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Do or do not. Cognitive configurations affecting open innovation adoption in SMEs

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ABSTRACT

The adoption of Open Innovation (OI) in small and medium-sized enterprises (SMEs) often rests on its positive evaluation from top-management teams and/or entrepreneurs. Because of the mixed outcomes attainable through SMEs' openness, managers must weigh the beneficial aspects of boundary-spanning against the complexities coming from inter-organizational arrangements and knowledge transfer. Building upon the tenets of dual-process theory, this study highlights the cognitive configurations leading toward willingness or reluctance of OI adoption in SMEs. This is done by investigating perceptions of barriers, benefits, and organisational resistance to openness, such as the not-invented-here (NIH) and not-shared-here (NSH) syndromes in combination with decision-makers' cognitive styles. To shed further light on observed heterogenous outcomes and the effects of managerial cognitive configurations, this study analyses the willingness and reluctance to adopt OI among 434 managers and entrepreneurs working in SMEs. The results of combined PLS-SEM and fsQCA analyses outline different decisional paths associated with willingness and reluctance to adopt OI. Thus, this research contributes to the 'human side of OI' paradigm by providing fruitful implications about cognitive configurations of decision-makers in SMEs concerning OI adoption.

1. Introduction

Scholars and practitioners have suggested that the survival and growth of companies appear to be increasingly connected with networking capabilities, unceasing innovation, and knowledge-sharing activities (Bogers et al., 2017; Chesbrough, 2020; De Marco et al., 2020). In the context of small- and medium-sized enterprises (SMEs), the ability to create a successful network of collaborations that fosters innovation activity is crucial, as SMEs usually have fewer resources allocated to innovation and research and development (R&D) compared to larger companies (Stojčić, 2021; Teirlinck and Spithoven, 2013; van de Vrande et al., 2009).

Open Innovation (OI) aims to create opportunities for cooperative innovation processes with partners, customers, and/or suppliers through a network of external actors and sources, helping companies achieve and sustain the innovation process (Laursen and Salter, 2006). Namely, the OI paradigm requires companies to open their boundaries and let valuable knowledge flow in from the outside. As such, OI represents one of the possible routes for SMEs' development and innovation, allowing companies to gain a competitive advantage by accessing and leveraging a network of resources and knowledge (Bogers et al., 2017; Chesbrough, 2020; Dahlander et al., 2021).

In the context of SMEs, where resource availability is often limited, embracing the somewhat perilous adoption of OI forces firms to commit and allocate resources in the present against benefits deferred to the long term (Bigliardi and Galati, 2016; van de Vrande et al., 2009). Consequently, decision-makers could negatively frame OI, considering it too risky a source of capital expenditure without a short-term benefit (Bigliardi and Galati, 2016; Lee et al., 2019). In fact, decision-makers may assess OI carefully and suspiciously, often leading to

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non-adoption decisions because of the perceived costs, lack of organisational structure, and lack of proper supporting network (Bogers et al., 2017; Greco et al., 2019). As OI adoption represents a continuum and not a binary state of open–closed (Barrett et al., 2021), the decision to pivot and embrace the OI route lies in the decisions of entrepreneurs, managers, and innovators at the strategic level (Flamini et al., 2021; Kor et al., 2007; Najar and Dhaouadi, 2020). This is particularly true for SMEs, where the decision-making power is often concentrated in one or a small group of individuals, creating a situation where cognitive perceptions and attitudes become central (Najar and Dhaouadi, 2020; Pappas et al., 2021).

The interplay between cognitive processes, perceptions, and emotions in entrepreneurial decision-making has already been largely explored by analysing the cognitive micro-foundations of entrepreneurial processes (Eggers and Kaplan, 2013; Kor et al., 2007; Sassetti et al., 2018; Shepherd et al., 2021). However, when it comes to evaluating the adoption of OI, little is known about its micro-foundations and human side (Bogers et al., 2018; Sun et al., 2021). Such area of study deserves additional attention, as seminal studies have shown the crucial role of decision-makers' characteristics in fostering or neglecting OI activities in SMEs (Ahn et al., 2017; Barrett et al., 2021; Bogers et al., 2017). In addition, some preliminary studies have explored the human side of OI, focusing on CEO characteristics (Ahn et al., 2017), employees diversity (Bogers et al., 2018), and leadership styles (Rangus and Černe, 2019). However, research is still scarce on aspects related to the cognition and decision-making of OI adoption and implementation (Aleksić et al., 2021; Bogers et al., 2017, 2018). For example, we still know little about the factors behind acceptance or reluctance toward OI in SMEs (Bhimani et al., 2022).

Given the effects of managerial cognitive configuration on decisional outcomes (Hodgkinson and Healey, 2011; Simon, 1955), as well as the relevance of managerial representation/abstraction toward the development of OI-(un)friendly culture (Ahn et al., 2017; Bhimani et al., 2022), we turn to the concept of managerial cognition literature to contribute to the investigation of the human side of OI (Evans, 2008). We supplemented the OI intellectual domain with the tenets of dual-process theory (DPT) (Kahneman, 2013), which was considered the general decision-making context, and the cognitive evaluation of OI-related elements, which was aimed at the specific decision-making context. DPT describes the relevance of two cognitive styles when making decisions and their lasting effects on organizational strategic choices (Vlacic et al., 2019, 2020)—one guided by intuitive, heuristic-based, and associative processes, and the other predominantly deliberate and related to a careful evaluation and assessment (Evans, 2008).

The general decision-making context refers to attitudes toward the environment and the unknown. In accordance with DPT, both types of cognitions are non-contextual, as they involve cognitive approaches of the individual to any decision and are not solely related to the evaluation of OI (Calabretta et al., 2017). In addition, other specific elements of the evaluation are tied to OI and pertain to managerial perceptions such as perceived barriers and benefits (Pappas et al., 2021), and the not-invented-here (NIH) and not-shared-here (NSH) syndromes (Burcharth et al., 2014). Consequently, this study aims to shed light on the multifaceted nature of decision-making processes related to willingness or reluctance toward OI adoption in SMEs while considering the general and specific contexts of the decision.

A multi-method approach was adopted, which integrated the use of PLS-SEM and fsQCA methodologies. The combination of PLS-SEM and fsQCA allowed investigating the elusive nature of the variables and complexity of decisional processes surrounding OI, which are extrinsically and intrinsically motivated and influenced by both the characteristics of the decision-makers and contextual factors (Fiss, 2011; Pappas et al., 2021). Moreover, this method allowed us to better explore the interactions between model constructs with additional details (Rasoolimanesh et al., 2021), answering recent calls for more multi-method studies in the field of innovation (Dabić et al., 2021).

As a result, this study offers several contributions to the literature about OI and managerial decision-making through the lens of the recently developed concept of the 'human side of OI' (Ahn et al., 2017; Bogers et al., 2018). First, this paper enlarges the debate about OI on its human side (Bogers et al., 2018). Our findings further stimulate the debate about the contexts and specificities under which entrepreneurial and managerial cognition take place (Eggers and Kaplan, 2013; Lee et al., 2019; Sassetti et al., 2018). Second, due to the high complexity of decision-making processes related to OI, the investigation of an individual element alone may not sufficiently explain the processes and outcomes (Bigliardi and Galati, 2016). Our analysis indeed considers the interplay of general cognitive styles and a series of context-specific elements for OI, such as benefits, barriers, and syndromes towards OI. Finally, our study contributes to the emerging stream of literature interested in understanding the drawbacks of OI (Bogers et al., 2017, 2019; Lee et al., 2019), and for this reason, we not only include the elements that drive the adoption of OI, but also those that lead to reluctance toward its adoption (Brunswicker and Vanhaverbeke, 2015).

