

Innovation reliability and variability strategies: the importance of absorptive capacity to systemic outcomes

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Abstract: The role of absorptive capacity (AC) has been widely recognised in the innovation literature. This study examines the predictive role of AC for business performance, and evaluates the mediation of market orientation (responsive-proactive) and innovation competences orientation (exploitation-exploration) in that relationship. The findings show that innovation competence orientations are more important to business performance than market orientations and that innovation competences are better enhanced by AC than by market orientations. AC is not only confirmed as an antecedent of ambidextrous market and innovation competence orientation, but it also helps directly and indirectly to explain business performance. Responsive market orientation (REMKTOR) and innovation competence orientation mediate the positive relationship between AC and business performance. The intensity and significance of the indirect effects reveal the specific knowledge-transformative roles of market and innovation competences orientations. Firms seem to mitigate uncertainty by adjusting their preferences toward less risky innovation strategies.

Keywords: absorptive capacity; market orientation; innovation competences orientation; business performance; explorative innovation; exploitative innovation.

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1 Introduction

In a dynamic world marked by change and a maze of interrelated competitive dimensions, a firm that resists fostering organisational learning as a continuous structural process can hardly expect to achieve higher relative performance, given the importance of learning for innovation activities (Alexiou et al., 2019; Grimsdottir et al., 2019). Such activities benefit from knowledge that is both internal and external to the firm. Absorptive capacities (AC), and the way they relate to innovation exploitation and exploration, are therefore expected to be important to the firm's business performance (Ben-Menahem et al., 2013). This study presents and tests a conceptual model integrating the direct effect of absorptive capacity on innovation competences orientation, market orientation and business performance, as well as the mediation effect of these paradoxical firm orientations (responsiveness-proactivity and exploitation-exploration) on the relationship between AC and business performance. Exploitation and exploration are separated in a set of market and innovation related constructs to understand which of the two orientations is more important to business performance: market orientation (responsive-proactive) or innovation competences orientation (exploitation-exploration) (e.g., Uotila et al., 2009). This is the central research question of this study.

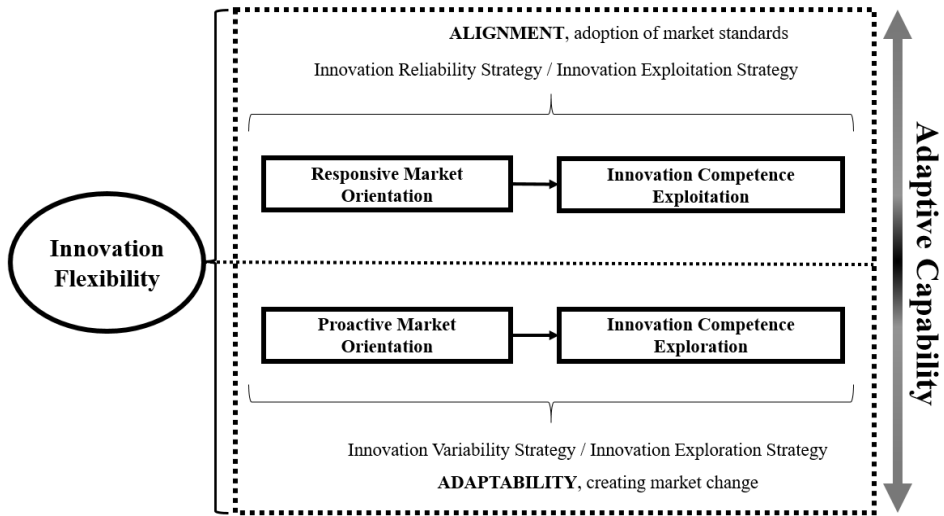
To our knowledge, this is the first study to empirically address the question while separating the exploitation and exploration strategies for market orientations (responsive-proactive) and innovation competences orientation (exploitation-exploration), and considering the role of AC. Thus far, this issue has been poorly understood and as the few studies that address the matter (Ge and Ding, 2005; Langerak et al., 2007; Olavarrieta and Friedmann, 2008) frequently bundle model exploitation and exploration together in a single construct, this constitutes a gap in the literature (ambidexterity). Furthermore, there is contradictory empirical evidence, especially regarding the impact of market orientation on firm performance (Han et al., 1998; Kirca et al., 2005). The paradox of alignment vs. adaptability in face of changing conditions is also examined: firms need efficiency today and renewal for the future. The current study designates a responsive market orientation (REMKTOR) together with an innovation competence exploitation orientation as an “innovation reliability strategy”, and a proactive market orientation together with an innovation competence exploration orientation as an “innovation variability strategy”. The innovation reliability strategy is considered to be responsible for the firm’s alignment with its environment (adopting market characteristics), while the innovation variability strategy is considered to be responsible for the firm’s adaptability to its environment (creating market change) (Mom et al., 2007).

Throughout this study, and for better clarity: the exploitation arm of the conceptual model (REMKTOR together with innovation competence exploitation) is regarded as a capability with the purpose of aligning the firm with the market (innovation reliability strategy or innovation exploitation strategy). Similarly, the exploration arm of the models (proactive market orientation together with innovation competence exploration) is regarded as a capability with the purpose of creating market change (innovation variability strategy or innovation exploration strategy). An innovation reliability and variability strategy is terminology borrowed from Mom et al. (2007). The set composed of both such strategies is hereby coined ‘innovation flexibility’, while the search and balance of the two strategies – which is implicit and not directly observed – is referred to as adaptive capability (Staber and Sydow, 2002; Wang and Ahmed, 2007). The terminology is depicted in Figure 1.

The theoretical background of this study is the knowledge-based view (KBV) of the firm (Spender, 1996). Knowledge is highlighted as the most strategically significant firm resource. KBV is combined here with the dynamic capabilities perspective (Teece et al., 1997), which refers to an organisation’s ability to change its operations in an efficient and responsive way while striving for survival. In addition, paradox theory provides grounding for the theoretical expectation of finding innovation reliability and variability strategies simultaneously in firms.

The term “dynamic capability” was defined by Teece et al. (1997, p.516) as the firm’s “ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments”. While a capability designates a functional area of the firm that enables it to carry out specific actions, a competence refers to the knowledge, skills, and resources shaping the firm’s ability to deliver superior customer value (Day, 1994). In other words, a competence designates the proficiency through which a capability is put into practice. A dynamic capability enables firms to change their core capabilities (Teece et al., 1997). AC can be regarded as a dynamic capability (Zahra and George, 2002; Wang and Ahmed, 2007).

Figure 1 Constructs terminology



Paradox theory sustains that organisations should deal with paradoxical tensions by attending to competing demands simultaneously in order to achieve long-term sustainability (Lewis, 2000). Similarly, an important stream in ambidexterity literature defends simultaneous exploration and exploitation (Gibson and Birkinshaw, 2004; O’Reilly and Tushman, 2008).

Based on the KBV and dynamic capabilities, this study develops a conceptual model integrating AC, market orientation (responsive-proactive), innovation competence orientation (exploitation-exploration), and business performance. Is innovation competence orientation as relevant to business performance as market orientation (responsive-proactive)? Are manufacturing firms aligning and adapting at the same time? How important is an open learning culture, hinted at by AC, to business performance? While these constructs relate to the collection, transformation, and use of information and knowledge, making strong correlations between them expectable, they do so through different inputs and with different aims, and are conceptually different from one another, acting as a sequence of information funnels progressively segmenting and treating knowledge with an increasingly narrow purpose.

