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Antecedents to innovation performance in SMEs: A mixed methods approach☆

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ABSTRACT

The studies on product innovation performance (PIP) are not conclusive. In this paper, we use a mixed methods approach to fill this gap. First, we use structural equation modeling to determine the antecedents to PIP and whether a manager's training level moderates the relation between the antecedents and PIP. Second, we apply a fuzzy-set qualitative comparative analysis (fsQCA) to identify alternative configurations that lead either to PIP or its absence. The sample comprises data from an online survey of 367 certified innovative Portuguese small and medium enterprises. The results show that the antecedents to information technology support and knowledge sharing positively affect an organization's learning capacity that in turn positively affects PIP. No evidence exists for the moderating effect of the training level. The efficiency of PIP positively affects its efficacy. Alternative configurations exist that lead to the presence or absence of this efficacy.

1. Introduction

Ambiguity exists on which antecedents make firms innovative. Therefore, we analyze the following research question: what are the key antecedents that lead to product innovation performance (PIP) in firms? PIP is a dynamic process that involves the technical design, manufacturing, management, and commercial activities that a firm uses to market a new or improved product (Alegre & Chiva, 2008). PIP has two key dimensions: efficiency and efficacy. Efficiency reflects the mechanisms or efforts that the firm uses to innovate, and efficacy reflects the final results of innovation (Amabile, Conti, Coon, Lazenby, & Herron, 1996). Therefore, efficiency helps to achieve efficacy.

This paper presents an original model to explain PIP by identifying antecedents at different organizational levels, which is uncommon in the literature (Lo, 2016). Building on the resource-based view (RBV) of the firm and its related theories, the dynamic capabilities view and the knowledge-based view, we consider three antecedents to PIP: ITS, KS, and OLC.

Firms act in complex, dynamic, and interconnected environments that are full of uncertainty and are constantly changing. Therefore, the study of a firm's innovation only through internal antecedents gives an incomplete view. Thus, the research on innovation must also account for external antecedents or mechanisms that firms obtain from networks with other firms. Knowledge sharing (KS) is the firm's ability to exploit the information and knowledge it gains from trading partners and to identify market opportunities (Shih, Hsu, Zhu, & Balasubramanian, 2012).

The internal antecedents to PIP involve aspects related to the firm's own organizational structure. Firms use information technology support (ITS) that they implement at all organizational levels and functional areas. Employees use ITS for access to knowledge and relevant information within the firm (Gupta & Govindarajan, 2000; Lee & Choi, 2003).

Therefore, if firms succeed in implementing strong ITS mechanisms and can exchange knowledge inside and outside the firm, they will acquire an important dynamic capability: organizational learning capability (OLC). This is the firms' capability to absorb new technologies and knowledge that makes them stronger in complex environments and that helps them to better adapt to changes. In addition, this capability can lead directly to PIP in a sustainable way. Innovative firms are successful in implementing these mechanisms. Further, managers with a higher training level (TL) are better able to take risks, to analyze the environment, or to make changes in the firm. This paper presents the TL as a possible moderator of the relations between the antecedents and PIP.

In this paper, we address these antecedents at the individual,

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organizational, and inter-organizational levels. So far, few studies consider both the internal and external antecedents to PIPs or their effects at different organizational levels (Lo, 2016). First, we apply structural equation modeling (SEM) to determine the antecedents. And then, we apply a fuzzy-set qualitative comparative analysis (fsQCA) to identify alternative configurations that either lead to PIP or its absence.

This paper contributes to the literature on PIP in the following ways: The main contribution is the use of primary information from managers of certified innovative SMEs in Portugal. The second contribution is the identification of key antecedents that contribute to PIP. Third, the model proposes the existence of an individual variable (TL) that can enhance the relations between the antecedents and PIP. Fourth, we uncover the relation between efficiency and efficacy that affects PIP. Fifth, we discover alternative configurations that lead to PIP efficacy and those that lead to its absence. Sixth, we make an important contribution to the empirical literature by testing the model through a mixed methods approach, which produces more solvent and robust results. On the one hand, we apply a quantitative method to verify the hypotheses of the model on PIP (H1–H5). On the other hand, we apply a qualitative method to identify alternative pathways within the proposed model that lead to PIP efficacy (H6–H7). Fig. 1 illustrates the model.

The remainder of this paper proceeds as follows: Section 2 provides a comprehensive acknowledgment of the constructs and the formulation of seven hypotheses. In Section 3, we introduce the methods, the sample, and the measurement assessment. Section 4 contains the survey's results (analysis and results of the structural equation modeling and analysis and results of the fuzzy-set qualitative comparative analysis). Section 5 concludes with a discussion and conclusions.

2. Literature review and hypothesis development

2.1. Organizational theories

Although many studies address OLC and PIP (e.g., Alegre & Chiva, 2008; Alegre, Lapiedra, & Chiva, 2006), few involve different organizational levels (Hult, Hurley, & Knight, 2004; Lo, 2016). Following Argote, McEvily, and Reagans (2003), Bueno and Ordoñez (2004), and Koc and Ceylan (2006) we propose that the antecedents to OLC occur at three organizational levels (individual, organizational, and inter-organizational). We follow the suggestion because identifying an antecedent at only one level does not fully explain the relation between OLC and PIP.

