prevailing in the past has left its mark on the role of the family in the Eastern Bloc, especially with regard to the ties that prevail in families. However, we expect some differences in perceived relational support.

We expect that students perceived the differences in structural support in the investigated countries. The data from Doing Business indicate the 19th and 40th place, respectively, for Latvia and Poland in terms of ease of doing business (World Bank Group, 2020). However, Ukraine underwent a tremendous improvement, coming second in the world in terms of growth rate in the Doing Business ranking since 2009; and since 2014, it has risen by 41 places in the ranking. Despite the seemingly many existing similarities resulting from their common traditions, geographic region, or turbulent history, with periods of independence, occupation, and border changes, Latvia, Poland, and Ukraine actually differ in many aspects of their socio-economic reality.

In view of the differences described above, we believe that there will be differences between countries in the entrepreneurial intentions of young people and in the factors influencing these intentions. These differences may result from the fact that although all of them have been operating under the conditions of a market economy since the 1990s, they operated under different conditions before that period. Ukraine was exposed to central planning for the longest time (excluding the western(?) territories belonging to Poland before WWII). Poland did not lose its statehood and could enjoy relative freedoms, also in the context of small private activities, which the authorities allowed to a small margin (Korzhoze & Pasko, 2020).

On the other hand, Latvia is a relatively small country; without a quick transformation and openness to European economies, it would be difficult to obtain an adequate standard of living for its citizens. Additionally, Latvia and Poland are part of the European Union, while Ukraine is still waiting to be. With all this in mind, the objective of this research is to determine whether there are similarities or differences in the studied entrepreneurial variables. Consequently, we proposed the following hypotheses:

H5. There are differences between students from Latvia, Poland and Ukraine in their: H5a. Entrepreneurial self-efficacy, H5b. Perceived entrepreneurial education results, H5c. Perceived relational support, H5d. Perceived educational support, H5e. Perceived structural support, and H5f. Entrepreneurial intentions.

Based on the literature review, research hypotheses were formulated on the relationships between the mentioned potential determinants of intentions adopted in the context of predicted entrepreneurial intentions. We conceptualized these factors in a unique form that has not been used in previous studies.

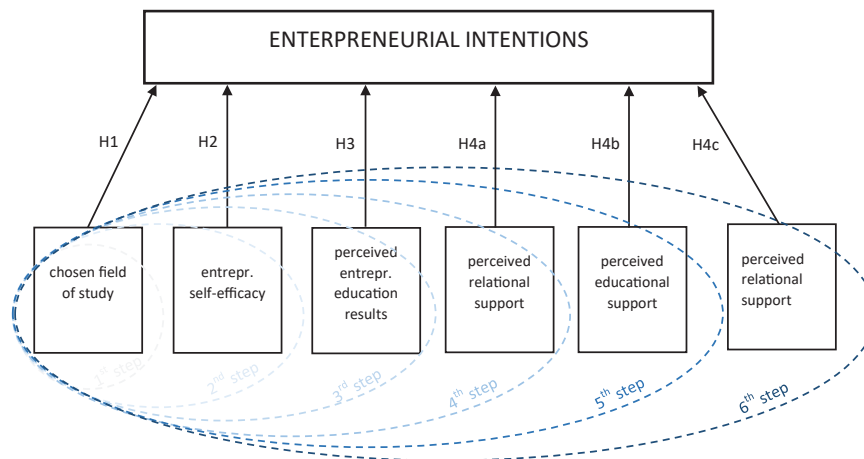


Figure 1. Research model

The graphical representation of our research proposal is the model (Figure 1), where EI and its predictors are placed in individual rectangles, while the arrows indicate particular hypotheses that will be verified in the subsequent steps during the hierarchical regression analysis.

