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Understanding the HRM systems double contribution to radical and incremental innovation in SMEs: A configurational approach

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Abstract

Aim/purpose – In this paper, we explore the contribution of Human Resource Management Systems (HRMS) to innovation in SMEs. We consider two HRMS with different orientations: Commitment HRMS (focusing on long-term career development to increase employees' creativity) and Collaboration HRMS (focusing on the use of external human capital to achieve innovation). We believe that SMEs' radical and incremental innovation follow different paths from a configurational perspective. We want to understand how the two HRMS influence radical and incremental innovation, consequently, we explore the contributions of Commitment HRMS and Collaboration HRMS.

Design/methodology/approach – We apply a set-theoretic method, an analytic quantitative and qualitative technique to approach data – fuzzy-set Qualitative Comparative Analysis (fsQCA) – to test our models. We use a sample of 377 Portuguese SMEs from across industries.

Findings – Results show there are two pathways that lead SMEs to high levels of incremental innovation and three alternative paths that originate high levels of radical innova-

tion. By contrast, there are ways that lead to lower levels of incremental (two options) and radical innovation (three options).

Research implications/limitations – We provide propositions for theory development on the contribution of HRMS to innovation. Managerial contributions regard the several options provided to SME managers in search of innovation. Limitations regard the lack of generalization power of results due to the cross-sectional nature of the work. However, the research design is replicable without restrictions.

Originality/value/contribution – We suggest that SMEs' radical and incremental innovation follow different paths from a configurational perspective. With this study, we contribute to showing the diversity of ways to reach higher innovation levels at SMEs, so that managers know the alternatives they have at their disposal. Additionally, we reveal the ways that lead to lower innovation levels at SMEs, so we alert managers to the undesired pathways they should be cautious about.

Keywords: Human Resources Management Systems, incremental innovation, radical innovation, SME, fsQCA.

JEL Classification: M12, O15, O31.

1. Introduction

Human Resources Management systems (HRMS) are defined as configurations of Human Resources Management (HRM) practices (Zakaria et al., 2021; Zhou et al., 2013) grounded on relational and organizational aspects streaming from traditional HRM strategy research (Zhou et al., 2013). As specific configurations of HRM practices, HRMS are of being of importance to achieve innovation in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019). Plenty of HRM contributions influence innovation: from the selection of candidates to training and development; from employee participation to performance appraisals and remuneration practices (Barba-Aragón & Jiménez-Jiménez, 2020; Zakaria et al., 2021). Considering there are internally and externally oriented influences over innovation in SMEs (Maes & Sels, 2014), it makes total sense to address the HRM contribution to innovation from two perspectives; internal and external (Zhou et al., 2013). Internally, by focusing on the internal networks built on trust (Curado & Vieira, 2019) and commitment to increase employees' creativity and encourage individual participation in innovative activities (Ceylan, 2013; Zhou et al., 2013). Externally, by incentivizing relationships with external stakeholders and partners to acquire new knowledge and new ideas for companies (Gudda et al., 2013) using externally oriented knowledge-related capabilities (Maes & Sels, 2014).

Innovation plays a vital part in ensuring competitive advantage in specific organization settings, such as SMEs (Mas & Sels, 2014). Acting often as “first-movers” to test and achieve any form of innovation, SMEs can play a key role in key economic dynamics by exploring first-hand products, services, and technologies that can shape economic dynamics (Dibrell et al., 2008; Mas & Sels, 2014). When addressing innovation in SMEs, one should consider a clear dichotomy: incremental and radical innovation (Lennerts et al., 2020; Park et al., 2019; Woschke et al., 2017). The degree of newness distinguishes radical from incremental innovation (Tang et al., 2022); radical innovation is more drastic, it reflects fundamental changes and clear departures from existing solutions, while incremental innovation regards marginal extensions and improvements to current solutions.

Evidence shows that distinct HRMS can impact organizational innovation (Zhou et al., 2013), with results showing commitment-based HRMS as contributors to several types of innovation (Ceylan, 2013; Easa & El Orra, 2020). Furthermore, evidence also shows that, while different HRMS contribute to product innovation, the combined influence of both can present negative or even contradictory results with innovation types related to the innovation process (Easa & El Orra, 2020). For example, while research findings address the importance of both collaboration-based and commitment-based HRMS to achieve both types of innovation, evidence surrounding commitment-based HRMS to achieve innovation remains vastly underexplored (Easa & El Orra, 2020). Translating the empirical scarcity of research to the resource-constrained reality of SMEs, it is often a challenge to achieve the necessary resources for innovation, consequently, SMEs tend to innovate less than large firms. Evidence shows that less developed HRM structures in the context of SMEs can act as hindrances to achieving organizational innovation (Adla et al., 2019). Thus, studies have been increasingly exploring the contribution of resources for innovation in SMEs (Woschke et al., 2017). It is therefore relevant to identify all contributions to increasing innovative outputs in small businesses, including the ambiguous ways in which HRM affects innovation (Easa & El Orra, 2020; Maes & Sels, 2014). Only a limited number of studies have addressed the relationship between HRMS and innovation (e.g., Ceylan, 2013; Chiang et al., 2014; Li et al., 2018; De Saá-Pérez & Díaz-Díaz, 2010). Very few studies have considered HRMS contributions to both radical and incremental innovation, and the ones that did (such as Adla et al., 2019; Lennerts et al., 2020; Park et al., 2019) have disregarded specific HRMS, types of innovation or complex configurational perspectives. As such, the literature presents a two-folded research gap. First, there is a lack of evidence

surrounding the similarities and differences between both Commitment-oriented Human Resource Management System (Com-HRMS) and Collaboration-oriented Human Resource Management System (Collab-HRMS) in their ambiguous role as contributors to incremental and radical innovation. Second, to our knowledge, no other work has considered such a relationship while following a complex configuration analysis – allowing us to understand both circumstances promoting radical and incremental innovation but also their absences. This identified gap led us to the research question our study aims to address: how do HRMS contribute to radical and incremental innovation in Portuguese SMEs?