The remaining of the paper is structured as follows. The following section presents the theoretical foundation for the study. Section 3 describes the methodology used, and Section 4 presents the results of the study, both for PLS-SEM and fsQCA. Section 5 presents a discussion of the results, and section 6 explores the implications of our study. The final section provides concluding remarks, limitations, and future research avenues.

2. Theoretical foundations

2.1. Cognitive styles

Given that individual behaviour determines innovation (Bogers et al., 2018), the managerial mindset and cognitive configurations are vital to OI adoption (Stefan et al., 2022). Cognition represents 'a set of procedures by which sensory inputs coming from interactions between individuals and their environment are transformed, condensed, interpreted, stored, renewed, and used' (Neisser, 1967; Vlačić et al., 2022, p. 5). Accordingly, managers dealing with OI are noted as 'self-influencing cognitive beings' (Bhimani et al., 2022, p. 4), and cognition plays a relevant role in OI (dis)engagement decisions. As mentioned by numerous scholars (Allinson and Hayes, 1996; Phillips et al., 2015), different cognitive configurations influence the managerial perception of organizations and their role, and thus decision-making as well as strategic transformations (Shepherd et al., 2021; Vlacic et al., 2020). Moreover, scholars acknowledge that actors' cognitive proximity, which refers to a shared knowledge base and expertise similarity, influences absorptive capability and affects innovation (Boschma, 2005). Namely, closer cognitive proximity enables effective communication and flow of information, which may be crucial for complementing a knowledge base. Conversely, cognitive distance enables broadening horizons, as it brings novel perspectives and potentially new routines.

In this paper, the focus is on cognitive configurations that guide managers to reconsider current innovation practices and adopt or discard OI practices (Sun et al., 2021). In this vein, the underlying cognitive styles may explain the managerial willingness or reluctance toward OI adoption (Stefan et al., 2022; Sun et al., 2021), particularly in SMEs, where the decision-making power is centralised and reliant on the characteristics of the upper echelon (Ahn et al., 2017; Hambrick, 2007). Focusing on the human side of openness, Ahn et al. (2017) noted that managerial leadership is required to mitigate various challenges, and it has a direct effect on the establishment of an OI-(un)friendly culture. Bhimani et al. (2022) refer to OI manager cognition as a balancing factor between perceived OI commitment and negative feelings and emotions related to the external knowledge sourcing and sharing.

To gain a deeper understanding of the mechanisms underlying managerial decision-making, we draw upon the tenets of DPT, which

classifies cognitive styles into two different types of information processing and thinking. Namely, the intuitive cognitive style represents a creative, rapid, unconscious, expertise-based style, while the rational cognitive style is analytic, deductive, formal, and critical (Dane and Pratt, 2007; Evans, 2008; Evans and Stanovich, 2013; Kahneman, 2013). According to DPT, individuals reach decisions using both cognitive styles. Even though the cognitive styles are apparently dichotomous (Allinson and Hayes, 1996), in essence they are task-dependent and, as such, managers tend to shift between the styles when making their decisions (Lowik et al., 2017; Luoma and Martela, 2021). For example, as noted by Payne et al. (1990), the use of intuition guides managers to engage in the search for solutions and opportunities beyond the existing boundaries, while rational cognition fosters conventional solutions following predominantly established rules and methodologies within disciplinary boundaries.

One important distinction to make is between intuition as a cognitive style in contrast to intuition as a cognitive strategy (Baldacchino, 2019). A cognitive style denotes an underlying and enduring propensity toward a specific mode of information processing (Hodgkinson and Clarke, 2007). Most individuals tend to have such a preference for one style over the other, and this predisposition tends to persist over time (Epstein and Pacini, 1999). This was the case in Baldacchino's (2013) study, where a negative correlation among a sample of entrepreneurs was found between the two cognitive styles. Conversely, a cognitive strategy makes reference to the information processing mode an individual engages in when addressing a task at hand (Baldacchino, 2019). Baldacchino (2019) further specifies that, while the selected cognitive strategy could be prompted by the individual's cognitive style, the former could also be determined by circumstantial factors. Moreover, although most individuals have a preferred cognitive style, one can strive towards cognitive versatility (i.e. a versatile cognitive strategy), which is an ability to employ the appropriate mode of processing depending on the task addressed (Hodgkinson and Clarke, 2007). Thus, to (un)welcome OI practices and avoid barriers without missing the benefits, managerial cognitive styles (Lowik et al., 2017; Luoma and Martela, 2021) tend to explain heterogenous willingness or reluctance to adopt OI among SMEs, which leads to the following proposition:

Proposition 1. Cognitive styles, in addition to NIH and NSH syndromes, perceived benefits, and perceived barriers influence the willingness or reluctance to adopt OI. This combination may vary depending on the context.

2.2. The not-invented-here (NIH) and not-shared-here (NSH) syndromes

The adoption of OI practices requires managers and employees to reshape learning processes (Hodgkinson and Healey, 2011), which often generates organizational refusal and workforce desertion (Obradović et al., 2021; Stefan et al., 2022). Essentially, to absorb and share knowledge with the environment, firms need functional organisational interfaces. Thus, the development of skills related to screening, interpreting, and assimilating knowledge represents a requirement for efficient knowledge transactions (Cruz-González et al., 2015). In particular, OI can provide organizations with co-creation advantages and thus lead to an increased rate of success in innovation activities, also challenging the *status quo* and embedded practices. In the context of OI, the increased openness and the acquisition of heterogeneous external knowledge may cause complexity and internal resistance to change, often referred to as the NIH (Katz and Allen, 1982) and NSH syndromes (Burcharth et al., 2014).

The NIH syndrome represents one of the most constraining factors toward OI adoption, as it portrays a workforce preference to exploit internal capabilities rather than embarking on prosperous collaborations with a diverse set of business partners, such as suppliers, competitors, distributors, and research institutions (Antons and Piller, 2015; Popa et al., 2017; Randhawa et al., 2016). The NSH syndrome represents another hesitating viewpoint toward openness, illustrated as a workforce's deliberate generation of barriers toward knowledge outflows (Burcharth et al., 2014; Najar and Dhaouadi, 2020).

The NIH and NSH syndromes emphasize the importance and relevance of the human side and micro-level understanding in the decision-making process associated with OI (Stefan et al., 2022). Managers are well aware of intra-organizational challenges associated with creating and capturing value generated throughout OI practices due to reluctance to embrace external knowledge (the NIH syndrome), as well as to exploit external knowledge assets (the NSH syndrome) (Chesbrough et al., 2018; Chesbrough and Crowther, 2006). Under the effects of the NIH and NSH syndromes, managers tend to neglect opportunities that external collaborations can provide (Lichtenthaler, 2011) and diminish innovative output and performance (Burcharth et al., 2014). Despite their intrinsic relationship, the NIH and NSH syndromes differ in terms of the direction toward which each syndrome is oriented; the former tends to undermine acquisition of external knowledge (i.e. outside-in), while the latter tends to challenge external exploitation of knowledge (i.e. inside-out) (Chesbrough and Crowther, 2006).

OI practices enable SMEs to access critical resources (Albats et al., 2021), to increase awareness of new technological trends (West et al., 2014), and to generate high-value creation potential (West and Bogers, 2014). However, we know that decision-makers are subject to bounded rationality (Simon, 1955) and may be affected by impediments and a lack of optimal actions in addition to a desire for protecting self-knowledge, capabilities, and image. Thus, as an effect of uncertainty and potential cognitive dissonance, managers tend to follow established routine behaviour and search for knowledge in close proximity, giving rise to the NIH and NSH syndromes and preventing knowledge sharing and sourcing. This is especially true in the case of OI, as knowledge search processes are associated with ambiguity and risk. Given that the NIH and NSH syndromes set constraints for the adoption of OI practices, we propose the following:

Proposition 2. NIH and/or NSH syndromes, combined with cognitive styles, perceived benefits, and perceived barriers, negatively influence the willingness to adopt OI in SMEs. This combination may vary depending on the context.