METHODOLOGY

The study was part of the SEAS Project (Survey on Entrepreneurial Attitudes of Students), which has been an ongoing project at the Faculty of Management and Economics, GUT, since 2008. The 2019 edition, for the first time, became an international one. The sample population comprised 2,095 first-year undergraduate students from three technical universities: Gdansk University of Technology (GUT), Poland ($n=1,016$), Lviv Polytechnic National University (LPNU), Ukraine ($n=718$), Riga Technical University (RTU), Latvia ($n=361$). The research was carried out before the Russian invasion of Ukraine. Of the participants, 79.5% were STEM students (854 from GUT, 538 from LPNU, and 266 from RTU), and 20.5% represented the Business and Management field (162 from GUT, 180 from LPNU, and 95 from RTU). The survey was conducted during normal lectures and seminars. All the students who were present received a questionnaire in a paper version.

Entrepreneurial intentions were measured with five items based on Liñán and Chen (2009). A five-point Likert scale was used. Principal component analysis indicated that all statements loaded on a single factor. The item explained 73.38% of the variance. Cronbach's alpha level reached 0.91. A single score indicating the level of Entrepreneurial Intentions was computed for each participant by averaging the answers to five items. Entrepreneurial Self-Efficacy was assessed using five items derived from Wilson, Kickul, and Marlino (2007). The ESE scale was used to measure the students' perceptions of their ability to perform instrumental functions of the entrepreneurial life cycle. For each statement, they rated their level of confidence on a five-point Likert scale (1 = "no confidence," 5 = "complete confidence"). Representative items are "I can come up with a unique idea for a business" and "I can grow a successful business." The principal component method was applied. The item explained 61.98% of the variance, and Cronbach's alpha for the ESE scale was 0.85.

Perceived Entrepreneurial Education Results were measured using five items derived from Cox, Mueller, and Moss (2002). Again, a five-point Likert scale was used. Principal component analysis indicated that all statements loaded on a single factor. The item explained 60.25% of the variance. Cronbach's alpha level reached 0.82. A single score indicating the level of perceived entrepreneurial education results was computed for each participant by averaging the answers to five items. Representative items are "I can plan a new business" and "I can manage a small business." Perceived Entrepreneurial Support was measured using nine items in three categories: perceived relational, educational, and structural support. Students were asked to indicate their level of agreement with each of the statements using a five-point Likert scale.

Exploratory factor analysis was conducted to determine the structure of the scale. The principal component method was used. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.72, above the commonly recommended value of 0.60, and Bartlett's test of sphericity was significant $\chi^2(36) = 6084.03$, $p < 0.001$. The Kaiser criterion was applied to determine the number of factors, based on which it was determined that three factors should be selected. In total, these factors explain 68.92% of the variance. After the analysis of the factors with the Varimax orthogonal rotation method, it was found that the first factor was composed of two items, intended to measure relational support. The factor loadings of both of these items were 0.89. The second factor consisted of three items that were intended to measure perceived educational support. The factor loadings of these items were 0.78, 0.88 and 0.89, respectively. The last factor consisted of four items. They were intended to measure perceived structural support. The factor loadings of these items were 0.46, 0.82, 0.87, and 0.77, respectively. No cross-loadings were observed. The three identified factors followed the expected structure and the following reliability levels were obtained (Cronbach's alpha coefficient was computed): 0.83 for educational support, 0.77 for relational support, and 0.74 for structural support. Composite scores (mean values) for each of the factors were computed.

Data management included the following steps: checking for coding mistakes and if the minimum and maximum values were in a range to control the data for accuracy, inspecting cases with missing values above the traditional limit of 10% to clean the dataset, examining reliability levels of results (Cronbach's alpha internal consistency for multi-item indices) obtained in the sample ($n=2095$), which indicated an acceptable level as it is more than the threshold value of 0.70 (Pallant, 2001, p. 85), checking for univariate normality of all items using standard guidelines (i.e., skewness > 3 and kurtosis > 9) (Schivinski, Langaro & Shaw, 2019); the absolute values of skewness of the observed variables in our study are within the range of 0.04 to 1.02 and the absolute values of kurtosis are in the range of 0.24 to 1.5.