We suggest that SMEs' radical and incremental innovation follow different paths from a configurational perspective. In particular, we want to understand how different HRMS contribute to radical and incremental innovation in SMEs. Therefore, we test a sample of Portuguese SMEs across industries to understand the influences that the two HRMS have over radical and incremental innovation. Additionally, we also address the contributions of firm size and firm industry in order to explore potential trends. We adopt a configurational analysis that allows us to discover the configurations leading to high innovation levels but also to low innovation levels.

With this study, we contribute to showing the diversity of ways to reach higher innovation levels at SMEs, so that managers know the alternatives they have at their disposal. Additionally, we reveal the ways that lead to lower innovation levels at SMEs, so we alert managers to the undesired alternatives they should be cautious about.

Our paper is structured as follows. First, we conduct a literature review, providing an overview of organizational innovation, addressing incremental and radical innovation alike. Then, we argue on the importance of HRM practices and systems in organizational innovation by narrowing our discussion toward evidence surrounding collaboration-based HRMS' and commitment-based HRMS' role as contributors to forms of organizational innovation. Evidence surrounding SMEs drives our research hypotheses. Then, we provide insight into our research methodology and main findings, following a fuzzy-set qualitative comparative analysis to explore complex configurations between HRMS and innovation types in SMEs. A discussion of our findings follows the results sections, with concluding remarks addressing the academic and practical contributions of our work.

2. Literature review

2.1. Organizational innovation

Organizational innovation regards the adoption of new ideas or behaviors by an organization (Ling & Nasurdin, 2010). Innovation is essentially about identifying and using opportunities to create new products, services, or work practices (Jiménez-Jiménez & Sanz-Valle, 2008; Mumford, 2000). A critical part of the knowledge and skills needed for innovation resides in individuals (Subramaniam & Youndt, 2005). Therefore, organizations with a tendency to innovate continually seek to manage their human resources effectively to create and market new products and services (D'Agostino & Moreno, 2018). Given the influence of radical innovation on the industry, the literature has paid attention to the research on radical innovation but neglected the research on incremental innovation (Han et al., 2020). Innovative capacity or the ability to adopt innovative practices in an organization is determined by human resource management practices (Arulrajah, 2014; Ling & Nasurdin, 2010). The practices that favor radical innovation are not the same practices that favor incremental innovation. Some organizations may be more suited to one type of innovation but not the other, and different degrees of innovation need to be managed differently (Hitt et al., 2010). Internal and external antecedents play different influences on radical and incremental innovation, e.g., organization structure (Jansen et al., 2006; Prajogo & McDermott, 2014), informal social relations (Jansen et al., 2006), alliance portfolio characteristics (Wuyts et al., 2004); externally and internally oriented knowledge-related capabilities (Maes & Sels, 2014), competition intensity (Bouncken et al., 2018); internal capabilities and external sources (Hervas-Oliver et al., 2019), public support (Radicic et al., 2020) and HRM (Barba-Aragón & Jiménez-Jiménez, 2020; Lei et al., 2021; Li et al., 2018; Park et al., 2019), and resource scarcity in SMEs (Adla et al., 2019; Woschke et al., 2017). Therefore, dealing with incremental innovation differs from radical one. Thus, the literature has suggested that firms should adopt distinct approaches and strategies (Vasconcelos Gomes et al., 2019), and asked for studies that emphasize how radical and incremental innovation management differ (Löfsten, 2017).

2.1.1. Incremental innovation

Incremental innovation is one that derives from existing knowledge (Hitt et al., 2010) and results from an exploitative innovation process that seeks to improve the current technologies (Han et al., 2020; Mei et al., 2013). Incremental innovation can occur more routinely and is also conducive to technological catch-up, resulting in additional competitive advantages, and displays low-risk characteristics (Norman & Verganti, 2014). Incremental innovation allows for small adjustments and improvements in current product lines (Chang et al., 2011; Hitt et al., 2010), which makes it possible to improve the performance of these products, reduce costs, and increase desire (Norman & Verganti, 2014). Radical innovation generates deep changes in the industry, thus the literature often addressed radical innovation (Vanhaverbeke, 2013) but paid less attention to the research on incremental innovation (Han et al., 2020). Incremental innovation, being more usual, is also capable of originating technological developments that support competitive advantages at lower-risk levels than radical innovation (Norman & Verganti, 2014). It requires less time to develop and it reaches markets faster (Shaikh & Colarelli O'Connor, 2020). The development of incremental innovation is more common than radical innovations in SMEs (Forsman & Annala, 2011). Since innovation is often the result of complex relations in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019), we suggest that:

H1: There are alternative paths leading to high levels of incremental innovation in SMEs.

Additionally, since the lack of innovation often results from different combinations of circumstances in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019), we propose that:

H2: There are alternative paths leading to low levels of incremental innovation in SMEs.