We use the RBV that states a firm has unique and different combinations of resources and capabilities (Barney & Clark, 2007). By using exclusive and new combinations of resources, a firm can achieve learning capacity and PIP (Acedo, Barroso, Casillas, & Galan, 2006; Lockett, O'Shea, & Wright, 2008) that gives it a sustainable competitive advantage (Peteraf, 1993). The RBV highlights a firm's internal factors as a source of competitive advantage. This approach shows that internal factors might be tangible, such as ITS, or intangible, such as knowledge. These resources have certain characteristics – for instance, scarcity, value, imperfect imitability, irreplaceability, and rent appropriation – that are crucial sources of competitive advantage (Barney & Clark, 2007).

Several other approaches derive from the RBV: the knowledge-based view (KBV), which considers knowledge as a special resource; and the dynamic capabilities view (DCV), which considers OLC to be a dynamic capability within the organization. According to the DCV, OLC can emerge from antecedents at different levels. Following Gold, Malhotra, and Segars (2001), ITS at the organizational level serves knowledge management, and KS at the inter-organizational level is an antecedent to OLC (Shih et al., 2012). The KS also supports the KBV that says a firm can acquire, transfer, and embed context-specific knowledge

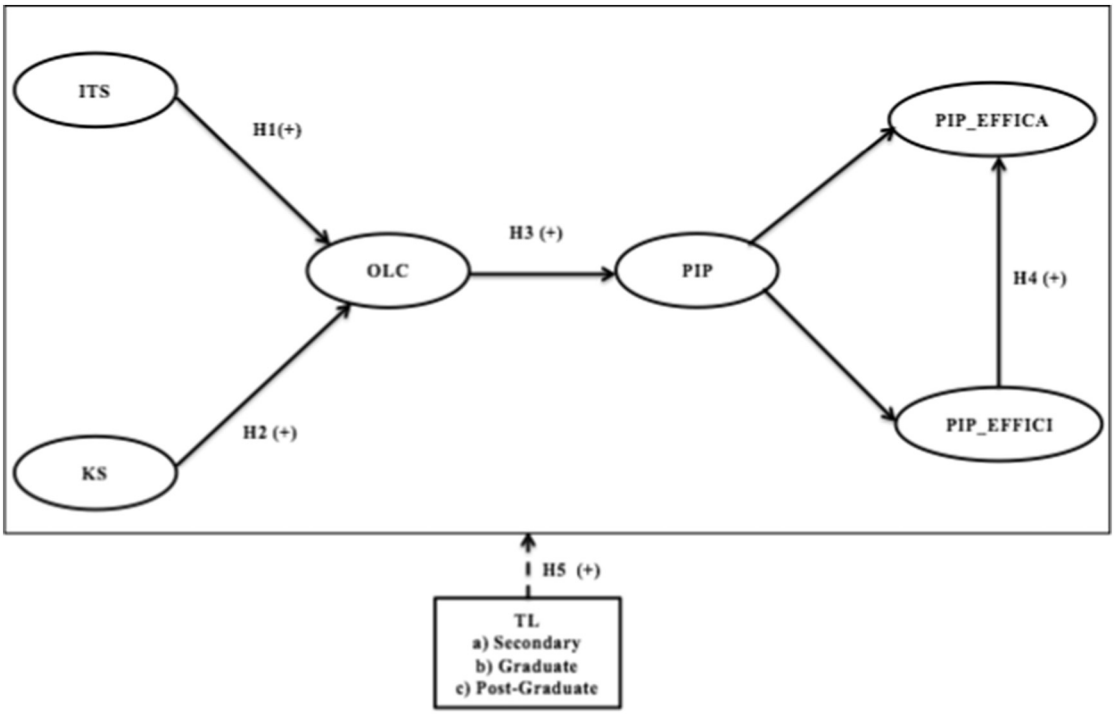

Fig. 1. Research model.
Note: This paper uses the SEM for H1–H5 (antecedents or causal conditions of PIP) and the fsQCA for H6–H7 (paths condictions for PIP_EFFICA).

via interfirm cooperation (Grant & Baden-Fuller, 1995) that is a key antecedent to OLC and PIP (Nonaka & Takeuchi, 1995).

The OLC facilitates the development of PIP (Alegre et al., 2006; Alegre & Chiva, 2008). Both are second-order constructs that encompass two latent dimensions. The OLC comprises experimentation (Alegre & Chiva, 2008; Nevis, DiBella, & Gould, 1995) and risk-taking (Alegre & Chiva, 2008; Sitkin, 1996). PIP comprises efficiency and efficacy (Alegre et al., 2006; Alegre & Chiva, 2008; OECD-Eurostat, 2005; Valle & Avella, 2003).

2.2. Information technology support

This construct refers to the degree to which the use of information technology supports knowledge management (Gold et al., 2001). Information technology is a crucial element in the creation of knowledge (Gupta & Govindarajan, 2000; Lee & Choi, 2003). Information technology facilitates the rapid collection, storage, and exchange of knowledge, thereby assisting the knowledge creation process (Roberts, 2000). A well-developed technology integrates fragmented flows of knowledge (Gold et al., 2001).

Integration can eliminate barriers to communication among departments in an organization, because information technology fosters all modes of knowledge (Riggins & Rhee, 1999). Firms that share ITS can develop high OLC and achieve innovation. ITS is a central pillar of knowledge-intensive industries, where weaknesses in ITS can curtail rational approaches to OLC (Bassellier, Benbasat, & Reich, 2003; Kamoche & Harvey, 2006).