The contributions of this study to the innovation literature are twofold. First, the mediation analysis offers insights into the knowledge-transformative roles of market and innovation competences orientation. Second, it shed light on whether the search for external knowledge dominates the early stages of innovation and later followed by other internal firm processes, a question raised by Raisch et al. (2009).

This paper is structured as follows. The next section provides the theoretical background before formulating the hypotheses and presenting their theoretical foundations. The methods and results are then presented in the following section. The paper concludes with a discussion of the results, implications for theory and practice, limitations, and possible avenues for further research.

2 Theoretical background

2.1 *Absorptive capacity*

External sources of knowledge are of great importance to the development of innovation processes within the firm (Cohen and Levinthal, 1990). External knowledge is integrated in the firm through AC, the firm's ability to recognise the value of new external information, to assimilate that information, and apply it to commercial ends (Cohen and Levinthal, 1990). While its antecedents are knowledge stocks, knowledge flows, and communication, AC is highly path dependent (Berghman et al., 2013), needing regular rather than occasional investments to be effective (Cohen and Levinthal, 1990). AC can be fostered by developing intra-firm diverse teams that are able to work together and expose themselves to new perspectives (Cohen and Levinthal, 1990). Sensemaking, cognition (Berghman et al., 2013), and the ability to internally communicate and share what has been absorbed are also important for AC (Odongo et al., 2018). Creativity and individual knowledge have also been found to be of relevance to individual AC (Odongo et al., 2018; Seo et al., 2015). Moreover, AC enables the firm to be proactive in building its internal competences, beyond just reacting to the environment (Daghfous, 2004).

Although AC is important to innovation (Lane et al., 2006), it is not clear from the literature what impact it has on the firm's innovation exploitation strategies on one hand and on its innovation exploration strategies on the other. It is of interest to analyse exploitation and exploration as separate orientations rather than bundling the two together (Kauppila, 2007). Unifying the two within a single process leads to a suboptimal balance with negative effects on the firm's efficiency (Gupta et al., 2006). The tensions between exploitation and exploration orientations resulting from trade-offs of resources allocation in the choice of predominance of one *vs.* the other (Guisado-González et al., 2017; He and Wong, 2004) can be better understood by separating these orientations. Moreover, given the positive association between organisational ambidexterity (exploitation and exploration firm behaviour) and firm growth (Patel et al., 2012), it is not only relevant to investigate how AC relates to the exploitation and exploration activities of the firm separately, but also how of these processes affect business performance.

2.2 *The market and innovation competences orientations*

This study considers the market to be a driving force of innovation activities. Lamore et al. (2013) provided evidence that responsive and proactive market orientations are positively related to the integration of research and development (R&D), suggesting that such a conceptualisation of market orientation would help to examine the marketing and R&D functions. The construct of responsive and proactive market orientation used herein originates from the criticisms raised against the more traditional perspective of the construct (customer-competitor view). Few studies have empirically tested its effects on firm performance (Atuahene-Gima et al., 2005) or on innovation competences orientation (Tan and Liu, 2014). In addition, innovation competences orientation (exploitation-exploration) expresses choices about how innovation processes are driven and can therefore be regarded as strategies. The inter-relationships of these constructs are assessed against an outcome which this study regards as business performance (Gibson and Birkinshaw, 2004).

3 Hypotheses

3.1 *Absorptive capacity and market orientation*

AC, a specific form of learning (Sun and Anderson, 2010), expresses the firm's ability to identify, assimilate, and explore knowledge gained from external sources (Grimsdottir et al., 2019). Knowledge is a central factor for both exploitation and exploration activities in firms (Mom et al., 2007). Cohen and Levinthal (1989) implicitly presented AC as a capability by using the term "ability" (Lane et al., 2006). They refined the original definition, presenting AC as the firm's ability to value, assimilate, and commercially use new external knowledge. In order to benefit from externally acquired knowledge, firms need to translate it into usable market-oriented forms (Zahra and George, 2002).

Market orientation can be considered a dynamic capability (Zahra, 2008) with the purpose of achieving the firm's external alignment with its market context (Ben-Menahem et al., 2013). Market orientation is defined by the firm's ability to follow and respond to changes in the marketplace while using intelligence generation and information dissemination (Zahra, 2008). It is about engaging with customers to deliver according to their perceived needs in the present and in the future (He and Wei, 2011). It requires a systematic use of generated knowledge to guide strategy recognition, understanding, creation, selection, implementation, and modification toward adaptation and response formulation (Hunt and Morgan, 1996). This study follows the Narver et al. (2004)' conceptualisation of market orientation consisting of a dual set of behaviours (or strategies) comprising REMKTOR and proactive market orientation. Responsive market orientation aims to discover, understand, and satisfy customers' expressed needs. Proactive market orientation is defined as the firm's process to discover, understand, and satisfy customers' latent needs. Separating these two different behaviours within market orientation is fundamental when also focusing on innovation (Narver et al., 2004). The essence of the concept is that REMKTOR is an exploitative, less risky, and less expensive perspective of market orientation. Proactive market orientation is an explorative, more risky, and costly perspective of market orientation. Building on customers' explicit needs certainly seems a more linear and straightforward process than venturing into an exploration of uncertain, unexpressed, latent needs.

The non-narrow knowledge acquisition, sharing, and creation obtained through AC should be able to enhance market related information that is useful for responsive and proactive market orientation processes, by amplifying the knowledge combination possibilities (Van den Bosch et al., 1999). This rationale is corroborated by recent findings. AC of market knowledge positively affects firm performance through more powerful customer acquisition and retention (Rakthin et al., 2016). AC illustrates the degree of the organisational absorptiveness of a wide variety of knowledge domains (market, technology, trends, business models), allowing for more knowledge combination possibilities within specialised domains like that of market orientation. We therefore propose:

H1a: AC positively associates with responsive market orientation.

H1b: AC positively associates with proactive market orientation.

3.2 *Absorptive capacity and innovation competences orientation*

Cohen and Levinthal (1994) stated that greater AC enables firms to forecast trends and take advantage of opportunities ahead of competitors. In order to act preemptively, the forecasting of trends is essential to the AC for innovation processes, because innovation is about the future. Previous studies demonstrate the positive effect of AC on innovation. In fact, Lane et al. (2006) noted that AC was especially impactful on innovation. While focusing on non-narrow knowledge domains, AC enables novel, firm-specific, knowledge combinations. Therefore, it can fuel radical innovation (Lane et al., 2006). AC is also found to strengthen strategic innovation that exceeds technological innovation (Berghman et al., 2013). Recent findings show that the effect of external knowledge on innovation is greater when this knowledge is adequately shared across the organisation (Alexiou et al., 2019).

AC increases the speed and frequency of incremental innovation based on the argument that the latter develops primarily upon a base of existing knowledge (Anderson and Tushman, 1990). Van den Bosch et al. (1999) argued that AC fosters incremental innovation through a deeper understanding of a narrow range of closely related topics. Additionally, Lin and McDonough (2014) found that management teams could benefit from adopting ambidextrous cognitive frames to broaden their knowledge base while integrating multiple sources of learning emanating from inside, as well as from business units or organisations outside. Such learning should enable the continuous development of both incremental and more radical innovation activities, thinking that we transpose to the strategies of innovation exploitation and exploration competences, respectively. Furthermore, knowledge management capability is found to be positively related to innovation competences (Soto-Acosta et al., 2018). In this study, innovation competences involve two dimensions: innovation competence exploitation and exploration.