RESULTS

In Table 1, we present the descriptive statistics of our measures together with the Cronbach results obtained in the sample (n=2095). Cronbach's alpha reliabilities range from 0.74 to 0.91. Reliabilities are satisfactory for all variables as they are above the recommended level. In order to examine relationships between variables that are of interest in this study, correlations between them were computed.

Table 1. Descriptive statistics

	Alpha	Mean	Std. Dev.
Entrepreneurial intentions	0.91	3.16	1.01
Entrepreneurial self-efficacy	0.85	3.08	0.87
Perceived entrepreneurial education results	0.82	3.02	0.87
Perceived relational support	0.77	4.22	0.73
Perceived educational support	0.83	3.01	0.92
Perceived structural support	0.74	2.80	0.70

Table 2 presents the pairwise correlation coefficient of the variables used in the study. To examine the hypotheses in this study, hierarchical regression analysis was used, as we believe it is particularly relevant in the context of studying entrepreneurial intentions. This approach allowed us a step-by-step analysis of how various factors such as personal characteristics, education and environmental influences incrementally affect the formation of entrepreneurial intentions. The methodology fits well with the multifaceted nature of research on entrepreneurial intentions, in which different layers of influences interact. It offers a structured way to analyze these complex relationships, as emphasized in entrepreneurship research (e.g., Krueger et al., 2000). The initial steps in the analysis process included evaluating the assumptions for hierarchical multiple regression subsequent models. All the relationships between the dependent variable (EI) and the independent variables are significant. The perceived support factors, such as perceived relational, educational and structural support, have a positive inclination towards entrepreneurship. Entrepreneurial self-efficacy and perceived entrepreneurial education results are also positively related to the students' entrepreneurial intentions. Nineteen out of the twenty-one correlations were positive and significant. The results indicate that there is no multicollinearity problem, as pairwise Spearman Correlation coefficients are below the threshold value of 0.8 (Gujarati, 2003: 359) with one case of slightly above 0.8. Additionally, the no autocorrelation assumption is not violated as the Durbin-Watson statistic value lies between 1 and 3, namely $1 < 1.906 < 3$, and multicollinearity is not an issue according to VIF, which is widely employed to eliminate multicollinearity (Hair, Black, Babin & Anderson, 2010). All the VIF values of all the variables are below the recommended level of 5 (exceeded 1, but below 3.063). Moreover, we investigated the statistics of standardized residuals and excluded ten observations because their values were above and beyond the recommended range between -3.0 and 3.0.

Table 2. Correlation matrix

	EI	Field of study	ESE	PEER	PRS	PES	PSS
Entrepreneurial intentions	1						
Field of study	0.118**	1					
Entrepreneurial self-efficacy	0.552**	0.055**	1				
Perceived entrepreneurial education results	0.556**	0.087**	0.816**	1			
Perceived relational support	0.192**	0.034	0.159**	0.132**	1		
Perceived educational support	0.256**	0.201**	0.203**	0.241**	0.152**	1	
Perceived structural support	0.115**	0.034	0.112**	0.133**	0.057**	0.318**	1

Note**. Correlation is significant at the 0.01 level (2-tailed).

The hierarchical regression analysis was structured to add predictors incrementally across six models, examining their impact on entrepreneurial intentions.

Firstly, the field of studies was entered (Model 1 in Table 3). Thus, ESE was entered in Model 2, perceived entrepreneurial education results was added in Model 3, perceived relational support in Model 4, perceived educational support in Model 5, and finally, perceived structural support in Model 6 (Table 3). Each of these predictors was introduced in an order from factors most directly related to the individual to more external and contextual aspects. The field of study is often seen as a fundamental factor that shapes the development of skills, attitudes, and professional orientations of students. In the context of entrepreneurship, choosing between STEM and business fields may reflect different approaches to innovation, creativity, and risk, key for entrepreneurship (Bae et al., 2014). Then the further order was as follows: individual beliefs (ESE), followed by interpretation of educational experiences (PEER), and then the external ecosystem of support (relational, educational, structural). This sequence was based on the theory that individual cognitive processes and interpretations precede the influence of external factors on entrepreneurial intentions (Klyver & Grant, 2010). The objective was to explore whether these components contribute to the explanation of the variance of the criterion variable over and beyond one another. Additionally, control variables for universities affiliation were included as dummy variables to account for potential variability associated with different institutions.