2.3. Perceived benefits and barriers

Often, the OI paradigm in SMEs is evaluated against its potential benefits. As noted by Barret et al. (2021), the adoption of OI practices yields both pecuniary advantages (e.g. cost and risk reduction, customer acquisition, and access to markets and geographies) and non-pecuniary ones (e.g. credibility, capability development, and knowledge acquisitions). However, the decision to adopt OI is not free from risk, and decision-makers often acknowledge barriers related to the ability to exchange technology assets, which in turn cause hurdles and perceived negative returns from engaging in OI practices (Bigliardi and Galati, 2016; van de Vrande et al., 2009).

Scarcely researched, although acknowledge by scholars for its relevance, the effects of managerial cognitive configurations on perceived benefits and barriers of OI remain overlooked and require further research (Bhimani et al., 2022; Stefan et al., 2022). For example, Brunswicker and Vanhaverbeke (2015, p.1242) conceptualised OI as a 'cognitive framework for a firm's strategy to profit from innovation'. Thus, willingness to adopt OI comes from managerial cognitive configurations and perceived capabilities to align inbound knowledge flows with SMEs' innovation practices. Acting as either gatekeepers or facilitators, it is certain that managers represent a focal intermediary (Bhimani et al., 2022; Brunswicker and Vanhaverbeke, 2015; Najar and Dhaouadi, 2020), and the effects of managerial cognition play a significant role in willingness or reluctance to adopt OI.

SMEs may highly benefit from OI collaborations (Flamini et al., 2021)—in light of SMEs' inherently limited capabilities (van de Vrande

et al., 2009), OI enables increased innovative performance, establishment of multifaced decision-making, and shorter time to market (Ullrich et al., 2018; West et al., 2014). Even so, the adoption of OI brings challenges and barriers related to the process of value appropriation, which is necessary to close and protect generated assets and the workforce absorptive capacity (Teirlinck and Spithoven, 2013). By examining the individual level and capturing the micro-foundations of the paradox of openness, Stefan et al. (2022) revealed the 'dark side' of OI related to the potential failures and high costs associated with organizational openness. Thus, the process behind the decision of whether or not to adopt OI is challenging and often perceived through worst-case scenarios, as failure often rests on the managerial capability to explore and exploit business functioning alterations in a cost-efficient and low-risk way (Chesbrough, 2010; Chesbrough et al., 2018). This restrictive approach towards openness could be particularly sensitive for SMEs because of limited opportunities for trial-and-error learning processes, liabilities of smallness, lack of financial and human resources, capabilities, and ultimately less formalized practices (Albats et al., 2021; van de Vrande et al., 2009). SME restrictions toward OI exist because of information asymmetry (Brunswicker and Vanhaverbeke, 2015) and a potential lack of focus on core competitive advantages because of the necessity of maintaining partner proximity (Boschma, 2005). Further, a lack of resources and restrictions regarding support-independent R&D causes SMEs to co-create innovative solutions with external sources. Hence, managers are led to blur organizational boundaries and become even more open, which can cause tension, knowledge leakage, and misappropriation (Ritala and Stefan, 2021). Additionally, perceived barriers such as selection of wrong partners, unclear OI goals, lack of organizational structure leading to coordination problems, knowledge drains, and inflated opening of enterprise boundaries logically have the effect of turning decision-makers away from entering into OI practices (Ullrich et al., 2018).[1]

Given that the implementation path of OI was found to be dependent on understanding the importance of the potential benefits and barriers, the following proposition emerged:

Proposition 3. Perceived benefits and barriers, combined with cognitive styles and the NIH and NSH syndromes, influence willingness to adopt OI in SMEs. Perceived benefits tend to favour willingness to adopt OI, while perceived barriers tend to lessen it. This combination may vary depending on the context.

As a result of exploring the decision-making process behind willingness or reluctance toward OI, the following model (Fig. 1) is presented below.

3. Methodology

3.1. Data collection

This study deployed a survey method to collect data from managers working in SMEs. We collected the data through an online questionnaire distributed in early 2021 using a crowdsourcing platform (www.prolific.ac), which allowed compensating participants for their time. The service guaranteed the accuracy of participant profiles, allowing us to select a pool of participants according to the desired characteristics needed for the research, assuring the representativity of the selected sample (Palan and Schitter, 2018; Peer et al., 2017; Schweitzer and Mai, 2021). In our case, we gathered responses from managers working in companies with fewer than 250 employees, as per the European Union's SMEs classification (European Commision, 2015), operating in the United Kingdom (UK). We choose the UK for the sample primarily because it allowed for a better comparison with existing studies on OI, which were mostly on western companies (Lu and Chesbrough, 2021). In addition, the UK has a well-developed network of collaboration for SMEs (Iammarino et al., 2012), and OI is specifically mentioned in the UK National Innovation Strategy (Audretsch and Belitski, 2022; Department of Business Energy and Industrial Strategy, 2021).

Based on the relevant literature and the researchers' experience in the field, we initially designed a preliminary draft of the questionnaire (Groves et al., 2009). The draft was tested for accuracy of the content with several executives working in SMEs in the UK and then for comprehension and duration with MBA and postgraduate students from a university in the same country.

According to the received feedback, we adjusted the questionnaire and then distributed it via the Prolific platform (Groves et al., 2009). A total of 442 completed questionnaires were received, of which 8 were eliminated because they failed one of the three instrumental manipulation checks, which comprised non-sensical tasks included to ensure participants were paying attention while filling out the survey (Groves et al., 2009). The final dataset was composed of 434 respondents, as depicted in the following table (Table 1).

The collected sample comprised a diverse set of experienced managers and entrepreneurs working in various sectors in SMEs of different sizes, therefore avoiding single-source bias (Bianchi et al., 2019; Caputo et al., 2019). When using self-administered surveys, respondents may give directional responses. To avoid this, even though the research project was labelled as a comprehensive study to understand OI in SMEs, no reference to the model in Fig. 1 was provided, so that respondents' attention was not drawn to the relationships being targeted in this study. Subsequently, questions were organized in different sections, preventing respondents from developing their own theories about possible cause–effect relationships (Groves et al., 2009). Additionally, the survey included reverse-coded items to reduce the risk of directional answers.

To ensure that response bias did not jeopardise the validity of our data, we also performed a series of robustness checks (Podsakoff et al., 2003). In particular, non-response bias was checked through independent sample *t*-tests, where we did not find any statistically significant difference between the responses of early and late respondents, or randomly divided groups of respondents on control variables such as age, gender, industry experience, company position, size (employee number), industry, operational market, and technology levels. We checked for common method variance using Harman's single factor test, which showed a total variance of 23.71%, which was less than the suggested threshold of 50%; it was also cross-checked with a marker variable and correlation matrix procedure, as suggested by Podsakoff et al. (2003). Self-selection bias was checked by comparing the answers of the eliminated respondents with the included ones, which showed no significant difference.

3.2. Measures

The scales used in the study were derived from pertinent published research to ensure validity (see Table 2). All items were measured on a seven-point Likert scale, ranging from '(1) Strongly disagree' to '(7) Strongly agree'.