2.1.2. Radical innovation

Radical innovation is characterized by strategic innovations that lead to the creation of new products and/or services or the transformation of existing processes (Hitt et al., 2010; Sumo et al., 2016). These are fundamental changes that represent revolutionary evolutions, originating changes in existing knowledge (Chang et al., 2011), thus, radical innovation has three properties: novelty, uniqueness, and influence on future inventions (Dahlin & Behrens, 2005). Radi-

cal innovation is a firm-level outcome (Strese et al., 2018) resulting from inventive processes aiming at exploring new opportunities to foster novelty and deviating from existing technology bases (Han et al., 2020; Lin et al., 2013). Therefore, radical innovation usually applies new technology and satisfies customers considerably better than existing market solutions, acting as a “game changer” (O’Connor et al., 2008). Larger firms have the greatest propensity to develop innovative solutions with higher degrees of novelty (Tellis, 2013, p. 240), yet, SMEs also engage in radical innovation (Maes & Sels, 2014; Strese et al., 2018; Tang, 2022). Different types of networks (e.g., peer collaboration) influence radical innovation (Hao & Feng, 2016), therefore, the firm’s location in a cluster influences radical innovation (Grashof et al., 2019). The same happens with industry-university collaborations and radical innovation (Arant et al., 2019). HRMS focused on change and creativity has a positive effect on radical innovation (Barba-Aragón & Jiménez-Jiménez, 2020). SMEs are the main drivers of radical innovation (Tang et al., 2022). Since innovation performance is often the result of complex relations in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019), thus following Tang et al. (2022) we suggest that:

H3: There are alternative paths leading to high levels of radical innovation in SMEs.

Additionally, since the lack of innovation often results from different combinations of circumstances in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019), we suggest that:

H4: There are alternative paths leading to low levels of radical innovation in SMEs.

2.2. Human resources management

Human resources management is essential for inducing creative work behaviors among employees, which in turn allows for increased organizational innovation (Donate et al., 2015; Ling & Nasurdin, 2010). The literature extensively pointed out the significant role of HRM in organizational innovation (Barba-Aragón & Jiménez-Jiménez, 2020; Lei et al., 2021; Li et al., 2018; Park et al., 2019). HRM practices (Zakaria et al., 2021) (particularly those oriented toward commitment, e.g., Park et al., 2019) are claimed to establish the terms and conditions of the relationship between the employee and the company. A key aspect of innovative companies is to manage their human resources effectively to create new products and services (Ling & Nasurdin, 2010). Through

effective HRM practices, workers are encouraged to experiment with new ideas and implement changes in the various organizational activities, which are likely to contribute to organizational innovation (Donate et al., 2015; Easa & El Orra, 2020). From the human resources management perspective, both macro research (Apanasovich et al., 2017; Radicic et al., 2020), organizational practices (Zakaria et al., 2021), and organizational behavior research (Park et al., 2019) have devoted a great deal of effort to understand how human resources can support innovation. Selecting candidates based on their potential, training and evaluating a candidate's performance with the objective of personal development, employee participation, teamwork, and remuneration practices enhance the process of innovation activities (Barba-Aragón & Jiménez-Jiménez, 2020; Zakaria et al., 2021). Moreover, HRM-Innovation studies often address external relations contributing to innovation (Radicic et al., 2020). Regarding radical innovation, in particular, external and diversified sources may imply a necessary input of knowledge that differs significantly from the pre-existing one in the firm (D'Agostino & Moreno, 2018). Considering that internally and externally oriented knowledge-related capabilities influence innovation in SMEs and given that HRM influences knowledge exchange (Maes & Sels, 2014), we address the contribution of two HRMS that are also internally and externally oriented. The two innovative architectures of human resources management are the commitment-oriented system and the collaboration-oriented system. Both systems exert great influence on innovation not only by managing people but also by cultivating desirable social relationships (Gittell et al., 2010; Zhou et al., 2013).

2.2.1. Commitment-oriented Human Resource Management System

The Commitment-oriented Human Resource Management System (Park et al., 2019) (Com-HRMS) refers to human resource management practices that value employees and foster the creation of an environment of commitment between employees and the company (Ceylan, 2013; Easa & El Orra, 2020; Zhou et al., 2013). Com-HRMS focuses on long-term career development, growth opportunities, increased motivation in group work, and day-to-day social interactions, developing experienced and competent employees. Commitment can increase employees' creativity by building a suitable work environment and encouraging individual participation in innovative activities (Ceylan, 2013; Zhou et al., 2013). Com-HRMS is implemented through such practices as selective hiring, extensive training, performance evaluation, performance-based remuneration.

neration, job enrichment, teamwork, internal career opportunities, information sharing, security in employment, and job rotation (Zhou et al., 2013). According to Mossholder et al. (2011), Com-HRMS is strategically more appropriate when employees have company-specific knowledge and skills that are difficult to find available in the external labor market. Previous studies indicated that individual commitment-oriented human resources practices influence different types of innovation activities, such as training and performance evaluation with a focus on personal development, teamwork, and product innovation activities (Agarwala, 2010; Zhou et al., 2013). A high-commitment philosophy is beneficial for achieving innovative results, being that Com-HRMS is also positively related to management performance in such environments (Gambi et al., 2022). According to Zhou et al. (2013), practices such as job security not only establish a psychological commitment of workers to organizations, but also develop their motivation to take risks. In the same vein, selective hiring and extensive training for creativity not only create a “menu” of valuable talent but also convey value to innovation. Employee engagement, teamwork, and flexible job assignment programs motivate employees as well as ensure description and opportunities to innovate. Thus, a healthy environment for innovation is one in which employees feel incentivized and autonomous – being free of impediments to taking the initiative to innovate. Considering Com-HRMS are appropriate to test models in research and development (R&D) contexts (Park et al., 2019), like innovative settings (Kim, 2021), and since innovation is conditioned by HRMS in SMEs (Curado, 2018; Maes & Sels, 2014; Muñoz-Pascual et al., 2019), we suggest that:

H5: High levels of Com-HRMS contribute to high levels of incremental innovation in SMEs.

H6: High levels of Com-HRMS contribute to high levels of radical innovation in SMEs.

H7: Low levels of Com-HRMS contribute to low levels of incremental innovation in SMEs.

H8: Low levels of Com-HRMS contribute to low levels of radical innovation in SMEs.