The F Change value is not statistically significant ($p > 0.1$) only in the sixth model. Table 2 presents the standardized regression coefficients, R^2 , change R^2 , and F Change value.

Table 3. Hierarchical regression results (criterion variable: entrepreneurial intentions)

Predictors	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Field of study (STEM=0; Business = 1)	0.22***	0.19***	0.16***	0.15***	0.12**	0.12**
Entrepreneurial self-efficacy		0.59***	0.34***	0.32***	0.32***	0.32***
Perceived entrepreneurial education results			0.32***	0.32***	0.30***	0.30***
Perceived relational support				0.15***	0.14***	0.14***
Perceived educational support					0.09***	0.09***
Perceived structural support						0.02
University dummies	Included	Included	Included	Included	Included	Included
R^2	0.098	0.331	0.356	0.368	0.375	0.375
ΔR^2		0.233	0.025	0.012	0.006	0.0
ΔF		724.92***	80.88***	40.21***	21.81***	1.05

Note: $n=2085$, standardized regression coefficients (β) are presented in the table. *** $p < 0.001$; ** $p < 0.01$. This table presents the results of hierarchical linear regression analysis, taking into account clustered robust errors, clustered at the university level. Dummy variables for the universities were included in each model to control for variability associated with different institutions. In each subsequent model, additional predictors were added.

The results showed that Model 1, including only the field of study and university dummy variables, explained 9.78% of the variance in EI. The field of study was a significant positive predictor ($\beta = 0.2277$; $p < 0.001$; $R^2 = 0.0978$). Hypothesis 1 can be thus considered supported. The addition of ESE in model 2 significantly increased the explanatory power ($R^2 = 0.3310$; R^2 Change = 0.2332; F Change = 724.92***). ESE emerged as a strong predictor ($\beta = 0.5928$, $p < 0.001$), underscoring the importance of self-efficacy in entrepreneurial intentions, thus Hypothesis 2 was supported. When perceived entrepreneurial education results scores were added in Model 3, the value for R Square increased to 0.3561. The addition of perceived entrepreneurial education results scores further improved the model (R^2 Change = 0.0251; F Change = 80.88***). Hypothesis 3 can thus be considered supported. Adding perceived relational support scores (Model 4) led to a slight increase in explained variance ($R^2 = 0.3683$; R^2 Change = 0.0122; F Change = 40.21***) and adding perceived educational support scores (Model 5), resulted in a modest increase in R square (0.3748) and a significant F Change (21.81***). Thus, Hypotheses H4a and H4b were supported. The inclusion of perceived structural support (Model 6) did not produce a significant increase in variance accounted for in the EI variable (R^2 Change = 0.0003; F Change = 1.05). PSS was not a statistically significant predictor, indicating a limited direct impact on EI compared to other factors, thus Hypothesis H4c was not supported.

In fulfilling our further objective of a comparison of the factors described in the literature background section regarding Latvian, Polish, and Ukrainian students (descriptive statistics are presented in Table 4), we employed the Kruskal-Wallis test to examine the differences.