Innovation competence exploitation expresses incremental refinements of the firm's existing innovation knowledge, skills, and processes, while innovation competence exploration expresses more substantive overhauls of such knowledge, skills, and processes (Atuahene-Gima, 2005). AC was also found to partially mediate the relationship between R&D investments and firm innovation (Huang et al., 2015). This suggests that AC plays a role in the orientation of innovation processes. The resulting hypotheses are:

H1c: AC positively associates with innovation competence exploitation.

H1d: AC positively associates with innovation competence exploration.

3.3 *Absorptive capacity and business performance*

Lane et al. (2006) stated that the maintenance and development of AC is of central importance to the firm's survival and success, due to its reinforcing, complementary, and refocusing roles in the firm's knowledge base. Stating that firms increasingly encourage their most qualified people to source knowledge externally, Salter et al. (2015) suggest that fostering such openness benefits people's alertness and contributions to ideation. In the same vein, when examining firms' abilities to introduce process innovations (production, supply chain, and administrative processes), Piening and Salge (2015) discovered that the external adoption and internal generation of innovation were among the key factors enabling a wide range of innovation activities. Hatch and Dyer (2004)

showed that specific investments in human capital produce a significant impact not only on organisational learning but also on firm performance (Al-Qubaisi et al., 2018; Grimsdottir et al., 2019). The linkage between human capital and competitive advantage leading to better performance is based on intangible firm specificities and intertwined social relationships that are difficult to imitate (Danneels, 2008; Mansour and Tremblay, 2018). If human capital and social relationships influence organisational learning, they also influence the sub-set of externally oriented learning: AC. The extent to which AC helps to align internal with external rates of change is a key antecedent of firm performance (Ben-Menahem et al., 2013). Therefore, an association between AC and business performance is to be expected.

In summary, fostering AC and expanding the depth and breadth of knowledge in the firm should create novel knowledge combinations while fueling individual as well as group ideation (Mansour and Tremblay, 2018), laying the groundwork for more sophisticated and complex knowledge transformation processes at other organisational levels besides those of market or innovation competences alone. Recent findings show that, in hi-tech firms, AC leads to higher performance when combined with customer relation and technological abilities (Al-Qubaisi et al., 2018; Tzokas et al., 2015). Ferreras-Méndez et al. (2015) also found a positive direct effect of AC on firm performance. Thus, we hypothesised that:

H1e: AC positively associates with business performance.

3.4 Market orientation and innovation competences orientation

When compared to short-term profit seeking firms, market oriented firms are likely to invest more in innovation (Ge and Ding, 2005). Theoretically, market orientation contributes to innovation by gathering market intelligence while allowing the firm to make appropriate use of it (Fang et al., 2012).

Market orientation (customer-competitor orientation, inter-functional coordination; herein “customer-competitor view”) was identified as a critical factor to distinguish between successful and unsuccessful innovations (Han et al., 1998). Also, while using the traditional view of the construct (customer-competitor view), Atuahene-Gima (1995) found market orientation impacts to be more significant for incremental innovation than for radical innovation. The author presented the view that radical innovation was more likely to be related to technological expertise. More recently, Narver et al. (2004) argued that market orientation (responsive-proactive view) should be the basis of a firm’s innovation, maintaining the congruency of the construct’s effects even if under a different concept.

Responsive and proactive market orientations have different goals and different underlying logics that live in tension (Tan and Liu, 2014). A firm with an excessive REMKTOR may become too undynamic to anticipate and respond to quick market changes, while a firm with an excessively proactive market orientation may see its focus on developing products to current markets reduced. This means firms need to discover how to balance the two (Tan and Liu, 2014).

The current study shares the perspective that exploitation and exploration are not necessarily mutually exclusive at the firm level (He and Wong, 2004). While exploitation involves optimising existing capabilities (Greve, 2007), exploration is about building new capabilities (Chakravarthy and Lorange, 2008). The scarcity of resources is responsible

for the tension between exploitation and exploration, making it necessary to find a balance between the two (He and Wong, 2004).

Since market orientation addresses both current and future market conditions (Slater and Narver, 1994), the relationships with innovation competence orientations are admissible. Atuahene-Gima (2005) found that exploiting existing product innovation competences (operational efficiency) and exploring new product innovation competences (strategic efficiency) required strong market orientation.

Responsive market orientation is about refinement and efficiency, fostering exploitative learning (Corso and Pellegrini, 2007) within the available knowledge-base and experience of the firm (Narver et al., 2004), thus contributing to exploitation (Baker and Sinkula, 1999). Proactive market orientation focuses on information and knowledge that goes beyond the firm's experience, and is marked by discovery, variation (Atuahene-Gima et al., 2005; Narver et al., 2004), and higher risk taking, which links it to exploration (Tan and Liu, 2014). It has already been empirically shown that REMKTOR and proactive market orientation lead to innovation competence exploitation and innovation competence exploration, respectively, although there are still few studies confirming this (Li et al., 2008; Tan and Liu, 2014).

According to Mom et al. (2007), the creation of reliability on the existing firm's innovation experience is at the base of exploitation activities, which the current study hypothesises as associating REMKTOR with innovation competence exploitation. Similarly, the creation of variability in this innovation experience is at the base of exploration activities, which is hypothesised herein as the association between proactive market orientation and innovation competence exploration. As such:

H2a: Responsive market orientation positively associates with innovation competence exploitation.

H2b: Proactive market orientation positively associates with innovation competence exploration.

Market orientation is conceptualised in this study as a dual funnel (responsive-proactive) which receives not only the customers' information but also the AC's information. Recent findings support the idea that market orientation operates through the innovation process, adding its effects to that of AC (Rakthin et al., 2016). It is assumed to combine both in order to feed innovation competences orientation (exploitation-exploration). This leads us to hypothesise:

M2a: Responsive market orientation mediates the relationship between AC and innovation competence exploitation.

M2b: Proactive market orientation mediates the relationship between AC and innovation competence exploration.

3.5 Innovation competences orientation and business performance

Whereas exploitation is associated with refinement and efficiency, exploration is associated with variation, experimentation, and higher risk (March, 1991). Exploitation is implemented through activities seeking to establish standardised processes, associated with short-term perspectives, while exploration creates entirely new ways to solve problems, and is associated with the longer term (March, 1996). Exploitation has to do

with experimental refinement and reuse of existing routines, while exploration concerns substantial changes in established processes (Baum et al., 2000).

Exploitation and exploration innovation strategies were found to positively impact business performance (Morgan and Berthon, 2008; Penney et al., 2018).

Gibson and Birkinshaw (2004) found a positive correlation between alignment and adaptability and firm performance. Moreover, ambidexterity (the interaction between alignment and adaptability) has a positive significant effect on firm performance. In their view, if an adequate organisational support is in place, individuals can engage in innovation exploitation and exploration oriented activities simultaneously. They designated this as contextual ambidexterity. Mom et al. (2007) proposed a mechanism to explain it, suggesting that managerial exploitation activities are positively affected by top-down knowledge inflows, while managerial exploration activities are positively affected by bottom-up and horizontal knowledge inflows. While these findings clarify how exploitation and exploration can be carried out simultaneously, Lavie and Rosenkopf (2006) stated that firms must not only explore new possibilities for adapting to future environmental changes but also exploit existing capabilities in order to compete in dynamic markets.