2.2.2. Collaboration-oriented Human Resource Management System

The Collaboration-oriented Human Resource Management System (Collab-HRMS) follows a transitional approach, being neither as market-driven nor as control-focused as Com-HRMS (Lopez-Cabrales et al., 2009; Zhou et al, 2013).

Similarly to Com-HRMS, Collab-HRMS comprises a set of HRM practices that are configured to achieve cooperation-oriented and goal-oriented relationships between organizations and employees as a means for organizational success (Zhou et al., 2013). This system is focused on the development of quality links and relationships with stakeholders and external partners, which can bring new knowledge and new ideas to companies (Gudda et al., 2013). It is exclusively referring to various entities that may share a common interest with the organization, namely, alliances, partnerships with other professionals, companies, and academic institutions (Zhou et al., 2013). The big difference from the Com-HRMS system is that it focuses on the use of external human capital to achieve innovation (Kim, 2021; Lopez-Cabrales et al., 2009; Zhou et al., 2013). While a commitment-oriented environment is useful for innovation via internal knowledge management, a collaboration-oriented environment is conducive to seeking external knowledge contributions to innovation (Zhou et al., 2013). Developing committed relationships within the company is not the only path to innovation, it is possible (and often desirable) to build collaborative relationships with external entities (Greer & Stevens, 2015; Lopez-Cabrales et al., 2009), e.g., competitors (Bouncken et al., 2018). The decision to adopt HRMS depends on the consideration of the value and exclusivity of human capital for the organization (Mossholder et al., 2011). When interests are common among several companies, external human resource management partnerships may be desirable. These external partnerships include collaborations, joint technical committees, joint ventures, strategic alliances, industrial districts, and innovation ecosystems (Radicic et al., 2020; Zhou et al., 2013). As a result, organizations can create inter-organizational structures that support knowledge sharing and lead to innovation (Zhou et al., 2013). Not only should organizations focus on developing a partnership, but also on maintaining quality relationships with these external partners (Lopez-Cabrales et al., 2009). Therefore, it is important that organizations establish a common interest with their partners to facilitate collaboration. Considering Collab-HRMS play an important role in creating structural, relational, and cognitive relationships aiming at exploring new non-redundant information and knowledge, which are critical resources for innovation (Mossholder et al., 2011; Zhou et al., 2013), and since innovation performance is conditioned by HRMS in SMEs (Curado, 2018; Maes & Sels, 2014; Muñoz-Pascual et al., 2019), we suggest that:

H9: High levels of Collab-HRMS contribute to high levels of incremental innovation in SMEs.

H10: High levels of Collab-HRMS contribute to high levels of radical innovation in SMEs.

H11: Low levels of Collab-HRMS contribute to low levels of incremental innovation in SMEs.

H12: Low levels of Collab-HRMS contribute to low levels of radical innovation in SMEs.

3. Research methodology

We used a fuzzy-set Qualitative Comparative Analysis (fsQCA) methodology to assess the contribution of HRMS to high and low levels of incremental and radical innovation in SMEs. The fsQCA was developed after the set theory was applied to sociological research (Ragin, 2008a). The fsQCA is a Boolean algebra research technique bridging both quantitative and qualitative research concerns (Fernández-Esquinas et al., 2021). By following both qualitative and quantitative strategies, fsQCA allows for case-sensitive analysis through complex interactions and multiple causations (Saridakis et al., 2016). Such techniques describe those found in qualitative research strategies. However, the fsQCA explores complex causality under quantitative research design principles and approaches (Ragin, 2008a, 2008b; Rihoux, 2003). A variable-oriented treatment of cause and effect is calibrated into conditions and outcomes under the fsQCA technique. Therefore, the fsQCA allows for a deeper understanding of circumstances leading to outcomes by using Boolean algebra principles (Fernández-Esquinas et al., 2021; Saridakis et al., 2016). Such a configurational analysis process is limited in conventional regression analysis approaches (Vis, 2012). Unlike traditional quantitative methods that follow correlation techniques, the fsQCA is useful to address asymmetric relationships between variables that expand on traditional quantitative analysis. Therefore, the fsQCA analyzes conjunctural pathways that can be satisfied by the sufficiency of conditions that, in interplay, contribute to the desired outcome (Kraus et al., 2018). Thus, the fsQCA also allows equifinality which occurs when at least two different paths contribute to the same outcome (Ragin, 2008a). The flexibility of fsQCA bridging both research strategies justifies its use in pragmatic research designs that bridge exploration testing and hypothesis testing (Kent, 2005). By extension, the fsQCA permits the study of complex pathways by allowing the analysis of circumstances leading to low levels or high levels of the outcome (Ragin, 2009).

The fsQCA is an emerging research technique in the context of innovation research (Kraus et al., 2018), therefore justifying its use in the context of the present work. The growing need to gather in-depth insights into complex phenomena in organizational research is increasing the use of fsQCA in the literature, being of importance to better understand the complexities behind organizational innovation (Fernández-Esquinas et al., 2021; Kraus et al., 2018; Saridakis et al., 2016; Woodside et al., 2018).

3.1. Measures

We used previously validated measures to assess both the conditions and the outcomes of this study. All scales comprise a 7-point Likert-like measurement system, reflecting respondents agreeableness with statements regarding their organizational reality. Regarding HRMS, the literature showed that innovation performance is conditioned by different HR management strategies in SMEs (Curado, 2018; Maes & Sels, 2014; Muñoz-Pascual et al., 2019). Following this rationale, we measured two HRMS: ComHRMS and CollabHRMS. ComHRMS is focused on long-term career development to increase employees' creativity, whereas CollabHRMS is focused on the use of external capital to achieve innovation (Zhou et al., 2013). Both measures come from Zhou et al. (2013). Examples of measurement items for Com-HRMS (15 items) include "The extent to which Diversity-oriented selective recruitment has been adopted in your firm" and "The extent to which Job enrichment has been adopted in your firm". Examples of items for Collab-HRMS (6 items) include "The extent to which Formal external learning program with business partners has been adopted in your firm" and "The extent to which Long-term personnel alliance with external academic institutions has been adopted in your firm". Dimension addresses the SME size influence on performance (Muñoz-Pascual et al., 2019). We use dimension as a condition contributing to innovation in SMEs. Similarly, industry type is of importance to SME performance behavior (Radicic et al., 2020). Thus, we consider the industry type of SMEs as a condition also contributing to innovation.