When considering the RBV, ITS presents the characteristics of rarity, appropriability, non-reproducibility, and non-substitutability that can lead to a competitive advantage (Wade & Hulland, 2004). The research on ITS has recently increased (Kohli & Grover, 2008) in response to its critics (Carr, 2003), who argue that investments in ITS do not add anything to PIP. However, most findings from empirical studies show that firms that possess strong ITS realize PIP (Bhatt & Grover, 2005; Kim, Shin, Kim, & Lee, 2011; Melville, Kraemer, & Gurbaxani, 2004).

ITS provides the necessary tools for effectively transforming inputs into outputs (Orlikowski & Iacono, 2001). Therefore, we emphasize the need to understand ITS as an antecedent to new OLC and PIP. A developing consensus in the research shows that ITS should be measured and examined in terms of the organizational level (Kohli & Grover, 2008). In this respect, ITS serves as an antecedent from which the firm can create new OLC and PIP.

2.3. Knowledge sharing

Knowledge sharing refers to the firm's ability to exploit information from business partners or to identify market opportunities (Shih et al., 2012). Inter-organizational KS permits firms to achieve a competitive advantage in rapidly changing business environments (Bhatti, Larimo, & Carrasco, 2016; Cao & Zhang, 2011). Inter-organizational KS is a complex issue with strategic importance for the relation between OLC and PIP (Boer, Berends, & Van Baalen, 2011; Cheng, 2011).

Firms determine the level of KS by the perceived benefits of information exchange, social satisfaction, and dependence among the partners (Cheng, 2011). The ability to share knowledge influences a SME's innovation (Maes & Sels, 2014). Although Ke and Wei (2007) examine KS from the perspectives of both the transaction cost and social-political theories, they fail to explain how KS contributes to OLC.

Current knowledge on whether and how firms can leverage relational capital and KS for innovation is equivocal. The research conceptualizes little of the underlying processes responsible for mobilizing relational capital; thus, it yields mostly contradictory empirical results. We consider KS as a resource of intellectual capital exchange between firms, or KBV (Liu, Li, Shi, & Liu, 2017; Wang, Sharma, & Cao, 2016).

Following Kianto, Sáenz, and Aramburu (2017), knowledge is the most important resource for PIP in firms. Pérez-Luño, Cabello-Medina, Carmona-Lavado, and Cuevas-Rodríguez (2011), Casanueva, Castro, and Galán (2013), and Xie, Fang, Zeng, and Huo (2016) report the positive effect of inter-organizational links on PIP.

The participation in interfirm KS appears to be an effective tool for obtaining new mechanisms, information, and OLC to develop PIP (Bhatti et al., 2016; Kim & Lui, 2015; Martín-Ríos, 2014). Gupta and Polonsky (2014) study the pharmaceutical industry and find that learning and KS are tightly coupled to PIP.

In this paper, we analyze how KS at the inter-organizational level contributes to the development of OLC in SMEs. Since knowledge is the core factor that supports effective and efficient decision-making, KS contributes to the creation of competitive advantage (Sung & Choi, 2012).

2.4. Organizational learning capability

Organizational learning capability refers to the importance that facilitators have for organizational learning (Hult & Ferrell, 1997; Jérez-Gómez, Cespedes-Lorente, & Valle-Cabrera, 2005).

From the KBV and DCV perspectives (Spender & Grant, 1996), organizational learning represents the refinement and renewal of dynamic knowledge. The renewal of knowledge assets provides the ability to learn and explore new knowledge while exploiting existing knowledge (Jaw & Liu, 2003). Organizational learning occurs in a context (Glynn, Lant, & Milliken, 1994) that consists of “both the organization and its external environment” (Argote, 2013, pp. 33).

The literature essentially addresses the facilitators for the development of normative models on creating a learning organization (Pedler, Burgoyne, & Boydell, 1997). Other studies divide organizational learning into low and high levels of cognition development (Dodgson, 1993). Lichtenthaler (2009) classifies organizational learning into three processes: explorative learning, exploitative learning, and transformative learning. All three processes have positive effects on organizational learning and PIP. Organizational learning requires organizations to plan, envision, and transact (Crossan & Sorrenti, 1997). According to Chiva, Alegre, and Lapiedra (2007), OLC comes from experimentation and risk-taking. Experimentation is the extent to which firms try out new ideas, are curious about how things work, or carry out changes in work processes (Nevis et al., 1995). Risk-taking regards the tolerance of ambiguity, uncertainty, and errors that facilitates organizational learning (Lane, Koka, & Pathak, 2006).

A degree of ambiguity and inconsistency still surrounds the question of how OLC affects PIP (Valaei, Rezaei, & Wan-Ismail, 2017). We argue that ITS and KS are antecedents (causal conditions) to OLC (Wamba et al., 2016). Following Chiva et al. (2007), OLC is a multidimensional concept that involves experimentation and risk-taking. Consequentially, OLC has a positive effect on PIP as a firm's outcome (solution) (Jiménez-Jiménez & Sanz-Valle, 2011). Thus:

H1. Information technology support has a positive effect on organizational learning capacity.

H2. Knowledge sharing has a positive effect on organizational learning capacity.

2.5. Product innovation performance

Product innovation performance is the result of successfully exploiting new knowledge (Amabile et al., 1996). This process comprises technical design, R&D, manufacturing, management, and the commercial activities that comprise the marketing of a new (or improved) product. Innovation involves two dimensions: technical and nontechnical; but studies mainly address the former (Ngo & O'Cass, 2013).