Atuahene-Gima et al. (2005) found that REMKTOR is positively associated with new product performance when the strategic consensus among managers is high, whereas proactive market orientation has a more positive effect on new product performance when learning orientation and marketing power are high. While an innovation exploitation strategy can promote the accumulation of benefits (Figueiredo, 2002) through incremental innovations marginally differentiated from those of the competitors (Roberts and Amit, 2003), an innovation exploration strategy can lead to business performance due to the benefits emerging from radical innovations, which are more differentiated from those of competitors (Rosenkopf and Nerkar, 2001).

Overall, the coexistence of both innovation competences orientations (exploitation-exploration) should allow the firm to better align with existing market demands (through innovation competence exploitation), while also attempting to create market changes (through innovation competence exploration). Both mechanisms should be expected to have a positive impact on business performance. The resulting hypotheses are:

H3a: Innovation competence exploitation positively associates with business performance.

H3b: Innovation competence exploration positively associates with business performance.

Considering the nature of AC, it can be expected that innovation competences orientation (exploitation-exploration) acts as a firm-specific knowledge-transformative channel, amplifying the effects of AC on business performance. This study also hypothesises that:

M3a: Innovation competence exploitation mediates the relationship between AC and business performance.

M3b: Innovation competence exploration mediates the relationship between AC and business performance.

3.6 Market orientation and business performance

Some empirical studies examining the link between market orientation and business performance established a positive impact of market orientation on measures of business performance, such as profitability (Slater and Narver, 1994, 2000), customer retention, sales growth, and new product success (Slater and Narver, 1994). However, despite the strong argument for the positive effects of market orientation on performance (Kohli and Jaworski, 1990; Narver and Slater, 1990; Slater and Narver, 1994, 2000), the empirical evidence is not in full agreement (Han et al., 1998). Moreover, recent marketing studies focusing on the link between market orientation (responsive-proactive) and firm outcomes also fail to reach unanimous conclusions (Atuahene-Gima et al., 2005; Baker and Sinkula, 1999; Li et al., 2008; Zhang and Duan, 2010).

The suggestion that firms with high market orientation levels would perform better, partly because of better new product development processes, was made by Kirca et al. (2005). The authors claimed the market orientation relationship with firm performance was stronger in manufacturing firms, low power distances, uncertainty-avoidance cultures, and studies using subjective measures of performance. While Kohli and Jaworski (1990) found that market orientation is likely to be related to business performance, they admitted that it may not be critical if the benefits do not exceed the costs of the implicated resources. They identified circumstances under which market orientation could lose importance, such as limited competition, stable market preferences, technologically turbulent industries, and booming economies.

Despite the diversity of the empirical evidence, this study takes the default position that an effective market orientation (responsive-proactive) should have a positive direct impact on the stakeholders' satisfaction as seen by top management. The resulting hypotheses are:

H4a: Responsive market orientation positively associates with business performance.

H4b: Proactive market orientation positively associates with business performance.

While firms displaying higher levels of market orientation (responsive-proactive) could directly and positively impact business performance, indirect effects through the mediation of innovation competences orientation (exploitation-exploration) may also be important. Han et al. (1998), for example, found innovation played a mediating role in the relationship between market orientation and performance, but they were using the traditional view of market orientation (customer-competitor view) in the specific context of a non-manufacturing industry (banking). Baker and Sinkula (1999) provided empirical support for the notion that a firm's market orientation enhances organisational innovativeness and new product success, in turn improving organisational performance. Ge and Ding (2005) demonstrated the mediation role of innovation strategy in the relationship between market orientation and performance. The impact of market orientation on performance was also shown to flow through proficiency in new product development performance (Langerak et al., 2007), while Olavarrieta and Friedmann (2008) found that the relationship of market orientation with performance was mediated by organisational innovativeness.

A more recent study shows that market orientation (responsive-proactive) positively impacts innovation ambidexterity, the latter partly mediating the relationship between market orientation and business performance (Tan and Liu, 2014). The mediation of

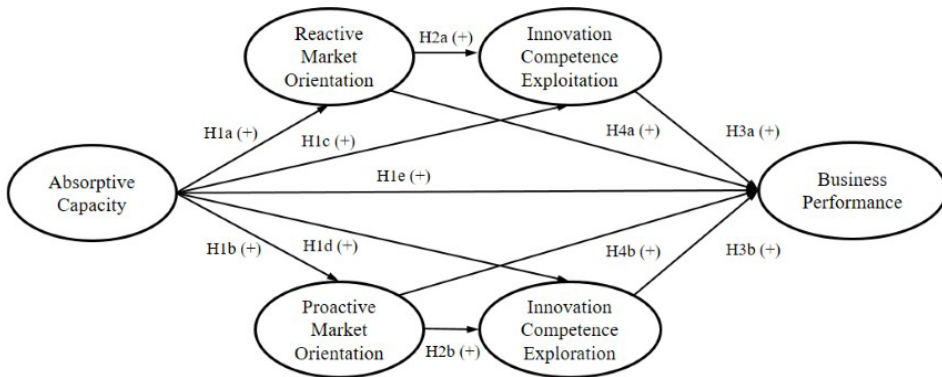
innovation-related constructs on the relationship between market orientation and performance is therefore expected, giving rise to the following set of hypotheses:

M4a: Innovation competence exploitation mediates the relationship between responsive market orientation and business performance.

M4b: Innovation competence exploration mediates the relationship between proactive market orientation and business performance.

Recent literature shows that AC results in higher firm performance (new product performance, market performance, and profitability) when used in conjunction with customer relation and technological capabilities (Tzokas et al., 2015). This general finding converges with the conceptual model presented herein. The main hypotheses of the conceptual model developed in this study are depicted in Figure 2.

Figure 2 Conceptual model



4 Methodology

4.1 Data collection

This study uses data collected from Portuguese manufacturing firms with 20 or more employees. The sample frame was obtained from Kompass Database (Kompass, 2015). An online survey was sent by email to the 3728 firms listed in the database. The CEOs and CFOs were identified as the key informants in this study. The online questionnaire guaranteed the anonymity of the respondents. 515 questionnaires were received, 370 of which were complete, resulting in a response rate of 14%. The response rate was of 10% of the sampling frame used.

4.2 Measures

All variables were measured by asking respondents to rate the extent of their agreement with a specific statement on a seven-point Likert-type scale (1 – *strongly disagree* to 7 – *strongly agree*). The constructs were measured using multiple items adapted from the literature.

AC was operationalised as a second-order factor consisting of three first-order factors:

- i knowledge acquisition, the organisational practice of identifying, valuing and acquiring new knowledge concerning the market, technologies, trends, and business models (Jaworski and Kohli, 1993)
- ii knowledge sharing, the organisational practice of assimilating, adapting, codifying, and disseminating such knowledge within the organisation (Jaworski and Kohli, 1993; Tippins and Sohi, 2003)
- iii knowledge creation, the organisational practice of combining externally acquired knowledge with existing knowledge to create new knowledge (Pavlou and El Sawy, 2006; Flatten et al., 2009).

The interest in including exploitation and exploration as an object of study herein relates to the positive association between organisational ambidexterity (exploitation, exploration, and their interaction) and firm growth (Patel et al., 2012). However, it is less clear how the activities involving exploitation and exploration contribute separately to firm performance. In addition to investigating how absorptive capacity relates to exploitation and exploration activities of the firm separately, it also seems relevant to assess how each of these activities can affect business performance. The scales chosen in the study allow for this separation.