Table 4. Descriptive statistics for three countries

		N	Mean	Std. Dev.	Std. Error Lower Bound	95% Confidence Interval for Mean		Mean Rank
						Upper Bound		
Entrepreneurial self- efficacy	Poland	1013	2.88	0.88	0.03	2.83	2.94	908.62
	Ukraine	714	3.44	0.77	0.03	3.39	3.50	1306.63
	Latvia	358	2.88	0.76	0.04	2.80	2.96	897.45
Perceived entrepreneurial education results	Poland	1013	2.79	0.86	0.03	2.73	2.84	881.25
	Ukraine	714	3.40	0.77	0.03	3.34	3.46	1313.05
	Latvia	358	2.91	0.81	0.04	2.83	2.99	962.10
Perceived relational support	Poland	1013	4.26	0.72	0.02	4.22	4.30	1078.21
	Ukraine	714	4.28	0.69	0.03	4.23	4.33	1085.66
	Latvia	358	3.97	0.80	0.04	3.89	4.06	858.29
Perceived educational support	Poland	1013	2.78	0.90	0.03	2.72	2.83	890.82
	Ukraine	714	3.22	0.93	0.03	3.15	3.29	1182.62
	Latvia	358	3.23	0.82	0.04	3.15	3.32	1195.16
Perceived structural support	Poland	1013	2.80	0.68	0.02	2.75	2.84	1054.68
	Ukraine	714	2.76	0.70	0.03	2.71	2.81	997.88
	Latvia	358	2.90	0.72	0.04	2.82	2.97	1099.95
Entrepreneurial intentions	Poland	1013	2.90	1.00	0.03	2.84	2.96	882.13
	Ukraine	714	3.57	0.92	0.03	3.50	3.64	1287.25
	Latvia	358	3.11	0.94	0.05	3.01	3.20	1011.08

A Kruskal-Wallis H test (Table 5) showed that there was a statistically significant difference ($p \leq 0.05$) between the different countries in: entrepreneurial self-efficacy, $H = 209.915$, $p = 0.000$, with a mean rank score of 908.62 for Poland, 1306.63 for Ukraine, and 897.45 for Latvia; perceived entrepreneurial education results, $H = 224.321$, $p = 0.000$, with a mean rank score of 881.25 for Poland, 1313.05 for Ukraine, and 962.10 for Latvia; perceived relational support, $H = 43.948$, $p = 0.000$, with a mean rank score of 1078.21 for Poland, 1085.66 for Ukraine, and 858.29 for Latvia; perceived educational support, $H = 125.547$, $p = 0.000$, with a mean rank score of 890.82 for Poland, 1182.62 for Ukraine, and 1195.16 for Latvia; perceived structural support, $H = 7.703$, $p = 0.021$, with a mean rank score of 1054.68 for Poland, 997.88 for Ukraine, and 1099.95 for Latvia; entrepreneurial intentions, $H = 191.561$, $p = 0.000$, with a mean rank score of 882.13 for Poland, 1287.25 for Ukraine, and 1011.08 for Latvia. By analyzing the results, it is possible to conclude that significant differences ($p < 0.05$) were found for all variables. This allows us to retain the hypotheses from H5a to H5f (Table 6), because at least one of the samples dominates at least one other sample. Unfortunately, the test did not show where this dominance occurs. Therefore, looking further for a more complete picture of the differences between countries, post hoc tests to test pairwise comparisons were performed.

Table 5. Results of Kruskal-Wallis test and the post hoc Dunn’s multiple comparisons test

Variable	Kruskal-Wallis test		Dunn’s multiple comparisons test		
	PL-UA		PL-LV	UA-LV	
	H	p	p	p	p
Entrepreneurial self-efficacy	209.915	0.000	***	ns	***
Perceived entrepreneurial education results	224.321	0.000	***	*	***
Perceived relational support	43.948	0.000	ns	***	***
Perceived educational support	125.547	0.000	***	***	ns
Perceived structural support	7.703	0.021	*	ns	**
Entrepreneurial intentions	191.561	0.000	***	***	***

Note: PL - Poland, UA - Ukraine, LV - Latvia; H - test value; ns - non-significant; p - significance level: * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$.

In the study, Dunn's multiple comparisons test, which is one of the post hoc tests, was applied (Table 5). Dunn's multiple comparisons test showed students from Poland and Ukraine to differ significantly in 5 analyzed variables, 4 variables being significantly ($p \leq 0.05$) different between Poland and Latvia, and 5 variables being significantly ($p \leq 0.05$) different between Ukraine and Latvia. According to the analysis of the results, it has been determined that the LPNU (Ukraine) students' entrepreneurial self-efficacy (mean = 3.44), perceived entrepreneurial education results (mean = 3.40) and entrepreneurial intentions (mean = 3.57) are statistically significantly higher than of those studying at GUT (Poland) (respective means = 2.88; 2.79; 2.90) and RTU (Latvia) (respective means = 2.88; 2.91; 3.11) but their perceived structural support is statistically significantly lower. In turn, Latvian students' perceived relational support (mean = 3.97) is lower than Polish (mean = 4.26) and Ukrainian (mean = 4.28), between which there is no statistically significant difference.