Based on the relevant literature, we analyze both dimensions while considering certain configurations of nontechnical innovation (ITS, KS, and OLC) that stimulate the development of PIP (Dennis, Brakus, Gupta,

& Alamanos, 2014; Díaz-Chao, Sainz-González, & Torrent-Sellens, 2015; Fossas-Olalla, Minguela-Rata, López-Sánchez, & Fernández-Menéndez, 2015). Only one antecedent is not sufficient or necessary for PIP; there are several paths that lead to PIP (Cheng, Chang, & Li, 2013). Consequently:

H3. Organizational learning capacity has a positive effect on PIP.

Product innovation performance involves two dimensions (OECD-Eurostat, 2005; Valle & Avella, 2003): efficiency (PIP_EFFICI) and efficacy (PIP_EFFICA) (Alegre et al., 2006). Innovation efficiency reflects the effort to achieve a certain degree of success, while innovation efficacy reflects an innovation's degree of success.

The innovation process includes several stages, from discovery to implementation (Kyffin & Gardien, 2009), that make success dependent on a firm's efforts (Lengnick-Hall, 1992). This process plays an important role in the success of innovation (Gupta & Malhotra, 2013). Accordingly:

H4. The PIP_EFFICI has a positive effect on PIP_EFFICA.

2.6. Manager's training level

Knowledge sharing is a complex procedure in which a managers' continuous learning enables them to be more effective and efficient (Chan & Chao, 2008). Darroch and McNaughton (2002) propose that continuous learning increases the probability of successful KS. A learning environment enables managers to adjust the organizational changes to the firm's knowledge system (Erkelens, Van Den Hoof, Huysman, & Vlaar, 2015).

In this paper, we focus on the training competency profile of managers who play a role in the firm's PIP. Therefore, we draw on KBV and other economic and managerial studies on PIP and managerial competencies to gain a better understanding of the relations between antecedents and PIP. Vila, Pérez, and Coll-Serrano (2014) argue that significant effects exist from specific competencies on the probability that managers act as innovators in the workplace. Competencies such as alertness to new opportunities; ability to present products, ideas, or reports; ability to mobilize the capabilities of others; ability to come up with new ideas and solutions; and the ability to use computers and the internet. That is the high TLs of the managers. Therefore, the TL is an important competency that can help firms to be more innovative.

The TL creates power effects on PIP and reduces the risk of managers' resistance to new systems (Wang, Yang, & Liu, 2010). Implementing a business-process system without a supportive learning environment could have drastic consequences (Bassellier et al., 2003). Therefore:

H5. The training level has a moderating effect on hypotheses H1 through H4.

2.7. Alternative configurations

The configuration theory determines the necessary conditions for an outcome as well as the combinations of attributes that are sufficient to lead to the outcome. More than one configuration of conditions could lead to the same result (Fiss, 2011) – equifinality (Doty & Glick, 1994). Such configurations expose asymmetric characteristics and synergetic effects that replace the traditional bivariate interaction effects. The conditions that lead to the outcome differ from those that lead to its absence (Fiss, 2011). Configurational approaches admit that conditions can be causally related in one configuration, yet they can be unrelated or even inversely related in others (Meyer, Tsui, & Hinings, 1993). The consideration of complexity and ambiguity lead to the following nonlinear relations:

H6. Alternative configurations exist that lead to PIP_EFFICA.

H7. Alternative configurations exist that lead to the absence of PIP_EFFICA.

3. Methods

Following Alegre and Chiva (2008), Groza, Locander, and Howlett (2016), and Bhatti et al. (2016), we apply a quantitative method to test for PIP (hypotheses H1 to H5). But, are quantitative methods sufficient to explain PIP? Further, Osabutey and Jin (2016) argue that traditional quantitative methods have important limitations in their ability to account for complex interactions between variables.

Other recent studies apply qualitative methods. Oyemomi, Liu, Neaga, and Alkhuraiji (2016) and Ozkan-Canbolat and Beraha (2016) use fsQCA. FsQCA identifies the necessary and core conditions of the configurations that lead to the outcome variable or its absence (hypotheses H6 and H7).

The main empirical contribution of this paper is the combination of quantitative and qualitative methods to explain PIP in firms. Few mixed method studies offer both a quantitative and a qualitative comparative analysis of PIP (Cragun et al., 2016). Therefore, this paper is a complete study on the antecedents and paths to PIP.

3.1. Sample

The data come from an online survey that was sent to 6846 Portuguese certified innovative SMEs. The survey garnered 385 responses. After applying adequate cleaning procedures (Hair, Anderson, Tatham, & Black, 2005), the final sample comprises 367 firms (5.4% response rate). Most of the respondents are female (56.4%), hold graduate or post-graduate degrees (76.5%), are on average 43.6 years old, and have tenure of more than five years (77.4%) at their firm. Of the firms, 92.4% are 10 years old or more, and the majority (65.9%) have 50 employees or less. Table 1 summarizes the respondents' demographic information.

To check for a possible nonresponse bias, we use a time trend extrapolation test to compare late and early respondents. The late respondents are those responses that we received after the first round of mailing, that is, after the follow-up. These respondents are very similar to nonrespondents, given that they would have fallen into that category without the follow-up efforts (Armstrong & Overton, 1977). A one-way analysis of variance (ANOVA) shows no significant difference between the early and late responses in terms of measures such as the firm's size (numbers of employees) and age. Thus, the sample is representative of the population.

Table 1
Sample characteristics (N = 367).