Responsive market orientation (REMKTOR) and proactive market orientation (PROMKTOR) scales adopted from Narver et al. (2004) are used herein as in the study of Zhang and Duan (2010). The Innovation competence exploitation (INXPLOIT) and innovation competence exploration (INXPLOE) scales were adapted from Atuahene-Gima (2005) and Wang and Rafiq (2014). Business performance (BPERF) was measured through four items using the scale adapted from Gibson and Birkinshaw (2004), expressing stakeholders' satisfaction from a top management perspective.

Although the strategy of the firms is not explicitly under survey, its expression towards learning, and the more exploitative or explorative character of application of such learning is. It is therefore possible to characterise and discriminate these strategy component effects on business performance.

The study does not control for industry sector due to the wide dispersion of sectors present in the sample. Future research could overcome this limitation by focusing on more specific sectors of industry.

5 Results

5.1 Measurement model

To evaluate the measurement model, a confirmatory factor analysis (CFA) using maximum likelihood (ML) estimation was performed using AMOS. The standardised factor loadings and *t-values* are presented in Appendix A. All standardised factor loadings are significant at $p < 0.001$. The Cronbach's Coefficient Alpha ranges from 0.78 (knowledge sharing) to 0.92 (innovation competence exploitation), all above the recommended threshold of 0.70 (Hair et al., 2010). The composite reliability values exceed 0.70 for all constructs (Nunally and Bernstein, 1978). These results provide evidence of internal consistency and reliability.

The average variance extracted (AVE) is a strict measure of convergent validity, and is more conservative than composite reliability (Malhotra and Dash, 2011): the AVE was

above 0.50; AVE was greater than the maximum shared variance (MSV), and also greater than the average shared variance (ASV); the square root of AVE was greater than the inter-construct correlations. Convergent and discriminant validity are supported. Table 1 presents the mean of the constructs, its standard deviation, composite reliability, AVE, MSV and ASV, as well as the inter-construct correlations.

Table 1 Convergent and discriminant validity assessment

	<i>Mean</i>	<i>SD</i>	<i>CR</i>	<i>AVE</i>	<i>MSV</i>	<i>ASV</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
AC (1)	4.80	1.17	0.90	0.75	0.52	0.42	0.86					
REMKTOR (2)	5.54	1.11	0.89	0.72	0.42	0.34	0.61	0.85				
PROMKTOR (3)	5.20	1.18	0.84	0.63	0.42	0.34	0.58	0.65	0.80			
INXPLOIT (4)	5.29	1.07	0.92	0.75	0.63	0.48	0.70	0.60	0.59	0.87		
INXPLOIT (5)	5.12	1.29	0.86	0.61	0.58	0.39	0.64	0.49	0.50	0.76	0.78	
BPERF (6)	5.12	1.08	0.90	0.75	0.63	0.45	0.72	0.55	0.57	0.79	0.70	0.87

Bolded numbers are the square roots of AVE. SD: Standard Deviation; CR: Composite Reliability; AVE: average variance extracted; MSV: Maximum Shared Variance; ASV: Average Shared Variance.

The measurement model shows an acceptable fit as represented by: $\chi^2 = 664.90$ ($df = 306$; $p < 0.001$); $\chi^2/df = 2.17$ below 3.0; CFI = 0.94, TLI = 0.94, and NFI 0.91, all three exceeding 0.90; standardised RMR = 0.08 below 0.10, and RMSEA = 0.056 below 0.08.

5.2 Common method bias

While not nonexistent, common method bias issues do not seem to be a risk in this study. The common variance obtained by squaring the unstandardised common loadings of the common latent factor in the purified measurement model was 31.4%, below the 50.0% recommendation (Hair et al., 2010). Introducing this common latent factor only slightly affected the items' standardised loadings: a maximum change of 0.14 was obtained (one item), well below the 0.20 threshold in Aiken et al. (1991). Moreover, a confirmatory factor analysis was performed using Harman's single-factor model (Harman, 1967). The results show a poor model fit ($\chi^2 = 2659.8$ ($df = 350$), $\chi^2/df = 7.60$, CFI = 0.67, TLI = 0.67, NFI = 0.64, standardised RMR = 0.19, and RMSEA = 0.134). If common method variance was responsible for most of the relations among the constructs, this one-factor model would fit the data well (Mossholder et al., 1998).

5.3 Structural model fit and main hypotheses tests

5.3.1 Structural model

The structural model presents an acceptable fit as represented by: $\chi^2 = 677.60$ ($df = 308$; $p < 0.001$); $\chi^2/df = 2.20$ below 3.0; CFI = 0.95, TLI = 0.94, and NFI = 0.91, all three exceeding 0.90; standardised RMR = 0.09 below 0.10; and RMSEA = 0.057 below 0.08.

The structural model was tested using covariance based structural equation modelling (CB-SEM). The model explains 69% of the variance of business performance. Table 2 summarises the results for the main hypotheses tested.

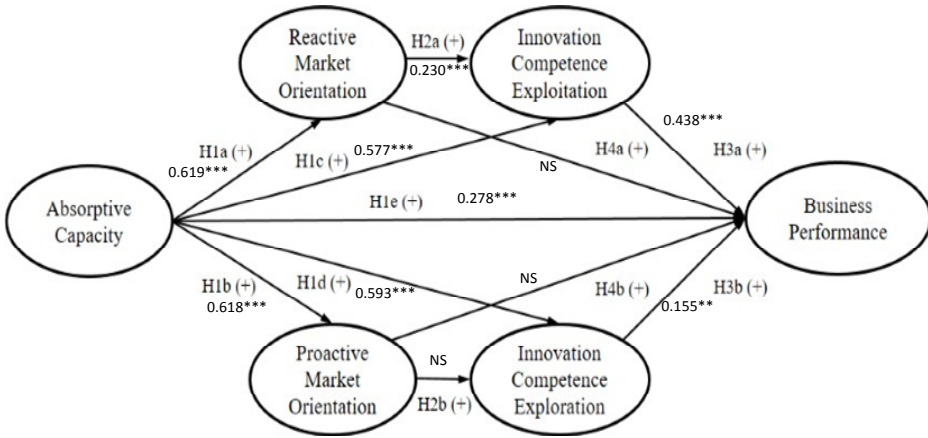
Table 2 Results of the main hypothesis testing

	<i>Path</i>	β	<i>SE</i>	<i>t-value</i>	<i>p-value</i>
<i>H1a</i>	AC→REMKTOR	0.619	0.061	9.249	***
<i>H1b</i>	AC→PROMKTOR	0.618	0.076	8.817	***
<i>H1c</i>	AC→INXPLOIT	0.577	0.076	8.370	***
<i>H1d</i>	AC→INXPLOIR	0.593	0.102	7.854	***
<i>H2a</i>	REMKTOR→INXPLOIT	0.230	0.066	4.224	***
<i>H2b</i>	PROMKTOR→INXPLOIR	0.102	0.077	1.616	NS
<i>H3a</i>	INXPLOIT→BPERF	0.438	0.086	5.739	***
<i>H3b</i>	INXPLOIR→BPERF	0.155	0.062	2.255	**
<i>H4a</i>	REMKTOR→BPERF	-0.003	0.081	-0.004	NS
<i>H4b</i>	PROMKTOR→BPERF	0.069	0.067	1.154	NS
<i>H1e</i>	AC→BPERF	0.278	0.090	3.836	***

β : standardised path coefficient; SE: standard error; NS: Not Significant. Tests of hypothesis are two tailed; ** $p < 0.05$, *** $p < 0.01$.