The findings also indicate that there is a significant difference in perceived educational support between Polish–Ukrainian, and Polish–Latvian students ($p < 0.01$). To be more specific, Ukrainian students (mean = 3.22) and Latvian students (mean = 3.23) have a higher level of perceived educational support, compared to Polish students (mean = 2.78).

Table 6 contains a summary of the tested variables, hypotheses, and outcomes.

Table 6. Summary of hypothesis test results

Variables tested	Hypothesis	Outcome
Field of study (Business or STEM)	H1. Chosen field of study → EI	Supported
ESE	H2. Entrepreneurial self-efficacy → EI	Supported
PEER	H3. Perceived entrepreneurial education results → EI	Supported
PRS	H4a. Perceived relational support → EI	Supported
PES	H4b. Perceived educational support → EI	Supported
PSS	H4c. Perceived structural support → EI	Not Supported
ESE	H5a. Differences between students in entrepreneurial self-efficacy	Supported
PEER	H5b. Differences between students in perceived entrepreneurial education results	Supported
PRS	H5c. Differences between students in perceived relational support	Supported
PES	H5d. Differences between students in perceived educational support	Supported
PSS	H5e. Differences between students in perceived structural support	Supported
EI	H5f. Differences between students in entrepreneurial intentions	Supported

As presented in the description of the results, only one of our hypotheses, regarding the effect of structural support on entrepreneurial intentions, was not supported during our research and analyses (Table 6).

DISCUSSION

In the vast majority, our hypotheses were confirmed in the research conducted. The hypothesis concerning the relationship between ESE and EI in Central and Eastern European countries was confirmed. Other factors did not influence the growth of entrepreneurial intentions to such an extent. This clear advantage of ESE over other constructs is also reflected in the Global Entrepreneurship Monitor study (Martínez-González, Álvarez-Albelo, Mendoza-Jiménez, & Kobylinska, 2022). The perception of acquired knowledge at previous educational stages (PEER) was also of great importance, but was not as significant as ESE.

At each of the universities surveyed, there is a department that is commonly described as less technically oriented and more socially oriented, namely the department of economics and management. The fact that young people choose this particular faculty may indicate completely different plans for their future careers compared to students choosing technical fields. Therefore, the study distinguished the variable field of study, and the authors decided to see to what extent the choice of field of study between business, economics and technology could explain the level of entrepreneurial intentions, since business students are more likely to start businesses compared to others (Liñán & Santos, 2007). One of the notable findings is the consistent positive association between being in a non-STEM field and higher entrepreneurial intentions, but the decreasing magnitude of the coefficient in subsequent models suggests that while the field of study is an important factor, its relative influence on EI becomes somewhat less pronounced when other factors are considered. We initially expected that the effect of the field of study variable would be much more impactful. The relatively moderate influence observed

may have several implications and this is good news, as it means that students choosing a major are not guided by future entrepreneurial plans, and entrepreneurial intentions can be aroused in them regardless of the major studied (non-STEM or STEM). Research on the impact of a major on entrepreneurial intentions usually concerns the content of the field of study offered, and not the relationship between the decision to start studies in a given field and the idea of a future career.

In contrast to ESE, perceptions of educational, relational and structural support were much less significant. Young people's intentions are thus primarily driven by their sense of efficacy and acquired knowledge, and are independent of their sense of external support. This indicates the important role of education at every stage, and particular emphasis should be placed on building a sense of self-efficacy at every stage of education, especially that related to entrepreneurship.