	Characteristics	Frequency	%
Gender	Male	207	43.6
	Female	167	56.4
Middle age	44	–	–
Level training	Secondary	86	23.4
	Graduate	199	54.2
	Post-graduate	82	22.3
Number of employees	< 50	242	65.9
	50–250	115	31.3
	> 250	10	2.7
Years in the company	< 2	27	7.4
	2–5	56	15.3
	> 5	284	77.4
Age of company	< 5	3	0.8
	5–10	25	6.8
	> 10	339	92.4

Table 2
Variables description and results for CFA.

Constructs	CFA
Information Technology Support (ITS) (Lee & Choi, 2003)	
ITS1. My organization provides information technology support for collaborative works regardless of time and place	0.70
ITS2. My organization provides information technology support for communication among organization members	0.86
ITS3. My organization provides information technology support for searching for and accessing necessary information	0.90
ITS4. My organization provides information technology support for simulation and prediction	0.71
ITS5. My organization provides information technology support for systematic storing	0.80
Knowledge Sharing (KS) (Chen et al., 2014)	
KS1. My organization provides relevant knowledge to our business partners.	0.76
KS2. My organization has teams up with business partners to enhance interfirm learning	0.89
KS3. My organization and other business partners jointly organize job training to enhance each other's knowledge	0.80
KS4. My organization and other business partners share successful experiences with each other	0.91
KS5. My organization and other business partners share new knowledge and viewpoints with each other	0.81
Organizational Learning Capability (OLC) (Alegre & Chiva, 2008)	
Experimentation (OLC-E)	
OLC-E1. In my organization, people receive support and encouragement when presenting new ideas	0.90
OLC-E2. In my organization, initiative receives a favorable response, so people feel encouraged to generate new ideas	0.98
Risk Taking (OLC-R)	
OLC-R3. In my organization, people are encouraged to take risk	0.94
OLC-R4. In my organization, people often venture into unknown territory	0.73
Product Innovation Performance (PIP) (Alegre & Chiva, 2008)	
Product innovation efficacy (PIP-EFFICA)	
PIP-EFFICA1. Replacement of products being phased out	0.46
PIP-EFFICA2. Extension of product range within main product field through new products	0.60
PIP-EFFICA3. Extension of product range outside main product field	0.50
PIP-EFFICA4. Development of environment-friendly products	0.67
PIP-EFFICA5. Market share evolution	0.74
PIP-EFFICA6. Opening of new markets abroad	0.56
PIP-EFFICA7. Opening of new domestic target groups	0.58
Product innovation efficiency (PIP-EFFICI)	
PIP-EFFICI8. Average innovation project development time	0.85
PIP-EFFICI9. Average number of working hours on innovation projects	0.92
PIP-EFFICI10. Average cost per innovation project	0.93
PIP-EFFICI11. Global degree of satisfaction with innovation project efficiency	0.88

3.2. Measurement assessment

We adopt scales from previous studies (Westland, 2015). The constructs are measured by using a Likert-type scale that ranges from 1 (strongly disagree) to 7 (strongly agree). The ITS is measured using Lee and Choi's (2003) scale; the KS scale comes from Chen, Lin, and Yen (2014); and the OLC uses a two-dimensional scale (Alegre & Chiva, 2008) of experimentation (E_OLC) and risk-taking (R_OLC). The PIP's two-dimensional scale (PIP_EFFICI and PIP_EFFICA) comes from Alegre et al. (2006) and Alegre and Chiva (2008).

We also perform a confirmatory factor analysis (CFA) by using AMOS® to assess the measurement validity. We only retain the 25 items that meet the recommended levels (Bagozzi & Baumgartner, 1994) that indicate good measurement validity. The unidimensionality among the items in each variable is confirmed. The item-to-total correlation is used for convergent validity. No item-to-total correlation score is lower than 0.4. The factors explain 62.6% of the variance, which is above the recommended value of 60% (Hair et al., 2005). Table 2 summarizes the variables' descriptions and the results of the CFA.

Following Podsakoff, MacKenzie, Lee, and Podsakoff (2003), the questionnaire was carefully prepared to reduce the common method bias (CMB). Respondents were guaranteed total anonymity, and all information that could serve to back-track to the respondents was removed. The existence of CMB is evaluated using Harman's Single Test. The five factors that emerge from the exploratory factor analysis account for 70.53% of the variance in the data with the first factor accounting for < 50% of the total variance. Thus, CMB is not present.

3.3. Calibration

Calibration is the process of classifying conditions from full membership to full nonmembership. Following Ragin (2008), we define three different anchors to calibrate the data to establish the degree of membership in each score: 0.95 for full membership, 0.50 for membership ambiguity, and 0.05 for full nonmembership (Table 3). The transformation of the Likert scales into fuzzy sets is possible by calculating the average values of the items (Woodside, Hsu, & Marshall, 2011). Since the measurement is a 7-point scale, we identify full nonmembership, the crossover point, and full membership as 2, 4, and 6 respectively. Following Woodside, Prentice, and Larsen (2015), we adjust the cut-values depending on the number of items in each variable and its statistics.

4. Analysis and results

4.1. Analysis and results of structural equation modeling

We use structural equation modeling (SEM) to test the fit of the data for hypotheses H1 to H5. The indices show an adequate overall model fit. Table 4 presents the absolute ($\chi 2/df = 1.956$, RMSEA = 0.051) and incremental (CFI = 0.897, TLI = 0.878) indices that factor in the recommended values for a good fit as in Hair et al. (2005) and Byrne (2009).

4.1.1. Measurement model fit

We assess the overall fit of the measurement model following the guidelines in Hair et al. (2005) who use the CFA to assess the psychometric properties of the constructs. The first-order confirmatory test

Table 3
Calibration for causal conditions and outcome.