Rational cognition (RC) was measured with the 4-item scale from Bianchi et al. (2019); these items concerned rationality when making decisions. *Intuitive cognition* (IC) was measured using the 5-item scale from Bianchi et al. (2019); these items concerned intuition when making decisions. *NIH syndrome* (NIH) was measured with 3-item scales adapted from Burchart (2014). *NSH syndrome* (NSH) was measured using 4-item scales adapted from Burchart et al., (2014). The notion of OI was introduced to the respondents after having asked the aforementioned items by presenting a simplified definition of OI based on Laursen and Salter (2006) together with examples inspired by Di Minin et al. (20l6). Next, *perceived benefits* (PBE) were measured with a 9-item scale adapted from Pappas et al. (2021); these items concerned the perceived benefits of adopting OI. *Perceived barriers* (PBA) were measured with an 8-item

[1] For detail overview of benefits and risks associated with open innovation see summary provided by Ullrich et al. (2018).

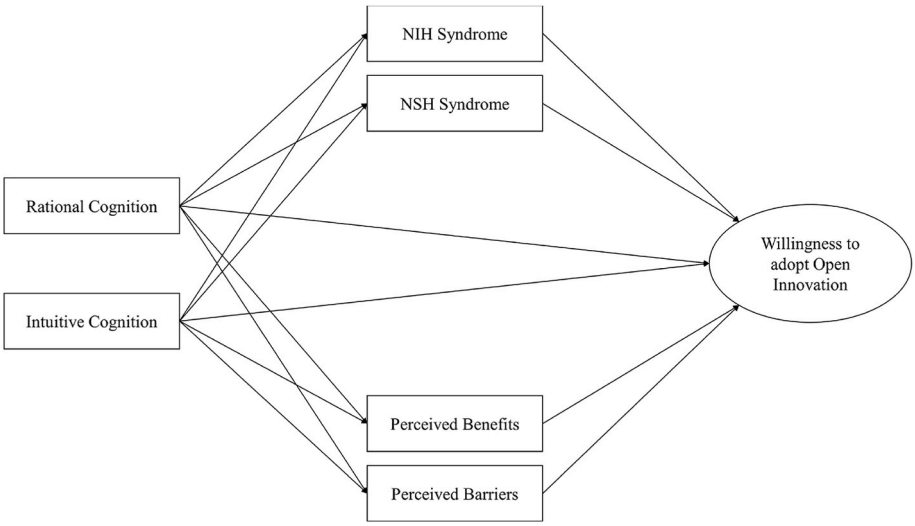

Fig. 1. Theoretical model.

Table 1
Sample characteristics.

Respondents characteristics					
Age			*Gender*		
18–30	157	36.18%	Male	289	66.59%
31–45	196	45.16%	Female	144	33.18%
46–60	65	14.98%	Other	1	0.23%
More than 60	16	3.69%			
Industry experience			*Company position*		
1–5 years	186	42.86%	Senior Manager	147	33.87%
6–10 years	113	26.04%	Middle Manager	187	43.09%
Over 10 years	135	31.11%	Junior Manager	51	11.75%
			Owner/ Entrepreneur	49	11.29%
Companies characteristics					
Size (employee number)			*Industry*		
Less than 5	63	14.52%	Manufacturing	170	39.17%
5–50	198	45.62%	Service	264	60.83%
51–250	173	39.86%			
Operational market			*Technology level*		
Business to Business	296	68.20%	High-Tech	240	55.30%
Business to Consumer	138	31.80%	Low-Tech	194	44.70%
Total Companies	**434**				

scale adapted from Pappas et al. (2021); these items concerned the perceived barriers to adopting OI. *Willingness to adopt OI* (WA) was measured using a 5-item scale adapted from Pappas et al. (2021); these items concerned the willingness to adopt OI.

3.3. PLS-SEM

The research model was firstly assessed using the PLS-SEM method (Hair et al., 2014; Henseler et al., 2016) with SmartPLS software version 3.3.3. PLS-SEM is a composite-based method for structural equation modelling, which is useful for theory testing with a prediction perspective (Rasoolimanesh et al., 2021). PLS-SEM is an ideal procedure for estimating and assessing the hypothesised relationships in path models with latent variables (Hair et al., 2014), as it facilitates the examination of complex path models by supporting the unrestricted use of different variable types and nonlinear terms (Hair et al., 2012, 2014). This approach mainly encompasses two procedures: (1) measurement model assessment, and (2) evaluation of the structural model. Accordingly, PLS-SEM bases its results on a symmetric mean effect of variables, producing a result that explains the existing relations with average effects. However, in recent years, scholars have debated the use of a solely symmetrical approaches, arguing that average effects are not always capable of catching the various facets of a phenomenon (Rasoolimanesh et al., 2021). As a result, to complement the PLS-SEM analysis, an fsQCA approach was implemented (Rasoolimanesh et al., 2021; Yildirim et al., 2022).

3.4. fsQCA

The fsQCA method mainly investigates various cases that enact a specific phenomenon in complex situations (Fiss, 2011; Ragin, 2008). The approach differs from conventional quantitative methods, since they are unable to examine causal complexity among different variables (Ragin, 2008). The fsQCA method is often developed to complement the findings of research models previously investigated through structural equation modelling analysis (Pappas et al., 2021; Rasoolimanesh et al., 2021). In doing so, researchers acquire the ability to assess the uncomplicated nature of their hypotheses that are normally tested using regression methods (Woodside, 2014). Therefore, this study applies fsQCA to explore the mechanisms underlying the antecedents that cause decision-makers to have the willingness (or reluctance) to adopt the OI strategy that were not disclosed in the PLS-SEM analysis. Specifically, fsQCA provided the opportunity to look at the conditions of having different variables in different configurations that highly influence decision-makers' willingness to opt for OI. In addition, further analysis was conducted for the configuration that may also lead to a reluctance of decision-makers in adopting OI (Fiss, 2011). The fsQCA analysis was developed using fsQCA software version 3.0 (Ragin and Davey, 2016).

4. Results

The assessment of the measurement model was established, indicating a satisfactory level of all requirements (Rasoolimanesh et al., 2021). Specifically, Table 2 represents the indicators' reliability and loadings for each construct. Few single indicators showed lower loadings, but, as the corresponding constructs presented acceptable levels of internal consistency, reliability, and convergent validity, the indicators were retained according to the procedures conducted by Hair et al. (2017). Specifically, one of the IC indicators, one of the NSH indicators, and three of the PBA indicators were dropped due to unsatisfactory loadings. Consequently, all constructs contained a composite reliability above 0.70; thus, they all confirmed the internal consistency and reliability of the measurements. Lastly, all average variance extracted

Table 2
Items and loadings.