Regarding outcomes, incremental innovation comes from Jansen et al. (2006). Example items for incremental innovation (7 items) include "We improve the efficiency of the products and services that are delivered" and "We often refine the delivery of existing products and services". Radical innovation comes from Sumo et al. (2016). Example items for radical innovation (4 items)

include “Creation of a new service within a particular market” and “New ways of interacting with the client who receives the service”. Incremental innovation is designed to measure the needs of existing customers that are met and related to the improvement of established solutions or the expansion of existing processes. Radical innovation, on the other hand, is designed to measure the needs of emerging customers or markets that are met and related to the creation of new solutions or the transformation of existing processes. Table 1 presents results for the reliability and discriminant validity of the measures used in the study.

Table 1. Reliability and discriminant validity of measures

Measure	α	ρ	CR	AVE	Source
Commitment-oriented HRMS (Com-HRMS)	0.920	0.930	0.932	0.484	Zhou et al. (2013)
Collaboration-oriented HRMS (Collab-HRMS)	0.772	0.791	0.840	0.471	
Incremental innovation	0.939	0.939	0.952	0.767	Jansen et al. (2006)
Radical innovation	0.861	0.863	0.906	0.707	Sumo et al. (2014)

3.2. Data collection and calibration

Collected data came from an online survey built using the Qualtrics® platform and sent to a database containing information on the largest 5000 SMEs in Portugal. A pretest was conducted prior to the deployment of the survey with two senior researchers and master’s students in HRM to validate the instrument. Two weeks later, after the initial deployment of the survey, a second reminder was sent. After cleanup procedures, the final sample comprised 377 responses.

Following fsQCA best practices, we transformed the data set into membership scores – a process defined as calibration (Ragin, 2008a). Calibration allows for the transformation of the existing variables into different classifications (Fiss, 2011). The various degrees of complexity and specific assumptions behind the study justify the calibration, transforming data into quantifiable dimensions that serve as a case analysis (Fernández-Esquina et al., 2021). We used an anchor system to establish variable data classifications (Schneider & Wagemann, 2012). Variable data fully – in the membership of the condition was classified as 1; variable data fully out – the membership of the condition was classified as 0; and a final classification for extreme ambiguity was established as a mid-point (0.5). That is, 1 represents circumstances where maximum or high levels of the condition were observed, whereas 0 represents circumstances where nonattendance or low levels of the condition were observed. Likert scales score followed a spe-

cific calibration technique that addressed classification anchors by using the mean values of the items of each condition after adjusting the cut-off values (Woodside, 2011). Table 2 presents the descriptive statistics and the calibration of conditions and outcomes.

Table 2. Calibration and descriptive statistics

Outcomes and conditions	Descriptive statistics	Calibration
Incremental innovation	$\mu = 5.03$; $\sigma = 1.22$; min = 1.5; max = 7	(6.9; 5.2; 2.6)*
Radical innovation	$\mu = 4.52$; $\sigma = 1.32$; min = 1; max = 7	(6.6; 4.6; 2.2)*
Collab-HRMS	$\mu = 3.44$; $\sigma = 1.26$; min = 1; max = 6.83	(5.6; 3.4; 1.4)*
Com-HRMS	$\mu = 4.58$; $\sigma = 1.12$; min = 1.47; max = 7	(6.25; 4.7; 2.45)*
Industry	208 (55.17%) = Services 169 (44.83%) = Manufacture	Services = 0 Manufacture = 1
Dimension	323 (85.68%) = Small (0 - 50 employees) 54 (14.32%) = Medium (51 - 250 employees)	Small = 0 Medium = 1

* Cutoff values (0.95; 0.50; 0.05).

4. Research findings

4.1. Necessity analysis

Following the calibration, we conducted both the necessity and sufficiency analysis of the conditions contributing to the outcomes of the study. The necessity analysis translates the degree of contribution a certain condition has in achieving desirable outcomes (Ragin, 2008a). According to best practices (Ragin, 2008a), the consistency values resulting from the necessity analysis are below the recommended threshold (Ragin, 2008b). That is, neither Collab-HRMS, Com-HRMS, industry or dimension are necessary to the high or low levels of the two forms of innovation. Such findings corroborate that there are no unique and indispensable variables to generate innovation. Table 3 presents the necessity analysis results for high and low levels of incremental innovation. Table 4 presents the necessity analysis results for high and low levels of radical innovation. A “~” before the condition or outcome indicates nonattendance or low levels of the condition or outcome.