Conditions/outcome	Descriptive statistics	Calibration
PIP_EFFICA	μ = 4.85, σ = 1.13, min = 1.00, max = 7	(6.2, 5.0, 3.3)
PIP_EFFICI	μ = 4.27, σ = 1.56, min = 1.00, max = 7.00	(6.3,5.1,3.5)
TL	23.4% secondary, 54.2% graduate, 22.4% post-graduate	Secondary = full nonmembership, graduate = membership ambiguity, post-graduate = full membership
ITS	μ = 4.46, σ = 1.46, min = 1.00, max = 7.00	(6.5, 4.9, 1.9)
KS	μ = 4.26, σ = 1.45, min = 1.00, max = 7.00	(6.2, 4.4, 1.6)
OLC_E	μ = 4.89, σ = 1.57, min = 1.00, max = 7.00	(7.0, 5.5, 3.0)
OLC_R	μ = 4.17, σ = 1.49, min = 1.00, max = 7.00	(6.5, 4.4, 2.0)

μ = mean, σ = standard deviation, min = minimum, max = maximum.

Table 4
Structural model fit, research hypotheses, and results.

Model 1: TL secondary	Paths	Estimate	SE	CR	P	Results
H1 (+)	OLC ← ITS	0.086	0.117	0.731	0.465	Not supported
H2 (+)	OLC ← KS	0.630	0.160	3.929	***	Supported
H3 (+)	PIP ← OLC	0.382	0.111	3.442	***	Supported
H4 (+)	PIP_EFFICA ← PIP_EFFICI	0.444	0.097	4.564	***	Supported
Model 2: TL graduate						
H1 (+)	OLC ← ITS	0.353	0.075	4.693	***	Supported
H2 (+)	OLC ← KS	0.437	0.080	5.455	***	Supported
H3 (+)	PIP ← OLC	0.385	0.075	5.102	***	Supported
H4 (+)	PIP_EFFICA ← PIP_EFFICI	0.274	0.056	4.912	***	Supported
Model 3: TL post-graduate						
H1 (+)	OLC ← ITS	0.685	0.184	3.715	***	Supported
H2 (+)	OLC ← KS	0.308	0.116	2.657	***	Supported
H3 (+)	PIP ← OLC	0.583	0.122	4.789	***	Supported
H4 (+)	PIP_EFFICA ← PIP_EFFICI	0.257	0.083	3.094	***	Supported

	X^2	Df	*p*-value	X^2/df	CFI	TLI	RMESA
Measurement model	560.477	249	0.000	2.251	0.954	0.945	0.058
Structural model	1484.652	759	0.000	1.956	0.897	0.878	0.051

SE = standard error, CR = composite reliability, *** = $p < 0.001$.
X^2 = chi-squared, Df = degrees of freedom, CFI = comparative fit index,
TLI = Tucker-Lewis index, RMSEA = root mean squared error of approximation.

with multiple factors shows an adequate fit (Table 2).

4.1.2. Structural model fit

Table 4 shows the results for the hypotheses. Hypothesis 1 relates to the relation between ITS and OLC. The results show an insignificant effect from support on capacity in model 1 (TL: secondary). Nevertheless, the results confirm significantly positive effects from ITS on OLC in model 2 (TL: graduate, ß = 0.353, $p < 0.001$) and in model 3 (TL: post-graduate, ß = 0.685, $p < 0.001$). Therefore, models 2 and 3 support H1. Hypothesis 2 refers to the relation between KS and OLC. The results confirm significantly positive effects from sharing on capacity in models 1 (ß = 0.630, $p < 0.001$), 2 (ß = 0.437, $p < 0.001$), and 3 (ß = 0.308, $p < 0.001$). Further, the findings show significantly positive effects from OLC on PIP (H3) in models 1 (ß = 0.382, $p < 0.001$), 2 (ß = 0.385, $p < 0.001$), and 3 (ß = 0.583, $p < 0.001$). Likewise, the results support the relation between PIP_EFFICI and PIP_EFFICA (H4) in models 1 (ß = 0.444, $p < 0.001$), 2 (ß = 0.274, $p < 0.001$), and 3 (ß = 0.257, $p < 0.001$).

The findings show that higher training levels are significant in affecting the impact of ITS on OLC (H1). However, one case exists where the TL is not significant: model 1 (concerning less training). Considering H2, H3, and H4, the results show significantly positive effects at the three training levels (Table 4 shows similar results for the different models). Consequently, the results do not support H5. Therefore, no evidence exists for a moderating effect from the TL.

4.2. Analysis and results of the fuzzy-set qualitative comparative analysis (fsQCA)

We test H6 and H7 with the version of the fsQCA that Oyemomi et al. (2016) and Ozkan-Canbolat and Beraha (2016) use. To address the configurations that lead to PIP_EFFICA (H6) or its absence (H7), we follow the recommendations of Ragin (2000, 2008), Schneider and Wagemann (2010), Fiss (2011), and Mas-Verdú, Ribeiro-Soriano, and Roig-Tierno (2015). The fsQCA accepts alternative configurations of conditions, equifinality, and asymmetry (Fiss, 2011) that allow for more than one configuration of conditions that lead to PIP_EFFICA or its absence. The fsQCA analysis uses the same variables as the SEM analysis.