The path coefficient from AC to business performance is significant at a level lower than 0.01 ($\beta = 0.278$; $t = 3.836$), thus supporting hypothesis H_{1e} . The path coefficient from AC to REMKTOR is significant at a level lower than 0.01 ($\beta = 0.619$; $t = 9.249$), thus supporting hypothesis H_{1a} , while the path coefficient going from AC to proactive market orientation is significant at a level lower than 0.01 ($\beta = 0.618$; $t = 8.817$), thus supporting hypothesis H_{1b} . The path coefficient going from AC to innovation competence exploitation is significant at a level lower than 0.01 ($\beta = 0.577$; $t = 8.370$), thus supporting hypothesis H_{1c} , while the path coefficient going from AC to innovation competence exploration is also significant at a level lower than 0.01 ($\beta = 0.593$; $t = 7.854$), thus supporting hypothesis H_{1d} . Hypothesis H_{2a} is also corroborated to a statistical significance level below 0.01 ($\beta = 0.230$; $t = 4.224$), thus confirming the significance of the path coefficient going from REMKTOR to innovation competence exploitation, while the path coefficient going from proactive market orientation to innovation competence exploration, hypothesis H_{2b} , is not significant. As for the impacts of innovation competences orientation (exploitation-exploration) on business performance, the path coefficient going from innovation competence exploitation to business performance is significant at a level lower than 0.01 ($\beta = 0.438$; $t = 5.739$), statistically supporting H_{3a} , while the path coefficient going from innovation competence exploration to business performance is only significant at a level lower than 0.05 ($\beta = 0.155$; $t = 2.255$), statistically supporting H_{3b} . Finally, regarding the impacts of market orientation (responsive-proactive) on business performance, both the path coefficients from REMKTOR to business performance and to proactive market orientation to business performance are non-significant, leaving H_{4a} and H_{4b} statistically unsupported. Figure 3 show these results in a visual form.

Figure 3 Model results



** $p < 0.05$, *** $p < 0.01$.

To summarise, findings reveal empirical support for statistically significant positive impacts of AC on responsive and proactive market orientation (H_{1a} , H_{1b}), of AC on innovation competence exploitation and exploration (H_{1c} , H_{1d}), and of AC on business performance (H_{1e}). Furthermore, there is empirical support for the statistically significant positive impact of REMKTOR on innovation competence exploitation (H_{2a}), but not of proactive market orientation on innovation competence exploration (H_{2b}). The impacts of innovation competence exploitation on business performance (H_{3a}) and innovation competence exploration on business performance (H_{3b}) are positive and significant. There is no statistical support for hypotheses concerning the impact of market orientation (responsive-proactive) on business performance (H_{4a} , H_{4b}).

5.4 Mediation hypotheses

A construct can be explained by indirect effects as well as by direct effects (Little et al., 2007). The existence of a significant indirect effect in a chain of causation suggests that mediation is present (Zhao et al., 2010). In this sense, a hypothesised mediator is an additional link in a certain chain of causation. Mediation renders hypothesis testing more consistent and precise (Malhotra et al., 2014).

Using a 1000 bootstrap sample process with replacement and a 90% confidence level, estimates for the direct and indirect effects as well as their significance were obtained.

The indirect effects of AC can simultaneously flow through distinct types of market and innovation competence orientations before they reach business performance. Computing the standardised indirect effects of AC on business performance flowing through each innovation competence orientation type entails multiplying the standardised direct path coefficients between AC and business performance through innovation competence exploitation ($0.577 \times 0.438 = 0.253$) and through innovation competence exploration ($0.593 \times 0.155 = 0.092$), respectively (Hayes, 2013). The significance of these effects was calculated using the Sobel statistics (Sobel, 1982), which requires a normal data distribution. Overall, the results confirm only three mediation hypotheses: M_{2a} , M_{3a} , and M_{4a} (Table 3).

Table 3 Mediation results of model 1

	<i>Mediator</i>	<i>Indirect effect</i>	<i>Direct effect</i>	<i>Total effect</i>	<i>Mediation</i>
<i>M</i> _{2a}	REMKTOR	0.142 (***)	0.577 (***)	0.719 (***)	Partial
<i>M</i> _{2b}	PROMKTOR	0.062 (NS)	0.593 (***)	0.655 (***)	–
<i>M</i> _{3a}	INXPLOIT	0.253 (***)	0.278 (***)	0.531 (ND)	Partial
<i>M</i> _{3b}	INXPLOIT	0.092 (NS)	0.278 (***)	0.370 (ND)	–
<i>M</i> _{4a}	INXPLOIT	0.101 (***)	–0.003 (NS)	0.098 (NS)	Total
<i>M</i> _{4b}	INXPLOIT	0.016 (NS)	–0.069 (NS)	0.085 (NS)	–
–	ALL MED.	0.457 (***)	0.278 (***)	0.735 (***)	Partial

ALL MED.: INXPLOIT, INXPLOIT, REMKTOR, PROMKTOR. ND: not determined; NS: not significant. Significance was calculated through the bias corrected percentile method (2-tailed); *p-values* in brackets; ****p* < 0.01.

6 Discussion

The main purpose of this study was to clarify which of two competences is more important to the business performance of manufacturing firms: market orientation (responsive-proactive) or innovation competences orientation (exploitation-exploration).

Innovation competences orientations (exploitation-exploration) are directly relevant to the positive enhancement of business performance, whereas market orientations (responsive-proactive) are not. This suggests that in the firm’s value chain, the marketing function is further from producing an outcome impact on firm performance than the innovation function. Additionally, the finding could also suggest that at the time the data were collected, firms were moving more on a “seller’s market” (a market driven by the firm’s offer) than on a “buyer’s market” (a market driven by customers’ demands). A seller’s market may require fewer market oriented activities. However, if the findings suggest that reliance on customers’ needs is not enough for manufacturing firms to thrive if strong innovation competences are not in place, there is also a significant positive impact of REMKTOR on innovation competence exploitation as well as a partial mediation role of REMKTOR in the relationship between AC and innovation competence exploitation. Together, the two findings indicate that the marketing role is important as a knowledge source and as a knowledge-transformative node for innovation activities.

Proactive market orientation is not found to have a positive significant impact on innovation competence exploration. Not only is the proactive market orientation mean value (5.19) lower than that of reactive market orientation (5.52), its effect on innovation competence exploration is non-significant. Furthermore, the impact of innovation competence exploration on business performance is much less intense than that of innovation competence exploitation. This means that at the time of the data collection firms were predominantly displaying an innovation reliability strategy (REMKTOR and innovation competence exploitation). It also indicates that firms are not effectively a transforming their customers’ latent needs into knowledge with a meaningful impact on innovation competence exploration, possibly curtailing the latter’s impact on business performance. Although it would be expected to find that firms predominantly display the less costly and risky innovation reliability strategy (REMKTOR and innovation competence exploitation), finding that proactive market orientation is ineffective signals

a weakness in the marketing activities of manufacturing firms. The findings show that the weakness is more marketing related than innovation related, because innovation competence exploration still has a positive significant impact on business performance. This finding has managerial implications, as it prompts manufacturing firms to accentuate and improve their proactive market orientation.