Table 3. Necessity analysis for incremental innovation

Conditions	High incremental innovation		Low incremental innovation	
	Consistency	Coverage	Consistency	Coverage
Dimension (dim)	0.135654	0.486509	0.151245	0.513491
~Dimension (~dim)	0.864344	0.518246	0.848756	0.481754
Industry (ind)	0.445722	0.510775	0.450973	0.489225
~Industry (~ind)	0.554275	0.516076	0.549029	0.483924
Com-HRMS (com)	0.844325	0.844373	0.543745	0.514770
~Com- HRMS (~com)	0.514796	0.543770	0.835614	0.835565
Collab- HRMS (collab)	0.750724	0.774586	0.561050	0.548006
~Collab- HRMS (~collab)	0.561928	0.574883	0.769222	0.744979

Table 4. Necessity analysis for radical innovation

Conditions	High radical innovation		Low radical innovation	
	Consistency	Coverage	Consistency	Coverage
Dimension (dim)	0.148511	0.530068	0.137719	0.469932
~Dimension (~dim)	0.851490	0.508093	0.862280	0.491907
Industry (ind)	0.465403	0.530773	0.430361	0.469227
~Industry (~ind)	0.534599	0.495371	0.569638	0.504629
Com- HRMS (com)	0.829964	0.826035	0.539319	0.513163
~Com- HRMS (~com)	0.510849	0.537017	0.817167	0.821252
Collab- HRMS (collab)	0.763661	0.784160	0.541162	0.531253
~Collab- HRMS (~collab)	0.543509	0.553376	0.780134	0.759369

4.2. Sufficiency analysis

After the necessity analysis, we conducted a sufficiency analysis. Complementary to the necessity analysis, the sufficiency analysis offers insight into conditions or multiple combinations of conditions that contribute to the desired outcome (Pappas & Woodside, 2021). There are several alternative pathways for generating innovation, therefore evidence in this study supports the arguments of the diversified managerial strategies that lead to different innovation outcomes (Hitt et al., 2010). Following best practices, we report the intermediary solutions for all the tested models due to their capacity to make simpler assumptions that reflect the theoretical expectations. The coverage indexes reflect empirical importance (Ragin, 2008b) and each solution's coverage should score between 0.25 and 0.90 (Ragin, 2006; Woodside & Zhang, 2013). Consistency scores reflect how the specific configuration of antecedents is sufficient for explaining the outcome condition. The consistency threshold should be at least 0.75, and preferably, 0.80 or higher (Ragin, 2005, 2006, 2009). Almost all the configurations as well as the parsimonious and intermediate solutions presented con-

sistency levels above the threshold of 0.80. There was a single configuration (configuration 2 in Table 6) that failed to meet the 0.80 score, nevertheless, it was quite above 0.75.

Given that all conditions in the intermediate solutions also constitute the parsimonious solutions (for a comprehensive explanation of complex, parsimonious, and intermediate solutions, see Fiss, 2011; Ragin, 2008), they are all core conditions (conditions present in both the parsimonious and intermediate solutions). Tables 5 to 8 present the results from the sufficiency analysis. Black circles (●) indicate the high levels of a condition in the configuration contributing to the outcome. White circles (○) indicate the low levels of a condition in the configuration contribution to the outcome. Blank spaces indicate that the condition does not contribute to the outcome in that specific configuration.

Table 5. Causal configurations contributing to high incremental innovation

High incremental innovation = f(collab, com, ind, dim)							
Configuration	Causal conditions				Coverage		Consistency
	collab	com	ind	dim	Raw	Unique	
1		●			0.844326	0.525505	0.844374
2	●		○	○	0.353037	0.034215	0.800597

Note: Solution coverage: 0.878541; solution consistency: 0.804453.

Table 6. Causal configurations contributing to low incremental innovation

Low incremental innovation = f(collab, com, ind, dim)							
Configuration	Causal conditions				Coverage		Consistency
	collab	com	ind	dim	Raw	Unique	
1		○			0.835614	0.742251	0.835564
2	○			●	0.104365	0.011003	0.792821

Note: Solution coverage: 0.846617; solution consistency: 0.823609.

Table 7. Causal configurations contributing to high radical innovation

High radical innovation = f(collab, com, ind, dim)							
Configuration	Causal conditions				Coverage		Consistency
	collab	com	ind	dim	Raw	Unique	
1		●		○	0.716375	0.076634	0.818622
2	●	●			0.683467	0.041794	0.888201
3		●	●		0.392911	0.010000	0.818538

Note: Solution coverage: 0.824114; solution consistency: 0.830699.

Table 8. Causal configurations contributing to low radical innovation

Low radical innovation = f(collab, com, ind, dim)							
Configuration	Causal conditions				Coverage		Consistency
	collab	com	ind	dim	Raw	Unique	
1		○		○	0.696257	0.100197	0.831265
2	○	○			0.687286	0.044457	0.879712
3	○		○	●	0.053919	0.007149	0.832867

Note: Solution coverage: 0.794633; solution consistency: 0.832867.

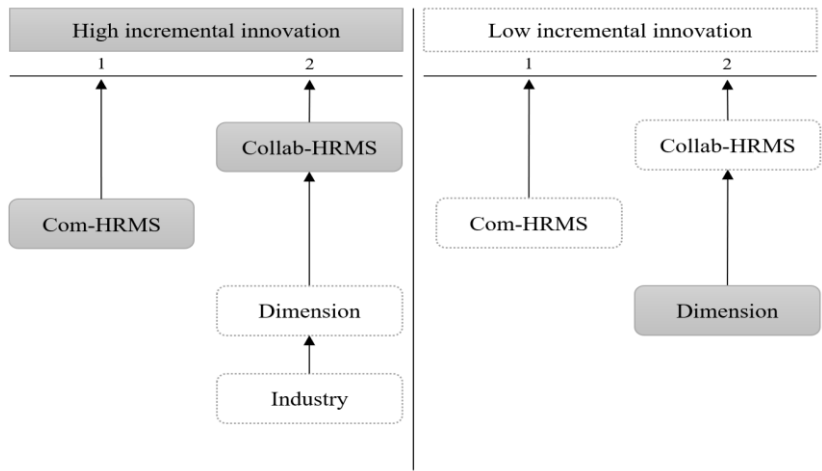
5. Discussion

Our configurational approach involving the contribution of different HRMS to both incremental and radical innovation is rare in SME empirical research to date, considering recent contributions are often limited to one type of innovation (Tang et al., 2022). There are no necessary conditions for either high (or low) levels of incremental innovation or high (or low) levels of radical innovation, which is consistent with innovation being the result of complex relations in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019) and not requiring a necessary circumstance to occur. There are alternative configurations leading to high radical innovation in agreement with Tang et al. (2022). There are as well alternative configurations leading to high incremental innovation, which suggests either form of innovation is equally complex for SMEs. Figure 1 presents the pathways leading to high and low levels of incremental innovation to increase readability. Similarly, Figure 2 presents the found pathways leading to high and low radical innovation.