Constructs and Items		Loadings	Mean (SD)	CR	AVE
Rational Cognition (RC)					
RC1	I double-check my information sources to be sure I have the right facts before making decisions.	0.720	5.970 (0.877)	0.878	0.643
RC2	I make decisions in a logical and systematic way.	0.822			
RC3	My decision making requires careful thought.	0.814			
RC4	When making a decision, I consider various options in terms of a specific goal.	0.846			
Intuitive Cognition (IC)					
IC1	When I make decisions, I tend to rely on my intuition.	0.720	4.921 (1.065)	0.861	0.610
IC3	I generally make decisions that feel right to me.	0.690			
IC4	When making decisions, I rely upon my instincts.	0.805			
IC5	When I make a decision, I trust my inner feelings and reactions.	0.893			
NIH syndrome (NIH)					
NIH1	I have a negative attitude to applying ideas and technologies from outside.	0.685	2.283 (0.855)	0.829	0.619
NIH2	I regard the application of external knowledge as valuable as the application of knowledge generated inside.	0.853			
NIH3	I have often received and used knowledge from external sources.	0.813			
NSH syndrome (NSH)					
NSH1	I have negative attitudes to having other companies receiving and using our knowledge and technology.	0.714	3.663 (1.154)	0.761	0.521
NSH3	I have often sold/revealed own knowledge and technologies to other companies	0.573			
NSH4	I am positive towards developing new ideas, solutions and technologies for other companies.	0.852			
Perceived Benefits (PBE)					
PBE1	Open Innovation can reduce my business costs	0.534	5.652 (0.758)	0.912	0.539
PBE2	Open Innovation can improve my business relation	0.821			
PBE3	Open Innovation can provide higher reliability of my business relations	0.754			
PBE4	Open Innovation is an efficient way for collaboration among firms	0.754			
PBE5	Open Innovation can provide closer relationship among trading partners	0.745			
PBE6	Open Innovation can provide better customer relations	0.743			
PBE7	Open Innovation can generate new business opportunities	0.757			
PBE8	Through Open Innovation I can access further market information and knowledge	0.746			
PBE9	Through Open Innovation I can improve my business management and organization facilitation	0.717			
Perceived Barriers (PBA)					
PBA1	Open Innovation in unsuitable for my business.	0.752	3.855 (1.053)	0.845	0.522
PBA3	I don't have a supporting organisational structure for Open Innovation	0.719			
PBA6	Open Innovation has unbalanced investment costs and returned benefits.	0.673			
PBA7	The laws concerning Open Innovation are not clear (e.g. contracts, patents, IP rights etc.)	0.709			
PBA8	I don't trust the Open Innovation in term of its security.	0.755			
Willingness to Adopt Open Innovation (WA)					
WA1	Given the chance I intend to use Open Innovation.	0.917	4.804 (1.187)	0.945	0.773
WA2	I am willing to use Open Innovation in the near future.	0.868			
WA3	I plan to use Open Innovation.	0.893			
WA4	I will recommend Open Innovation to others.	0.828			
WA5	I predict that I should use Open Innovation.	0.889			

(AVE) values exceeded the threshold of 0.50, supporting the construct measures' convergent validity.

To validate the discriminant validity, the heterotrait–monotrait ratio of correlations (HTMT) should be below 0.85, following the threshold suggested by Henseler et al. (2015), and the square root of the AVE for each construct should be greater than the correlation involving the constructs based on the criterion introduced by Fornell and Larcker (1981). Table 3 shows that the discriminant validity via Fornell–Larcker's criterion was reliable, and the values of the HTMT were in line with the necessary requirement (Henseler et al., 2015).

4.1. Results of PLS-SEM analysis

The structural model was conducted by taking into account the path coefficients and their significance levels. The path significance was evaluated based on p-values calculated after executing a bootstrap analysis with 5000 sub-samples in order to validate the stability of the results (Carrión et al., 2016). In addition, a mediation analysis was also developed to determine whether the impact of cognition styles on willingness to OI adoption was direct or mediated. Fig. 2 summarizes the structural model obtained through the PLS analysis, with the path coefficients, their significance levels, and the variance of the dependent variables as explained by the model (R^2).

The quality of the structural model was firstly evaluated using the coefficient of determinations (R^2). Moreover, the evaluation analysis revealed minimum collinearity in each set of predictors, as all the variance inflation factor (VIF) values were below the threshold of 5 with an average value (μ) of 1.880 (Hair et al., 2011). To test the model fit, the RMS theta was calculated, which is the root mean squared residual covariance matrix of the outer model residuals (Hair et al., 2011). This analysis computes the degree to which the outer model residuals correlate, and it is particularly useful for studies that assess reflective models. The acceptable cut-off for RMS theta for PLS path models is 0.12 (Henseler et al., 2016). The RMS theta computed here was 0.116, which supports the model fit criterion. In addition, a blindfolding analysis was executed for all endogenous constructs, for which the Q^2 values were above zero (NIH = 0.053; NSH = −0.001; PBE = 0.029; PBA = 0.007; WA = 0.385), indicating that the structural model had a satisfactory predictive relevance for the dependent variable.

Table 3
Discriminant validity.

	RC	IC	NIH	NSH	PBE	PBA	WA
Fornell-Larcker Criterion							
RC	0.816						
IC	0.275	0.781					
NIH	−0.311	−0.051	0.787				
NSH	−0.054	−0.010	0.208	0.722			
PBE	0.235	0.101	−0.424	−0.284	0.734		
PBA	−0.138	−0.012	0.205	0.361	−0.411	0.722	
WA	0.124	0.059	−0.255	−0.381	0.552	−0.623	0.879
HTMT							
RC	–						
IC	0.277						
NIH	0.395	0.035					
NSH	0.064	0.002	0.314				
PBE	0.264	0.104	0.544	0.349			
PBA	0.173	0.005	0.282	0.504	0.473		
WA	0.134	0.043	0.317	0.503	0.600	0.709	–

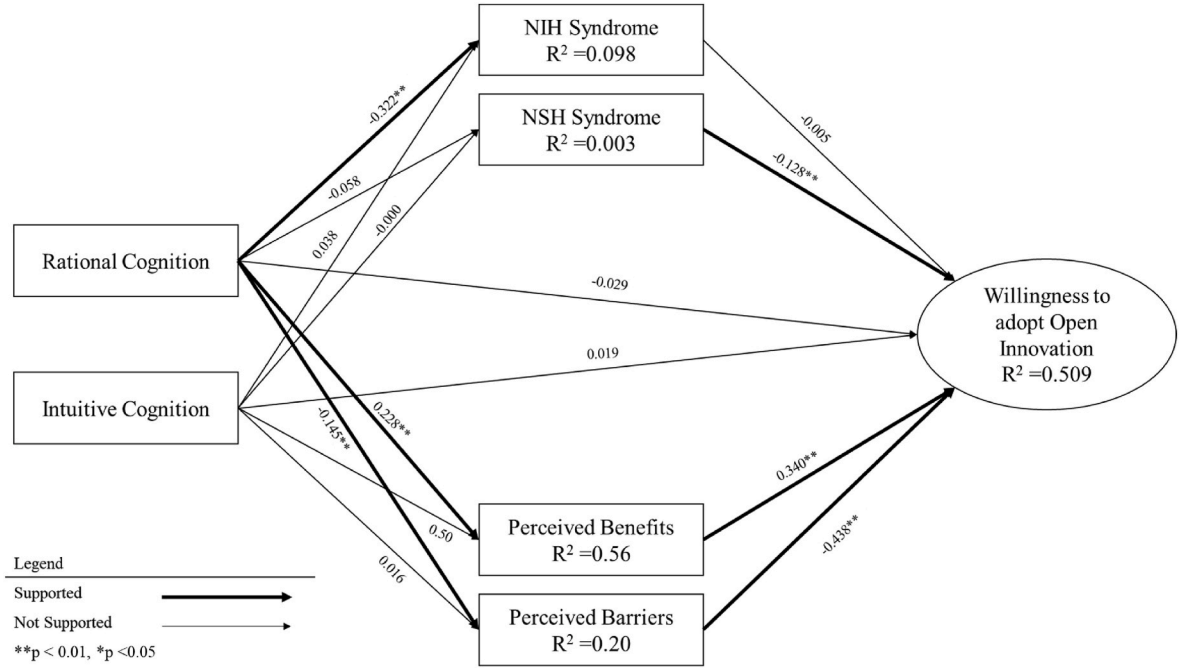

Fig. 2. PLS results.

As the last part of the structural model assessment, we performed a series of robustness checks. Following Sarstedt et al. (2020), we investigated the non-linearity with a two-step procedure: (a) testing quadratic effects on endogenous variables using SmartPLS, and (b) using the regression equation specification test articulated by Ramsey (1969), as well as adding/removing variables to discover whether severe changes may occur or not. In doing so, the quadratic effects for all our endogenous variables revealed that 80% percent of the relationships were linear. As a second step, Ramsey's test showed that our PLS-SEM was characterised by a non-linear relationship of all variables with WA. Following the robustness procedures, none of the variables accounted for bringing severe changes to the model after adding and/or removing different variables, indicating that the model had a satisfactory level of robustness. Lastly, an analysis of unobserved heterogeneity was included using the FIMIX-PLS procedure in SmartPLS. The metrics yielded divergent solutions, which, after evaluation of their segment size, indicated that the intended solution had a lower segment size in comparison with the minimum segment size. Therefore, the results of FIMIX-PLS showed that unobserved heterogeneity did not critically affect the data in the model (Sarstedt et al., 2017). However, to strengthen the findings of the PLS-SEM model, we opted for developing an fsQCA analysis, which deepened the understanding of the obtained results.