The lack of significance of market orientation (responsive-proactive) to business performance and the lack of significance of proactive market orientation to innovation competence exploration may be signalling a structural handicap common to most firms in the sample. It may mean that such firms are inexperienced or ineffective at correctly reading and transforming latent customers' needs in innovation competence exploration, thus limiting the impact of the latter on business performance. The fact that the findings relegate market orientation (responsive-proactive) to the bottom of the pecking order of capabilities, with absorptive capacity and innovation competences orientation ahead may be rooted in the same explanation: firms in this sample may not be correctly using customers' latent needs in their innovation activities. This could reveal an excessively defensive attitude, with most of the firms in the sample preferring to align with the market than attempting to create market change. Such a finding, if proven relatively time-invariant (something requiring further research), could reveal weaknesses for the future of such firms or, at least, limit their growth potential. It shows a preponderant conservative and risk averse market approach: to follow, rather than to create change. An alternative explanation (also requiring further research) could be that the activity sectors involved mainly display stable market preferences, rendering market orientation (responsive-proactive) secondary by nature and little worthy of development.

Innovation competences orientation (exploitation-exploration) is better enabled through AC than through market orientation (responsive-proactive). Additionally, and unlike market orientation, AC shows a positive significant direct impact on business performance. It is required firms to access, master, integrate, and adapt knowledge relative to the ever increasing competition dimensions, something that can be better achieved through the non-narrow scope of AC and its consequent knowledge spillovers onto innovation competences orientation (exploitation-exploration). If AC indicates the degree of organisations' openness to learning from the outside world, then the suggestion is that an open learning culture is key to the effectiveness of the firm's core capabilities and to firm performance (De Araújo-Burcharth et al., 2015; Grimsdottir et al., 2019). Martín-de-Castro (2015) advocated that a collaborative/open innovation, AC, and market orientation are three constructs that reinforce each other. As such, firm performance depends on strategic innovation (Berghman et al., 2013) and on technological innovation (Al-Qubaisi et al., 2018), dimensions in which it is difficult for a single firm to thrive on innovation (Martín-de-Castro, 2015). It is therefore important that firms are open to external relationships and networks to grow their own knowledge-bases and develop their innovation. Structured learning mechanisms also play an important role (Grimsdottir et al., 2019).

AC separately and significantly enhances exploitation and exploration innovation competences. Therefore, it is a pathway to develop ambidexterity in firms. As the standardised coefficients and their significance levels show, AC is almost as important to the development of an innovation reliability strategy (REMKTOR and innovation competence exploitation) as it is to the development of an innovation variability strategy (proactive market orientation and innovation competence exploration). This again suggests that the integration of non-narrow forms of knowledge is highly beneficial for

firms to accommodate and embrace the exploitation-exploration paradox faced when developing innovation (Guisado-González et al., 2017; Soto-Acosta et al., 2018). It is somewhat surprising, but also demonstrative of AC's power, that the finding holds true for an aggregate sample in which SMEs predominate.

7 Conclusions

7.1 Theoretical implications

First, this study extends Baker and Sinkula (1999) by integrating innovation competences orientations in the conceptual model, and it builds on the works of Ge and Ding (2005), Langerak et al. (2007), and Olavarrieta and Friedmann (2008), establishing the greater importance of innovation competences orientation (exploitation-exploration) over that of market orientation (responsive-proactive) for manufacturing firms' business performance. The work of Fang et al. (2012), investigating the relationships of diverse sources of knowledge with firm innovation is expanded, by considering not only market orientation but also AC.

Second, it supports the view that fostering AC, a higher-order knowledge-based capability (Wang and Ahmed, 2007), is very important to improve business performance directly, and especially indirectly, through innovation flexibility.

Third, it addresses the call of Lane et al. (2006) for a better examination of the link between AC and radical forms of innovation, and the call of Kauppila (2007) for the analysis of exploitation and exploration separately. In doing so, it establishes that AC is more important than market orientation (responsive-proactive) for the development of innovation competences (exploitation-exploration). This finding extends the work of Tan and Liu (2014), who did not consider AC in their model, and the work of Li et al. (2008), who did not evaluate the separate mediating role of innovation competences (exploitation-exploration).

Fourth, the study establishes that AC is key for firms to achieve ambidexterity: it emerges as a capability that leads to an innovation reliability strategy as well as to an innovation variability strategy in similar intensity. Achieving balance between the exploitation and exploration activities through AC offers a tangible ambidexterity development mechanism. This finding converges with Lin et al. (2013) in their conclusion that learning practices have an important impact on innovation ambidexterity, which in turn has a direct relationship with firm performance (revenues, profits, and relative competitive growth). However, our study expands on their work by focusing on AC as the main knowledge-based capability driver and, more importantly, by joining market orientation to the perspective. The balance found between exploitation and exploration activities is in line with the findings of He and Wong (2004), Gibson and Birkinshaw (2004), and Mom et al. (2007), reporting the positive effects of ambidexterity on firm performance. This is in line with paradox theory, defending that firms should engage competing demands simultaneously in order to ensure long-term sustainability (Lewis, 2000).

Fifth, the firms' higher preponderance for exploitation can be interpreted through the lens of cumulative prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992), explaining choices made upon risky prospects. One of the tendencies explained is the certainty effect, a behaviour in decision making that increases risk

aversion in choices involving high probability gains, and risk seeking in choices involving high probability losses. Considering this theory, the preponderance of a risk aversion behaviour under higher turbulence could mean that, despite such circumstances, firms still expect gains and rely even more strongly on an innovation reliability strategy. This interpretation suggests that only before a prevailing prospect of high probability losses would firms be expected to engage more strongly in risk seeking and preponderantly foster an innovation variability strategy. Cumulative prospect theory seeks to explain why exploitation activities are resilient to environmental turbulence and adverse economic conditions, perhaps only until survivability is at risk and an almost certain prospect of losses is faced.

Finally, although innovation flexibility can be designated both as a dynamic capability and as a core capability, this study regards it as core capabilities due to the presence of a higher order dynamic capability (AC). A set of propositions inferred from the results is presented below as possible theoretical contributions. A broader theoretical suggestion potentially clarifying the field would be the introduction of the concept of relative dynamic capability:

Proposition 1: *A capability should be considered dynamic if displaying a broad enough utility scope to influence the change of other subordinate, field-specific, core capabilities.*

Proposition 2: *A capability should be considered dynamic in relation to any other capability if its utility scope is wider, or more general, than the capability it is being compared with, and if it can be used as a change instrument over that capability.*

Proposition 3: *A capability that depends on factors or other capabilities external to its daily practice and purpose in order to change, should only be designated as dynamic in relative terms and when in connection to other subordinate, non-superseding, capabilities.*

As Easterby-Smith and Prieto (2008) have acknowledged, learning activities are at the very core of dynamic capabilities, since knowledge and tacit knowledge in particular can be regarded as the most strategically important asset of firms (Gupta and Govindarajan, 2000; Grant, 1996). The concept of relative dynamic capability would only identify the most important organisational and managerial capabilities leading to medium and long-term performance as 'dynamic', while introducing a rank order between different capabilities recognised in some studies as 'dynamic'. This is a proposition for complementary criteria to classify dynamic capabilities and mitigate the confusion surrounding its many definitions and unclear boundaries. This study proposes that dynamic capabilities are classified as such based on the range of core capabilities and other capabilities that they can guide and change.