The marginal effect of structural support on entrepreneurial intentions was also documented by the study of Eagle et al. (2011), although the methodology of this study was quite different. Fortunately, entrepreneurial intentions, even despite negative perceptions of the environment due to unfavorable conditions for entrepreneurial development, can be driven by optimism, as evidenced by the findings of a study from Indonesia (Wibowo, Purwana, Wibowo, & Saptono, 2019). What is puzzling is the low impact of perceived educational support on entrepreneurial intentions. It is perceived by young people in the countries surveyed to a greater extent than structural support, but it does not greatly relate to entrepreneurial intentions. Interestingly, again in Poland, perceptions of the existence of such support at university are low. Analysis at the level of individual countries shows differences in entrepreneurial intentions and other examined factors.

Differences between countries apply to PEER, where the highest value of the perceived effects of education was felt by young people in Ukraine, and by far the lowest was in Poland and Latvia. Poland's low position comes as a surprise, as this is where the most significant number of students in Europe (together with Latvia) benefit from entrepreneurial education at the secondary school level (Eurydice Report, 2018). This gives a very bad opinion of entrepreneurial education in Poland, a country where this education has been compulsory at the secondary school level since 2002 (Sadowska, 2016). Our results show that it is not enough to introduce entrepreneurial education into the curriculum, as the program and the way it is implemented are also important (Abaho, Olomi & Urassa, 2015). The best solution is to teach 'through' entrepreneurship, while the most common is a mixed approach, something between 'about' and 'for' entrepreneurship (Leon, 2017).

Another evident example of these differences is the lower value of positive perceptions of structural support in the case of Ukraine, compared to Latvia. The result obtained may mean that in Latvia, where socio-economic changes started earlier than in Ukraine, structural support is treated as the norm and is more visible to students. Meanwhile, in Ukraine, which has made a big leap (41st position in the Doing Business ranking) despite a lower position than the other two countries, changes are clearly observable. This positive change may have shaped the perception of structural support in the close future. The quite low level of perceived structural support of Polish students contradicts a 2014-2016 study among Polish and American students by Nowiński et al. (2020). The mentioned studies did not analyze the quality of support at each university, or the quality of entrepreneurship programs provided to students. Meanwhile, as the meta-analysis conducted by Martínez-Gregorio, Badenes-Ribera and Oliver (2021) indicates, even the length of entrepreneurship courses offered is important.

Relational support, on the other hand, was perceived low by Latvian youth. There were no differences between Polish and Ukrainian. Similar results were expected because culturally, Ukraine is very close to Poland. We also do not exclude the influence of cultural aspects, in the sense of Hofstede (2011), on the phenomena studied. According to Leon (2017), developing entrepreneurial skills is conditioned by the national cultural profile. It is important to mention that this paper does not claim that the proposed study presents the full picture of EI formation. Our research is not free of limitations. Conducting international surveys requires many resources that are not always available. Our survey was conducted with a sample that included students from three technical universities in three major cities in Latvia, Poland and Ukraine. These universities provide education in STEM and business fields, which allowed us to diversify the survey in terms of the chosen field of study. This choice enabled us to compare students in these two majors studying in the same ecosystem of cognitive influence on entrepreneurial intentions. We did not include students in humanities, medicine or arts in the study. It is worth mentioning at this point that the GUESS study shows that the highest entrepreneurial intentions are found in artistic fields, which the authors explain by the students' perception of their future as freelancers (Sieger, Raemy, Zellweger, Fueglistaller, & Hatak, 2021).

We also recognize that the selection of Lviv University may not be representative of Ukraine, which is a larger, more diverse country compared to Poland and Latvia. In the case of Poland and Latvia, the results of our study can be interpreted in the context of other technical universities in these two countries. We are also aware that our results cannot be applied one-to-one to other countries or universities. Self-efficacy is shaped through education, so it is crucial to foster it from

an early stage, whether it concerns its entrepreneurial aspect or enhancing general self-efficacy. It is also important to introduce entrepreneurship education as early as possible in educational programs (Huber et al. 2014); however, it needs to be a high-quality experience. When introducing entrepreneurship education, its purpose should be clearly defined. Both the content and teaching methods should depend on it (Ndofirepi, 2020). Education 'for' entrepreneurship should strengthen the elements influencing entrepreneurial intentions (motivation, self-efficacy), while 'in' entrepreneurship should indicate how to act in an entrepreneurial manner. The trend 'about' entrepreneurship, often present in academic programs, explains what entrepreneurship is. And lastly, 'through' should equip students with tools enabling them to solve social problems in an entrepreneurial way (Leon, 2017).