4.2.1. Necessity and sufficiency analysis

The condition's degree of necessity indicates its impact on achieving the outcome. Conversely, the condition's degree of sufficiency shows the extent of its relation to the explanation of the outcome (Fiss, Sharapov, & Conqvist, 2013). The sufficient sets are configurations of several conditions that lead to the outcome variable. Necessary conditions should present a consistency score that exceeds 0.80 (Ragin, 2000). No conditions (to the outcome nor its absence) comply with that threshold; thus, there are no necessary conditions.

When examining sufficiency, an analysis of the truth tables should show minimum thresholds for raw consistency (0.80) (Ragin, 2006). The PIP_EFFICA is 0.80, and the ~PIP_EFFICA is 0.81 (~ refers to the absence of). The consistency levels of the two intermediate solutions are at 0.75 (Ragin, 2005), and the solutions' coverage levels are within the suggested limits of 0.25 to 0.90 (Ragin, 2008; Woodside & Zhang, 2013).

Regarding PIP_EFFICA, 5 parsimonious configurations and 11 intermediate ones exist with consistency levels that comply with the 0.80 threshold (Fiss, 2011; Ragin, 2008) (Table 5). Considering ~PIP_EFFICA, 5 parsimonious configurations and 12 intermediate ones exist with consistency levels that comply with the threshold of 0.75 (Ragin, 2005).

4.2.2. Causal configurations

The causal configurations present core and peripheral conditions for PIP_EFFICA and ~PIP_EFFICA (Table 5). The core conditions are the ones included in the parsimonious and intermediate solutions, while the peripheral conditions are only part of the intermediate solution (Fiss, 2011; Fiss et al., 2013; Ragin, 2000, 2008).

5. Discussion and conclusions

We use a mixed methods approach to address PIP. The quantitative results show the following: First, ITS and KS have a positive effect on OLC (H1 and H2). This effect means that these two antecedents allow firms to learn. Second, OLC has a positive effect on PIP (H3) that means experimentation and risk-taking lead to innovation. Such findings strengthen the existence of the antecedents of PIP. Third, PIP_EFFICI has a positive effect on PIP_EFFICA (H4). This effect supports the argument that PIP_EFFICI leads to PIP_EFFICA, which is a considerable contribution to the literature. Such findings significantly extend the

Table 5
Intermediate solutions for PIP_EFFICA and ~PIP_EFFICA.

Intermediate Solution (PIP_EFFICA)									
Model: PIP_EFFICA = f (TL, PIP_EFFICI, ITS, KS, OLC_E, OLC_R)									
Configurations	TL	EFFICI	ITS	KS	OLC_E	OLC_R	Coverage		Consistency
							Raw	Unique	
1	●	●			○		0.247460	0.009688	0.901032
2			●	●	●		0.527291	0.063076	0.845983
3	●		●	●			0.461971	0.026561	0.826054
4	◯	●	○	○			0.197085	0.009429	0.919520
5	◯	●		○	●		0.196836	0.001380	0.947491
6		●		●	○	○	0.240776	0.007060	0.926793
7		○	●	●		●	0.352628	0.009394	0.817142
8	●			●	○	●	0.280700	0.005459	0.821587
9	●		●		●	●	0.369757	0.009497	0.860237
10	◯	○	○		●	●	0.189270	0.017065	0.804622
11	◯	●		○		●	0.206812	0.001154	0.958868
Intermediate solution (~PIP_EFFICA)									
Model: ~PIP_EFFICA = f (TL, EFFICI, ITS, KS, OLC_E, OLC_R)									
Configurations	TL	EFFICI	ITS	KS	OLC_E	OLC_R	Coverage		Consistency
							Raw	Unique	
1			◯		◯	◯	0.537169	0.001700	0.822760
2				◯	◯	◯	0.532634	0.020584	0.816713
3		•	◯	◯			0.208660	0.006639	0.763006
4	•		◯		◯		0.382213	0.001866	0.830649
5	○	◯	◯			◯	0.410590	0.014568	0.876683
6	○	◯		•		◯	0.303906	0.001986	0.826537
7	○	•		◯		◯	0.173420	0.002162	0.785009
8		◯	◯	•		•	0.290152	0.011595	0.886463
9	•	◯		◯	•		0.276695	0.029183	0.867195
10		◯	•	•	•	◯	0.289116	0.008688	0.838472
11	•	◯		•	◯	•	0.215865	0.007619	0.877591
12		◯	◯		◯	◯	0.553356	0.013765	0.858926

Overall solution coverage: 0.749994, Overall solution consistency: 0.782432.
Overall solution coverage: 0.803240, Overall solution consistency: 0.760541.
Black circles (•) indicate the presence of a condition, and open circles (◯) indicate its absence. Large open circles indicate core conditions: small or peripheral. Blank spaces indicate condition does not contribute to the configuration.

knowledge on PIP in SMEs by uncovering the relation between efficiency and efficacy.

The SEM analysis addresses the moderating effect of training (H5). The results show a limited influence of the TL on the model. For managers with less training, ITS does not have a significant effect on OLC. This finding shows that poorly educated managers are unable to use ITS to achieve OLC. The analysis accepts all of the other hypotheses regardless of the TL but does not support H5, which indicates that PIP ignores the role of this variable in the analysis.

Considering the qualitative approach, no necessary conditions exist for either the outcome or its absence, but alternative configurations exist that lead to PIP_EFFICA (supporting H6) and ~PIP_EFFICA (supporting H7). Regarding the number of configurations, the results show fewer configurations (11) that lead to PIP_EFFICA than those that lead to its absence (12). Such evidence indicates the existence of more pathways leading to less innovative outcomes than to innovation, which is disturbing for SME managers and constitutes a challenge for practitioners.