Table 4 summarizes the direct effects and their significance. The direct effects in bold show significant paths, while the others show non-significant paths. Control variables such as age, gender, industry experience, company position, size (employee number), industry, operational market, and technology level did not show any significant effect.

The results presented in Table 4 show that intuitive cognition did not play any direct role in adopting the OI strategy among decision-makers. Further, the analysis revealed a lack of support for the influence of the NIH syndrome on willingness to adopt OI strategies. However, the remaining direct effects were validated, showing that the effect of the NSH syndrome and perception concerns (i.e. perceived benefit and perceived barriers) affected managerial willingness to adopt OI. Also, the results confirmed that rational cognition had a direct effect on the NIH syndrome among decision-makers, while the same was not true about the connection between rational cognition and the NSH

Table 4
Direct effects.

Relationship	Std Beta	Std Error	t-value	p-value	95%CI LL	95%CI UL
RC → NIH	**−0.322**	**0.060**	****5.398**	**0.000**	**−0.417**	**−0.221**
RC → NSH	−0.058	0.052	1.070	0.285	−0.144	0.028
RC → PBE	**0.228**	**0.057**	****3.898**	**0.000**	**0.134**	**0.321**
RC → PBA	**−0.145**	**0.053**	****2.734**	**0.006**	**−0.231**	**−0.056**
RC → WA	−0.029	0.037	0.853	0.394	−0.087	0.033
IC → NIH	0.023	0.072	0.522	0.602	−0.094	0.145
IC → NSH	−0.000	0.064	0.088	0.930	−0.099	0.112
IC → PBE	0.050	0.060	0.651	0.515	−0.065	0.140
IC → PBA	0.016	0.077	0.358	0.720	−0.101	0.155
IC → WA	0.019	0.051	0.516	0.606	−0.069	0.100
NIH → WA	−0.005	0.041	0.066	0.948	−0.072	0.061
NSH → WA	**−0.128**	**0.039**	****3.240**	**0.001**	**−0.191**	**−0.063**
PBE → WA	**0.340**	**0.041**	****8.302**	**0.000**	**0.274**	**0.407**
PBA → WA	**−0.438**	**0.038**	****11.683**	**0.000**	**−0.500**	**−0.375**

**p < 0.01, *p < 0.05.

syndrome. Regarding perception concerns (i.e. perceived benefits and perceived barriers), rational cognition was positively associated with them. Lastly, rational cognition was not positively associated with willingness to adopt OI, similar to what was predicted for intuitive cognition.

4.1.1. Mediation analysis

A summary of the mediation analysis is presented in Table 5. The significant paths are highlighted in bold and considered meaningful. Rational cognition had a total indirect effect on wiliness to adopt OI (β = 0.148; p = 0.000) and two specific indirect effects on perceived benefits and perceived barriers (RC → PBE → WA; β = 0.077; p = 0.001; RC → PBA → WA; β = 0.063; p = 0.006). This indicated a substantial relationship between rational cognition and willingness to adopt OI. Rational cognition was also found to have a direct significant effect on NIH syndrome (β = −0.322; p = 0.000) as well as perception concerns (i.e. perceived benefits, perceived barriers) (β = −0.228; p = 0.000; β = −0.146; p = 0.006). The NIH syndrome did not show a mediation between rational cognition and willingness to adopt OI. The NSH syndrome, instead, had a direct significant effect on willingness to adopt OI (β = −0.129; p = 0.001); however, the effect was not consistent where NSH syndrome was placed as the mediator of the relationship. Last, perception concerns (i.e. perceived benefits and perceived barriers) had a direct effect on willingness to adopt OI (β = 0.338; p = 0.000; β = −0.438; p = 0.000).

Table 5
Path analysis.

Path	Std Beta	Std Error	t-value	p-value	95%CI LL	95%CI UL
RC → NIH → WA	0.002	0.013	0.064	0.949	−0.020	0.024
IC → NIH → WA	0.000	0.003	0.033	0.974	−0.005	0.005
RC → NSH → WA	0.007	0.007	0.995	0.320	−0.003	0.020
IC → NSH → WA	0.000	0.009	0.083	0.934	−0.015	0.014
RC → PBE → WA	**0.078**	**0.022**	****3.480**	**0.001**	**0.044**	**0.115**
IC → PBE → WA	0.017	0.021	0.642	0.521	−0.021	0.048
RC → PBA → WA	**0.063**	**0.024**	****2.733**	**0.006**	**0.024**	**0.101**
IC → PBA → WA	−0.007	0.034	0.362	0.718	−0.066	0.046

**p < 0.01, *p < 0.05.

4.2. Results of fsQCA analysis

The causal conditions of this study were measured with multi-item scales, which required averaging the score to compute the measure. The conditions of the initial seven-point Likert scale values were calibrated to a fuzzy set scale. To do this, we followed Ragin (2008), grading the membership of each causal condition between 0 and 1, where 0 represented 'non-membership' and 1 represented 'full membership'. According to the calibration process suggested by Ragin (2008), we identified three key qualitative points to perform the fuzzy set calibration on the condition through the direct method, which requires establishing the threshold for full membership, the crossover point, and the threshold for non-membership (Ragin, 2008). To establish the three thresholds, we followed best practices in fsQCA research and adopted the percentile method (Xie and Wang, 2020). Accordingly, the threshold for non-membership was set at the original value that covered 5% of the data values (fuzzy score = 0.05); the threshold for the crossover points was set at the original value that covered 50% of the data values (fuzzy score = 0.50); and the threshold for full membership was set at the original value that covered 95% of the data values (fuzzy score = 0.95). The calibration values for all conditions are shown in Table 6.

Before starting the analysis of sufficient conditions that may lead to high or low levels of willingness to adopt OI, we tested the necessity of each condition. The results of the necessary conditions analysis showed that not a single condition was necessary to achieve the outcome of WA (n.b. having all conditions at a consistency and a coverage level lower than 0.9, as recommended by Schneider and Wagemann [2010]). As a result, not a sole condition itself explained the willingness to adopt OI, requiring the analysis on combinations of causal conditions (Schneider and Wagemann, 2010; Xie and Wang, 2020). In performing the analysis of causal conditions, the frequency threshold was set to 4, and the consistency threshold was equal to or above 0.90 (Ragin, 2008; Schneider and Wagemann, 2010; Xie and Wang, 2020), allowing reaching the recommended value of 80% of cases included (Ragin, 2008).

The fsQCA results for the target variables suggested multiple intriguing configurations either showing a positive willingness to adopt OI (high levels of WA) or to have reluctance toward OI adoption (low levels of WA) among the decision-makers. The robustness of the solutions was tested following the suggestions of Fiss (2011) through a sensitivity analysis by setting different crossovers points for calibration (±25%). Minor, yet not relevant, changes were observed on permutations and number of solutions, confirming the robustness of our fsQCA results. We also double-checked the robustness of the solutions from the fsQCA analysis by randomly dividing the dataset into two sub-samples and checking for possible differences in results, as suggested by Woodside (2013). The outcome of the second robustness check did not highlight any significant differences yet confirmed the results of the fsQCA analysis.