Universities should not only provide educational programmes, but also provide cognitive support in the form of promoting successes, meetings, etc., in the spirit of entrepreneurship. This is especially important at universities that are not business-oriented by definition. It is also important to further enhance the process of starting and running a business, because although the impact of perceived structural support on entrepreneurial intentions was not confirmed in our research, its objective, not the perceived one, but the real impact on subsequent entrepreneurial activities, is vital. Our research also conveys a message to policymakers, pointing to the need to consider country-level reality in designing support models, since even in similar countries, support can affect people differently.

CONCLUSION

Looking for an answer to the question regarding the factors influencing entrepreneurial intentions, we combined two theoretical constructs: the entrepreneurial support model and entrepreneurial self-efficacy, and we proposed adding another factor, which is perceived entrepreneurial education results. The research model constructed in this way allowed us to formulate five research hypotheses, which we verified on students from three technical universities in Latvia, Poland and Ukraine. The vast majority of our hypotheses were confirmed, and so ESE (H2), PEER (H3), educational (H4a), and relational support (H4b) are related to young people's entrepreneurial intentions. The hypothesis regarding the impact of the perception of structural support (H4c) was not confirmed. However, in the case of individual countries, there were significant differences (H5), as exemplified by Ukraine. Young people from Ukraine evaluate their entrepreneurial intentions, entrepreneurial self-efficacy and entrepreneurial education results much higher comparing to youth from the other two countries surveyed (Latvia and Poland). Moreover, our research shows that the choice of field of study explains the level of declared entrepreneurial intentions to a small extent.

The results of the study led us to make suggestions primarily for educational institutions, which should provide more qualitative and quantitative support for their students, as well as foster their sense of self-efficacy and introduce elements of entrepreneurial education from an early stage. One of the shortcomings of our research is the limitation of the research sample to people studying at selected universities, which omitted young people who, for various reasons, did not choose to study. Another drawback is that the students' EI may be influenced over time by other factors, such as entrepreneurial experience (Kasouf, Morrish & Miles, 2015). Therefore, it is worth noting that our comparisons between countries do not include the level of entrepreneurial education and methods of transmitting this knowledge. In further research, it could be useful to refer to Hofstede's cultural profile when making international comparisons (Tukur & Adam, 2017). Some researchers point to the moderating effect of group collectivism, low gender egalitarianism and low uncertainty avoidance, as a linkage between entrepreneurial education and EI (Bae et al., 2014). This element can also be included in comparisons between countries in the future.

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Appendix - Scales used in the current research

I. Entrepreneurial intentions

Item	Factor
	1
EI1	0.809
EI2	0.871
EI3	0.886
EI4	0.864
EI5	0.850

II. Entrepreneurial self-efficacy

Item	Factor
	1
ESE1	0.694
ESE2	0.829
ESE3	0.759
ESE4	0.835
ESE5	0.811

III. Perceived entrepreneurial education results

Item	Factor
	1
PEER1	0.773
PEER2	0.851
PEER3	0.752
PEER4	0.673
PEER5	0.820

IV. Entrepreneurial support

Item	Factor		
	1	2	3
StructS3	0.865		
StructS2	0.817		
StructS4	0.769		
StructS1	0.459		
EduS3		0.891	
EduS2		0.877	
EduS1		0.776	
RelS1			0.888
RelS2			0.893

Biographical notes

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Authorship contribution statement

Julita E. Wasilczuk: Project Administration, Conceptualization, Methodology, Discussion, Review & Editing. **Magdalena Licznerska:** Conceptualization, Methodology, Data Analysis.

Conflicts of interest

The authors declare no conflict of interest.

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