The paths that produce innovation include the contribution of an HRMS (Collab-HRMS or Com-HRMS), either when considering incremental or radical innovation, regardless of other conditions. However, the configurations leading to high levels of incremental innovation differ from those leading to high levels of radical innovation, which illustrate the different essence of the phenomena in SMEs. As an example, considering the firm's industry, there is a special path regarding the services sector SMEs that leads to high levels of incremental innovation, and on the contrary, there is a particular path concerning the manufacturing SMEs that provides a way to high levels of radical innovation. Therefore, the results are consistent with the literature suggesting that firms should adopt distinct approaches and strategies (Gomes et al., 2019) since configurations leading to incremental innovation differ from the ones leading to radical innovation. Given existing evidence surrounding HRMS and radical innovation, we propose

that managers in manufacturing should deploy practices grounded in encouraging change and creativity, aimed at competence exploration as a core priority in performance appraisal and compensation (Barba-Aragón & Jiménez-Jiménez, 2020; Gomes et al., 2019).

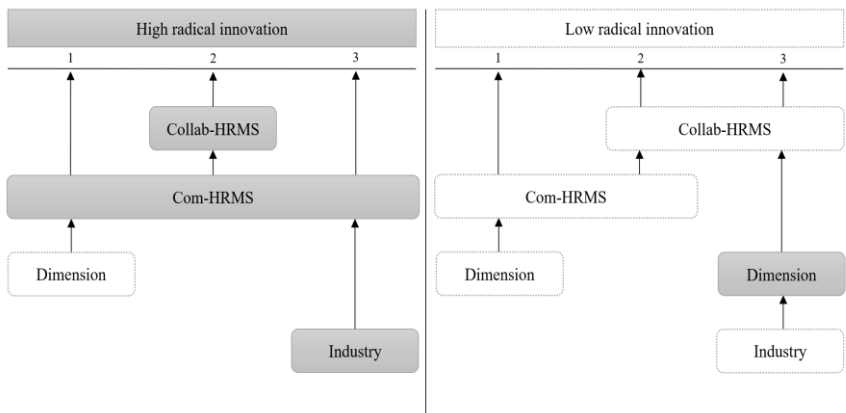
Figure 1. Causal configurations contributing to high and low levels of incremental innovation



Note: Grey/filled shapes indicates higher levels of the condition or outcome. White/blank shapes indicates lower levels of the condition or outcome.

Source: Authors' own elaboration.

Figure 2. Causal configurations contributing to high and low levels of radical innovation



Note: Grey/filled shapes indicates higher levels of the condition or outcome. White/blank shapes indicates lower levels of the condition or outcome.

Source: Authors' own elaboration.

There is a single condition configuration that generates high levels of incremental innovation which is to adopt Com-HRMS, regardless of Collab-HRMS. However, there is a single condition configuration that generates low levels of incremental innovation that refers to not adopting Com-HRMS, regardless of Collab-HRMS and the other conditions. Such results suggest the relevancy of the Com-HRMS in SMEs for incremental innovation. In contrast, Com-HRMS contributes to high levels of radical innovation in all three configurations. Curiously, Collab-HRMS only contributes to high levels of radical innovation when paired with Com-HRMS. We argue that the higher risk-driven nature of radical innovation depends on collaborative and commitment-heavy HRM strategies to strengthen the organizational capacity to adapt (Barba-Aragón & Jiménez-Jiménez, 2020). Nevertheless, Collab-HRMS is deemed irrelevant to high levels of radical innovation in either smaller SMEs, or in service-oriented SMEs, when Com-HRMS exists. The heavy reliance on communication management initiatives to maintain a sustainable market position among service-oriented SMEs (Benešová, & Hušek, 2019), the unstructured nature of personnel function (Barba-Aragón & Jiménez-Jiménez, 2020), and the ease and frequency of informal relationships in smaller SMEs might justify such findings.

There are no parallel findings regarding configurations leading to high incremental and high radical innovation, further illustrating the difference between the two phenomena. Our study also shows that there are several alternative configurations leading to low levels of incremental innovation and low levels of radical innovation that are not symmetrical with the configurations leading to high levels of incremental innovation and high levels of radical innovation. Such results reveal a lack of symmetry (asymmetry) between pathways for high and low levels for each type of innovation further reflecting the complexity of the phenomena. The paths that restrain innovation involve no HRMS (Collab-HRMS or Com-HRMS or both), either when considering incremental or radical innovation, regardless of other conditions. Such evidence is a clear alert to managers on the dangerous paths to avoid if they are in search of producing innovative outcomes in SMEs. Moreover, the configurations leading to low incremental innovation differ from those leading to low radical innovation, which reinforces theoretical differences among the phenomena and requires extra attention from managerial concerns. As an example, regarding the firm's industry, there are two special paths in the SME services sector that detains radical innovation, and no particular path concerning a way to hinder incremental innovation in a specific industry. Results of hypotheses testing show that HRMS contributes to innovation in SMEs in complex ways (Table 9).