7.2 *Managerial implications*

This study defends the development of AC to balance and enhance exploitation and exploration orientations commanding innovation activities and the innovation flexibility of the firm, to improve business performance.

High levels of AC help develop market and innovation competences orientations to adequately address market and technological turbulence, representing a key capability in

today's global competitive arena. Even if exploration activities are not predominant, they could be essential for the firm when survival is at stake. The development of such activities can be greatly enhanced by AC, especially under less turbulent conditions.

It is understandable that the variability innovation strategy is the least predominant due to its higher implicit uncertainty and longer-term orientation, but the results still highlight a worrying fact for the Portuguese firms represented in the sample: an ineffective use of proactive market orientation. The reasons for this could be either cultural or related to the industry sectors prevailing in the sample, many of which are traditional. Even so, non-high-tech SMEs fare better when displaying higher proactive market orientation (Laforet, 2008). The finding suggests that a potential for better use of a variability innovation strategy exists, namely in seeking a better understanding of the customers' latent needs while aligning proactive market orientation with innovation competence exploration.

The vision of O'Reilly and Tushman (2008) becomes even more meaningful: the hardships of exploratory activities require senior management teams to encourage learning, accept challenges to the *status quo*, accept failure as a part of the process, and care for the integration and transfers of knowledge. This suggestion articulates with other approaches, such as the meta-analysis of the relationships between organisational culture and innovation of Büschgens et al. (2013). These authors concluded that managers of innovative organisations implement cultures emphasising an external flexible orientation, while hierarchical cultures more focused on control and more internally oriented are less likely to be associated with innovative organisations. Furthermore, at the employee level, as Wei et al. (2013) found, perceiving an innovation culture positively impacts job satisfaction and perceptions of organisational dynamism and firm performance, suggesting that setting an innovation culture is essential for the firm to obtain better employee-level outcomes. Finally, this study offers managers of manufacturing firms the insight that innovation competences are more important than market orientations when higher business performance is a goal to achieve.

Overall, the findings suggest that the transformative knowledge-based processes allowed by higher order dynamic capabilities (AC) must be in place consistently. Such a conclusion directly summons management to support knowledge, creativity, open exchanges and learning in manufacturing firms, regardless of their size. The findings also implicitly underline the importance of qualified or creative employees to develop the knowledge base of the firms more effectively, in order to enable transformational processes in core capabilities leading to higher performance.

7.3 Limitations and further work

This study undoubtedly contains limitations. While the findings show that the simultaneous use of reliability and variability innovation strategies is associated with higher business performance, it would be enriching to perform similar studies in longitudinal contexts, as different industries may conceal different results. Additionally, studies performed under survivability-threatening conditions would be worth pursuing to search for the limit conditions that could cause an innovation variability strategy to become temporarily predominant. Although the sample is considered adequate, the questionnaire could be applied to a larger response group (IT or R&D managers). The expansion of this research into different time moments and contrasting management cultures, namely gathering data from different countries, could also help clarify the

circumstances under which firms would engage in riskier innovation activities of a more exploratory nature. Furthermore, cross-sectional studies have limitations in supporting the causality proposed in the hypotheses, while endogeneity issues could also affect the relationships hypothesised in the model. Additionally, single informant studies are more prone to common variance issues, while the exclusive use of subjective measures is subject to respondent bias and social desirability issues. Future research on the topic would benefit from multiple informant data and secondary objective data (for example: investments in R&D and financial performance indicators) to limit common variance issues.

Finally, using other quantitative techniques in parallel to SEM could help discriminate different strategies within the sample leading to similarly higher levels of business performance (competing strategies). Fuzzy set qualitative comparative analysis (fsQCA) is one of the techniques allowing this. SEM is limited in this respect, as it shows the significant aggregate relationships in the entire sample - the prevailing strategies - while leaving possible sub-sets of strategies with similar business performance outcomes hidden.

Declarations of interest

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Appendix A: item loadings of measurement

<i>Items</i>	<i>Std. loadings</i>	<i>t-value</i>
<i>Knowledge acquisition</i>		
We frequently acquire knowledge about technologies and market trends from external sources	0.84	1.00
We are able to identify and acquire external knowledge (e.g., market, technology) very quickly	0.83	16.99
Employees of our unit regularly visit other branches to learn about new technologies, trends, or business models	0.63	12.27
<i>Knowledge sharing</i>		
Existing knowledge (e.g., market or technology) is readily available to each department	0.73	1.00
Our company periodically circulates codified knowledge in the form of documents to update its departments	0.71	12.21
When something important happens (market or technology development), the whole company knows about it in a short period	0.74	12.61

Appendix A: item loadings of measurement (continued)

<i>Items</i>	<i>Std. loadings</i>	<i>t-value</i>
<i>Knowledge creation</i>		
Our employees have the capabilities to produce many novel and useful ideas	0.78	1.00
Within this company, we have the capabilities to successfully learn new things	0.90	19.02
We have the capabilities to effectively develop new knowledge or insights that have the potential to influence product development	0.87	18.36
When solving problems, we can rely on good cross-departmental support	0.74	14.97
<i>Responsive market orientation</i>		
Our business objectives are driven primarily by customer satisfaction	Dropped	–
We constantly monitor our level of commitment and orientation to serving customer needs	0.78	17.37
Our strategy for competitive advantage is based on our understanding of customers' needs	Dropped	–
We measure customer satisfaction systematically and frequently	0.89	20.98
We have routine or regular measures of customer service	0.87	20.26
<i>Proactive market orientation</i>		
We help customers to anticipate developments in the markets	0.79	17.11
We incorporate solutions to unarticulated customer needs in our products and services	0.82	17.80
We search for opportunities in areas where customers have difficulty in expressing their needs	0.77	16.50
<i>Innovation competence exploitation</i>		
Over the last 5 years, my company...		
...upgraded current knowledge and skills for familiar products and technologies	0.85	19.88
...enhanced skills in exploiting well-established technologies that improve productivity of current innovation operations	Dropped	–
...enhanced competences in searching for solutions to customer problems that are closed to established solutions rather than completely new solutions	0.83	19.17
...upgraded skills in product development processes in which the company already possessed significant experience	0.90	22.16
...strengthened our knowledge and skills for projects that improve efficiency of existing innovation activities	0.89	21.61

Appendix A: item loadings of measurement (continued)

<i>Items</i>	<i>Std. loadings</i>	<i>t-value</i>
<i>Innovation competence exploration</i>		
Over the last 5 years, my company...		
...acquired entirely new technologies and skills	0.79	17.55
...learned product development skills and processes entirely new to the industry (e.g., product design, prototyping new products, timing new product introductions, customizing products for local markets, etc.)	0.83	18.75
...acquired entirely new managerial and organizational skills that are important for innovation (e.g., forecasting technological and customer trends, identifying emerging markets and technologies, integrating R&D activities, marketing, manufacturing and other functions, managing the product development process)	0.82	18.46
...learned new skills for the first time (e.g., funding new technology, staffing R&D function, training and development of R&D and engineering personnel)	0.67	13.99
...strengthened innovation skills in areas where it had no prior experience	Dropped	-
<i>Business performance</i>		
Over the last 5 years, my company...		
...has given me the opportunity and encouragement to do the best work I am capable of	0.90	21.71
...people at all levels have been satisfied with the level of business performance	0.89	21.17
...has come much closer to achieving its full potential	0.82	18.61
...has done a good job in satisfying our customers	Dropped	-