The results corroborate the assumptions of the fsQCA: a) more than one configuration leads to PIP_EFFICA (as well as ~PIP_EFFICA), b) alternative configurations produce the same outcome, and c) the conditions for PIP_EFFICA differ from the conditions for ~PIP_EFFICA. The balanced fsQCA results show PIP_EFFICI, ITS, KS, E_OLC, and R_OLC are core conditions for PIP_EFFICA; while ~PIP_EFFICI, ~ITS, ~KS, ~E_OLC, and ~R_OLC are core conditions for ~PIP_EFFICA. In particular, PIP_EFFICI is a core condition for PIP_EFFICA, while ~PIP_EFFICI is a core condition for ~PIP_EFFICA. These findings reinforce the results from the SEM analysis regarding H4. Both TL and ~TL are core conditions for PIP_EFFICA, which means that managers can lead SMEs to innovation despite their training. The TL and ~TL are not core conditions for ~PIP_EFFICA, which indicates their lack of importance in preventing innovation in SMEs.

The results from the quantitative and qualitative analyses underline the effect of ITS, KS, and OLC on PIP and show the relation between its efficiency and efficacy. Table 6 gives a summary of the SEM (H1–H5) and the fsQCA (H6–H7) testing results.

The findings help managers make balanced decisions to create PIP. The ITS, KS, OLC, and PIP_EFFICI can contribute to PIP following a single model (SEM) and to PIP_EFFICA with several combinations (fsQCA). The findings show that a firm with OLC can have a high level of PIP if the firm simultaneously guarantees ITS and KS practices. Furthermore, firms that have PIP_EFFICI can develop high PIP_EFFICA.

Firms with ITS and KS practices can develop new capabilities such as OLC and, consequently, PIP. Surprisingly, a firm with a manager with low TL can also obtain good results in PIP. Therefore, SME managers can develop PIP_EFFICA through multiple pathways consisting of different combinations and levels of antecedents: ITS, KS, OLC, and PIP_EFFICI.

Table 6
Results of SEM and fsQCA.

	Methods	
Hypothesis	SEM	fsQCA
Model 1: TL secondary		
H1	Not supported	–
H2	Supported	–
H3	Supported	–
H4	Supported	–
Model 2: TL graduate		
H1	Supported	–
H2	Supported	–
H3	Supported	–
H4	Supported	–
Model 3: TL post-graduate		
H1	Supported	–
H2	Supported	–
H3	Supported	–
H4	Supported	–
Complete research model		
H5	Not supported	–
H6	–	Supported
H7	–	Supported

The application of a fsQCA to analyze the configurations that lead to PIP offers a significant contribution to the literature since the results show that the SEM and fsQCA can yield different paths within the same research model. Further, the equifinality of fsQCA provides insights into how to improve our understanding of SMEs.

5.1. Implications for theory and research

Theoretically, this study contributes to both the PIP and strategic management literature by trying to understand the antecedents that result in OLC and PIP. We operationalize multidimensional and multilevel variables for PIP. Thus, we demonstrate that the theoretical groundings put forth by the RBV, KBV, and DCV, which are often abstract, can be decomposed into a series of specific antecedents that more easily lead to PIP. In other words, we examine how effective firms enhance three antecedents to reach PIP. The antecedents to PIP are dynamic, add value to firms, and can help in turbulent environments (Kohli & Grover, 2008). Thus, we identify specific antecedents at different organizational levels that are key to achieving PIP.

By using an online survey, we attempt to empirically support the influence of antecedents on PIP. The results support the argument that the impact of antecedents on PIP is positive. Nevertheless, the argument that the manager's TL is a moderating variable that strengthens the effects of antecedents on PIP has no support.

From a methodological standpoint, this study exemplifies the complementarities of the SEM and fsQCA. The SEM method is appropriate to explain the relations through which antecedents influence PIP, whereas the fsQCA provides a deeper understanding of the complex, nonlinear, and synergistic effects of the PIP_EFFICA's antecedents. The SEM results show the adequacy of the model, while the fsQCA findings indicate multiple alternative pathways that lead to PIP_EFFICA.

5.2. Managerial implications

In practice, the results of this study provide managers with a clear understanding of the antecedents of PIP. We use the RBV, KBV, and DCV to specify three antecedents: two at the organizational level (ITS and OLC) and one at the inter-organizational level (KS). These antecedents are managerial options that can cope with changing environments and consequently achieve PIP. In addition, we also demonstrate the value of investing in ITS and KS to generate a new dynamic capability such as OLC. This is a key capacity for PIP. As noted previously, based on the fsQCA results, the study offers different paths to reach PIP_EFFICA; therefore, each manager can choose which ones to follow.

5.3. Limitations and future research directions

Considering the time and cost limitations, a sample of 367 is small (response rate is 5.4%). Nevertheless, the survey is nationwide, and the sample it generates is representative of Portuguese SMEs. Still, caution is needed when generalizing the results. Future studies on countries other than Portugal could generalize our conclusions.

Future studies might consider other antecedents to PIP such as creativity or employee's motivations and other types of innovations such as process innovation (Muñoz-Pascual & Galende, 2017). Such influences should be explored at both the individual, organizational, and inter-organizational levels. Longitudinal studies that incorporate several levels of analysis could provide evidence on the causal relations and interactions among the dimensions of PIP. Future research could also uncover the sources of innovative behavior in SMEs.

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