The following tables (Table 7 and Table 8) show the results of the fsQCA analysis. Four configurations were associated with high levels of WA, leading to OI adoption (Table 7), while five configurations were associated with low levels of WA, leading to a reluctance toward OI

Table 6
fsQCA Calibration.

	Min	Max	Fuzzy Scores		
			0.05	0.50	0.95
RC	1.000	7.000	4.500	6.000	7.000
IC	1.000	7.000	3.000	5.000	6.500
NIH	1.000	5.333	1.000	2.333	3.667
NSH	1.000	7.000	1.667	3.667	5.667
PBE	3.333	7.000	4.444	5.667	6.917
PBA	1.000	7.000	2.000	4.000	5.600
WA	1.000	7.000	2.400	4.800	7.000

Table 7
Configurations leading to willingness to adopt OI (high levels of WA).

Configurations	Solution			
	W1	*W2*	*W3*	*W4*
RC	●	○	○	●
IC	○	●	○	●
NIH	○			○
NSH		○	○	○
PBE	●		●	
PBA		○		
Consistency	0.896	0.928	0.908	0.915
Unique coverage	0.079	0.063	0.058	0.051
Raw coverage	0.400	0.388	0.388	0.382
Overall solution consistency	*0.854*			
Overall solution coverage	*0.673*			

Note: black circles (●) indicate presence; white circles (○) denote negation; blank spaces denote absence.

Table 8
Configurations leading to reluctance to adopt OI (low levels of WA).

Configurations	Solution				
	R1	*R2*	*R3*	*R4*	*R5*
RC	○	○	○	●	●
IC			○	○	●
NIH	●	●	●		
NSH		●		●	
PBE	○				○
PBA		●	●	●	●
Consistency	0.877	0.930	0.919	0.903	0.939
Unique coverage	0.079	0.016	0.013	0.049	0.036
Raw coverage	0.554	0.457	0.437	0.349	0.330
Overall solution consistency	*0.846*				
Overall solution coverage	*0.732*				

Note: black circles (●) indicate presence; white circles (○) denote negation; blank spaces denote absence.

adoption (Table 8). Both sets of solutions presented high levels of coverage and consistency, in line with the methodological requirements of Ragin (2008).

Table 7 shows that the overall solution coverage for the cases associated with high levels of willingness to adopt OI was able to explain 67% of the cases (coverage 0.673). The four configurations (W1, W2, W3, W4) showed high levels of coverage and consistency by themselves, presenting different paths to achieve high levels of willingness to adopt OI.

Moving to Table 8, it showed that the overall solution coverage for the cases associated with low levels of willingness to adopt OI (reluctance toward OI adoption) was able to explain 73% of the cases (coverage 0.732). Five configurations emerged (R1, R2, R3, R4, R5), all of them with high levels of coverage and consistency. It is worth noting that the configurations associated with low levels of willingness to adopt OI were not just the inverted configurations presented in Table 7; instead, they presented different sets of combinations. The non-specular nature of the configurations highlighted that low levels of willingness to adopt OI followed different decisional routes compared to those of high levels of willingness to adopt OI, allowing us to further comment on them in the next section.

5. Discussion

The results obtained from the PLS-SEM and fsQCA analyses confirmed the effects of each factor investigated, showing a decisional path and a series of configurations that led to willingness (high levels of WA) or reluctance (low levels of WA) to adopt OI. As introduced, two levels of decision-making contexts were explored in the present study. The first one, comprising RC and IC, was not specifically tied to OI considerations. This result may also be explained by the professionalization and managerialisation of the investigated sample, where formal structures and decision-making processes ensure consistency in decisions regardless individuals' cognitive styles (Adinolfi, 2021; Bianchi et al., 2019; Calabretta et al., 2017). The second level, which included NIH, NSH, perceived benefits, and perceived barriers, was specifically tied to the evaluation made by decision-makers in adopting OI or not, with a direct assessment of possible returns and drawbacks (Ahn et al., 2017; Antons and Piller, 2015; Greco et al., 2019).

5.1. Comments on PLS-SEM findings

The findings of the PLS-SEM analysis suggested an active role of rationality, perceived benefits, and perceived barriers of decision-makers in SMEs when appraising the adoption of OI. Indeed, these elements explained most of the variance of the measurement model.

At a general level, RC had an influence on most of the variables considered in the study. RC predicted an increase in perceived benefits, while at the same time reduced the perceived barriers associated with OI adoption. Indeed, looking at the indirect effects of RC, the PLS-SEM analysis showed a significant mediation effect on evaluating the benefits and barriers associated with OI (Bawack et al., 2021; Hayes, 2018). The indirect effects of RC suggested that a rational evaluation made by decision-makers also increased the proper weighting and balancing of benefits and barriers, for example, by easing distress towards the unknown (Bianchi et al., 2019; Rangus and Černe, 2019; Robinson et al., 1991). Thus, our findings concurred with the notion of Bhimani et al. (2022) that cognitive discrepancy reduction process' role in resolving disbalances comes from perceived commitment and negative emotions and feelings related to OI (dis)engagement.

Besides a better assessment of benefits and barriers, a rational approach helps to reduce suspicious attitudes toward externally sourced innovations, namely the NIH syndrome. It emerged that an analytical and logical assessment of the decision to adopt OI decreased the uncertainty associated with the radical structural changes required for such a decision (Bianchi et al., 2019; Galati and Bigliardi, 2017). This can improve the processes of accessing cognitive and organizational proximity and in turn foster exploration of different opportunities, expanding business relation networks, and accessing new markets (Calabretta et al., 2017; Eliëns et al., 2018; Kaufmann et al., 2014).

Conversely, IC in the PLS-SEM model was considered a stand-alone—it did not have a significant effect. The PLS-SEM results suggested that, on average, decision-makers in SMEs tend to rely on a more rational-like evaluation. Our PLS-SEM findings were aligned with prior findings using linear models exploring comparable decision-making situations, such as suppliers selection (Kaufmann et al., 2014), new product development gate-keeping (Eliëns et al., 2018), or products' features selection (Bianchi et al., 2019).

Moving to the second and context-specific level, a crucial role was played by perceived benefits and perceived barriers, while NIH and NSH had only a slight influence on the decision.

Perceived benefits associated with OI showed a positive influence on the decision in relation to both inbound (PBE items 1 to 5) and outbound (PBE items 6 to 9) OI activities. The benefits for inbound OI were considered a chance to increase internal business efficiency and relationships with suppliers. This result was consistent with the traditional situation in which SMEs are involved in the middle steps of the value chain, often operating in networks where relations and efficiencies are at the core of their competitive advantage (Radziwon and Bogers, 2019). Moreover, these activities are perceived as a way to improve and innovate the product and/or service offering (Barrett et al., 2021; Bigliardi and Galati, 2016). Our results extend prior literature findings by showing that decision-makers are aware and able to extensively assess the implication of OI in companies' activities prior to its adoption and implementation (Bigliardi and Galati, 2016; Greco et al., 2019; West and Bogers, 2014). These findings suggest that SMEs often have financial

constraints preventing them from developing a portfolio of multiple OI projects. Consequently, SMEs decision-makers need to be fully aware of the potential of OI, even prior to having experimented with it in the company (Antons and Piller, 2015; Burcharth et al., 2014).

Similar results, but with an opposite effect, emerged for the perceived barriers of OI. The PLS-SEM analysis predicted a significant negative effect, able to impair the adoption of OI in SMEs. The data suggested that the biggest challenge of OI was perceived to be the costs associated with the initiative, in addition to the structural changes required to fully embrace it. The size effect of the perceived barriers was the greatest of the model, indicating how these negative perceptions are relevant preconceptions that are able to extensively halt the implementation OI in SMEs (Burcharth et al., 2014; Veugelers et al., 2010), even able to block its adoption (Ahn et al., 2017). Considering its impact, this decisional construct should be taken into serious consideration in the context of SMEs.