Table 9. Results of hypotheses testing

Hypotheses	Results
H1: There are alternative paths leading to high levels of incremental innovation in SMEs	Supported
H2: There are alternative paths leading to low levels of incremental innovation in SMEs	Supported
H3: There are alternative paths leading to high levels of radical innovation in SMEs	Supported
H4: There are alternative paths leading to low levels of radical innovation in SMEs	Supported
H5: High levels of Com-HRMS contribute to high levels of incremental innovation in SMEs	Supported
H6: High levels of Com-HRMS contribute to high levels of radical innovation in SMEs	Supported
H7: Low levels of Com-HRMS contribute to low levels of incremental innovation in SMEs	Supported
H8: Low levels of Com-HRMS contribute to low levels of radical innovation in SMEs	Supported
H9: High levels of Collab-HRMS contribute to high levels of incremental innovation in SMEs	Supported
H10: High levels of Collab-HRMS contribute to high levels of radical innovation in SMEs	Supported
H11: Low levels of Collab-HRMS contribute to low levels of incremental innovation in SMEs	Supported
H12: Low levels of Collab-HRMS contribute to low levels of radical innovation in SMEs	Supported

6. Conclusions

Our study addresses a research gap focused on the dichotomous nature of innovation and its relationship with HRMS in SMEs. Therefore, our work aims at reducing the ambiguity on the precise ways in which HRMS affects innovation in SMEs (Maes & Sels, 2014) by addressing ways to reach high levels of innovation (incremental and radical) and ways that prevent innovation (incremental and radical). So, we are able to answer our research questions on how does HRMS contribute to radical and incremental innovation in Portuguese SMEs. Evidence allows us to put forward that HRMS contributes to radical and incremental innovation in Portuguese SMEs in very distinguished ways, given total support to the complexity of the innovative phenomena in SMEs (Curado, 2018; Muñoz-Pascual et al., 2019; Tang et al., 2022).

Our contribution to the literature regards the enlargement of the understanding of the phenomena from a comprehensive perspective: we offer the configurations leading to both high and low levels of incremental and radical innovation in SMEs. To achieve an insight into such complex interplay, we used a fsQCA approach to explore the causal complexity behind both types of organizational innovation. Bridging quantitative and qualitative concerns of empirical research, the rise of the fsQCA as an innovation research methodology (Kraus et al., 2018; Woodside et al., 2020) further supported our research design choices. Inspired by the fsQCA main findings we can provide in-depth practical contributions. As such, and given the theoretical support and our empirical results from a national study involving Portuguese SMEs, we propose that:

P1: There are alternative HRMS-supported paths leading to incremental innovation.

P2: There are alternative HRMS-supported paths leading to radical innovation.

P3: There are more alternative HRMS-supported paths leading to radical innovation than to incremental innovation.

P4: Incremental innovation is restrained at large firms lacking Collab-HRMS.

P5: Incremental innovation performance seems very dependent upon Com-HRMS.

P6: Incremental innovation has a specific Collab-HRMS-supported way to occur at microservices firms.

P7: Radical innovation is restrained at large services firms lacking Collab-HRMS.

P8: Radical innovation is restrained when firms have no HRMS (either Com-HRMS or Collab-HRMS) implemented.

P9: Radical innovation performance seems very dependent upon the existence of Com-HRMS at micro firms.

P10: Radical innovation has a specific Collab-HRMS-supported way to occur at micro firms.

P11: Radical innovation has a specific Com-HRMS-supported way to occur at manufacturing firms.

Regarding practical outcomes of our work, both HR managers and innovation managers benefit from our results. Managerial implications regard the different approaches SMEs should take in order to a) reach high incremental or radical innovation, and b) avoid situations of innovation prevention. Regarding the former, managers may consider the former, managers may consider the configurations in Tables 5 and 7 and engage all efforts in achieving them, as a way to succeed in the enhancements that support organizational competitive advantages. Therefore, we argue that, while managers in the manufacturing industry could engage in individual mechanisms of appraisal and compensation to promote radical innovation, service sector managers working in SMEs should foster and promote teamwork, encourage cross-functional tasks and develop teambuilding initiatives – thus fully translating practices supported by Collab-HRMS. Regarding low levels of innovation, managers should avoid the configurations in Tables 6 and 8, and that way try to escape organizational situations lacking improvement and novelty. Managers should deploy refined strategies considering the desired innovation outcome with particular attention to the circumstances surrounding organizational idiosyncrasies. For example, while Collab-HRMS is a sufficient condition contributing to high levels of incremental innovation, such an HRMS requires a combination with Com-HRMS to achieve high levels of radical innovation. Therefore, if a risk-heavy, fast-paced adaption strategy is a foreseeable reality, managers should be careful and ensure policies promoting both commitment and collaboration levels among employees. Such a double contribution, representing circumstances where both Com-HRMS and Collab-HRMS can contribute to both incremental and radical innovation pre-

sents challenges regarding industry type and size of SMEs. The adoption of both individual and team-based HRM strategies should be balanced, integrating both perspectives to achieve distinctive forms of innovation. Similarly, our findings also suggest possible HRM strategies for managers working in smaller service-oriented SMEs, whose specific configurations can provide tailor-made solutions for innovation performance in such firms.

Our work presents several limitations. The use of the fsQCA approach allows for the variable-like treatment of conditions found in quantitative methodologies. However, the cross-sectional nature of our research limits the generalization of results. Regarding the study's conditions and outcomes, we do not include several technology-related conditions that might contribute to higher or lower levels of incremental or radical innovation in SMEs. As such, we recommend future research to explore technological influences, such as information technology organizational preparedness to further analyze our initial groundwork.

We invite our colleagues to test our concluding propositions and further expand our study on assessing differences between firm sizes, industries, cultures, and countries. We also recommend future work to explore the requirements of cooperative strategies for innovation in terms of HRMS, as a contrasting HRM strategy to collaborative and committed HRMS. By extension, future venues of research might include the use of mixed methods to address the conditions and outcomes of our study and magnify our current findings.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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