Moving to the role of NIH and NHS, surprisingly, they had a limited negative effect on WA. Our data showed a neutral disposition in assessing the implications of receiving knowledge from outside sources. This could be because SMEs are used to knowledge inflows from the outside due to their limited availability of internal resources (Barrett et al., 2021; Bigliardi and Galati, 2016; Casprini et al., 2017). In contrast, SMEs seem more reluctant to sell/share their knowledge produced inside to their partners, as shown by a higher impact of the NSH syndrome. SMEs are particularly prone to protect internally developed knowledge, as this represents a key source of a company's competitive advantage (Barrett et al., 2021; Bigliardi and Galati, 2016).

5.2. Comments on fsQCA findings

The fsQCA results showed an extensive set of possible different decisional configurations, namely paths, related to the willingness or reluctance toward adopttion of OI, which complements and extends the results of the previous PLS-SEM analysis (Bawack et al., 2021; Rasoolimanesh et al., 2021). Indeed, all the variables included in the PLS-SEM analysis were acceptable configurations in the fsQCA analysis (Pappas et al., 2021; Rasoolimanesh et al., 2021).

When the complexity and uncertainty of a decision is particularly high, an array of elements impacts this decision. For example, a pure rational evaluation could be detrimental, while better results can be achieved thanks to the inclusion of intuitive hints (Bianchi et al., 2019; Boffelli et al., 2020; Kaufmann et al., 2014). Decision-makers constantly combine, intentionally or not, their rational and intuitive cognitive approaches in their decisional outcomes (Bianchi et al., 2019; Calabretta et al., 2017; Keller and Sadler-Smith, 2019). In addition, the contextual factors involved in OI adoption evaluation, such as perceived benefits, perceived barriers, NIH, and NSH, also play an important role.

5.2.1. Configurations associated with willingness to adopt OI

Starting from the configurations associated with high levels of WA (W1, W2, W3, W4), therefore leading to a willingness to adopt OI, fsQCA analysis showed four possible configurations, reflecting four different decisional paths (Bawack et al., 2021; Pappas et al., 2021).

Configuration W1 represented the largest proportion of cases; it portrayed the central role of the rational and well-informed decision-maker, accounting for the benefits associated with OI. In Configuration W1, IC and NIH were absent, emphasizing on the rational-related elements as drivers to adopt OI (Ahn et al., 2017; Antons and Piller, 2015). As such, a large portion of the decision-makers in the sample assessed willingness to adopt OI with a rational approach, focusing on the benefits coming from it and not fear of being open to the external environment. The Configuration W1 confirmed the results of the PLS-SEM analysis—the pivotal role of rational cognition and perceived benefits in high levels of willingness to adopt OI.

Configuration W2, instead, depicted the profile of an antithetical decision-maker, who relies on intuition, is open to share and sell internally developed knowledge, and is optimistic in coping with the barriers associated to adopting OI (Adinolfi, 2021; Bianchi et al., 2019; Kaufmann et al., 2014). In Configuration W2, RC was absent but not negated, showing a decision mainly grounded in instinctive feeling, heuristics, and previous experiences (Bianchi et al., 2019). To achieve high levels of willingness to adopt OI, Configuration W2 also required the absence of NSH and perceived barriers. Specifically, the absence of NSH highlights the awareness of decision-makers to opportunities associated with knowledge-sharing with partners and cooperating in an open network (Aleksić et al., 2021; Barrena-Martínez et al., 2020; Burcharth et al., 2014). The absence of perceived barriers suggests a positive attitude toward openness together, with confidence in partnering and networking with companies to attain shared goals (Ahn et al., 2017; Aleksić et al., 2021; Boffelli et al., 2020).

Configuration W3 showed the profile of an enthusiastic and context-focused decision-maker, mainly sensible toward possible beneficial business opportunities emerging from adopting OI (Adinolfi, 2021). In Configuration W3, both RC and IC were negated, showing that the positive WA was not only driven by general cognitive styles of the decision-maker. In this case, the decision about OI adoption was focused on and assessed via the perceived benefits and thus on the concrete benefits of the OI context (Adinolfi, 2021). In addition, these enthusiastic decision-makers were not influenced by NSH syndrome, which was absent; thus, they were not biased against openness. Similarly to Configuration W2, OI was mainly perceived as an opportunity for business development when decision-makers are open to share and sell internally developed knowledge (Aleksić et al., 2021; Barrena-Martínez et al., 2020). As such, Configuration W3 envisioned the profile of 'open-minded' decision-makers that are opportunity-driven and open toward the external environment (Ahn et al., 2017; Aleksić et al., 2021; Bogers et al., 2018).

Finally, Configuration W4 drew attention to a balanced decision-maker (Barrett et al., 2021). Surprisingly, this profile was more residual than the others. The profile highlighted a balanced evaluation of OI, relying on both rational and intuitive cognition when evaluating OI for their business. Configuration W4 required the absence of both NIH and NHS syndromes; thus, this was a group of decision-makers that were open to inbound and outbound flows of knowledge and innovation, as shown by the absence of NIH and NSH. However, this configuration (W4) did not require the presence of perceived benefits or barriers. This suggests that the evaluation was mainly performed by the use of non-contextual cognitive judgement, possibly because these decision-makers were less able to forecast the possible benefits and/or barriers associated with OI and their companies (Adinolfi, 2021; Ahn et al., 2017; Burcharth et al., 2014; Greco et al., 2019).

5.2.2. Configurations associated with reluctance to adopt OI

Moving to the configurations associated with low levels of WA (R1, R2, R3, R4, R5), therefore leading to a reluctance to adopt OI, five paths emerged from the fsQCA analysis. It is worthwhile to note that configurations with a negated WA are not simply symmetrical to the positive adoption configurations (Ragin, 2008; Woodside, 2013, 2014). Thus, decisional paths that lead to the reluctance of OI adoption follow different cognitive routes, deserving additional attention (Bogers et al., 2017; Rasoolimanesh et al., 2021).

An interesting finding emerging from the reluctance to adopt OI was connected with the negative values of rational cognition (○RC) together with the absence or negation of IC in Configurations R1, R2, and R3. The three configurations showed that some decision-makers had low rational reasoning and did not compensate for it with a high intuitive cognition. This situation pictures possible negative preconceptions and biases toward OI (Ahn et al., 2017; Bogers et al., 2018; Burcharth et al., 2014); indeed, in Configurations R1, R2, and R3, decisions of negated WA were primarily driven by the two syndromes, NIH and NSH, with related biases and suspicious attitudes toward openness and OI (Bogers et al., 2017; Burcharth et al., 2014; Greco et al., 2019; van de Vrande et al.,

2009).

Configuration R1, which accounted for the highest proportion of cases, gave the profile of a decision-maker not interested and unresponsive toward OI. In Configuration R1, perceived benefits were negated (○PBE), while perceived barriers were absent. This suggests that this type of decision-maker was not particularly afraid of the possible barriers to OI adoption; rather, they did not perceive any benefit of OI for their business. The presence of NIH in this configuration (R1) underlined the intention of decision-makers to keep their business close, seeing externally sourced innovations as suspect and deeming them inferior to internally developed ones (Greco et al., 2019). Configuration R1 also showed the negation of rational cognition (○RC) and absence of intuitive cognition. Such a combination of negated and absent cognitive elements generated a potentially dangerous situation in which OI was not adopted because of a possible superficial assessment of it (Adinolfi, 2021; Ahn et al., 2017; Bogers et al., 2018; van de Vrande et al., 2009).

Similarly, Configuration R2 and Configuration R3 showed portraits of decision-makers that were hesitant to and troubled by openness. In these two configurations, rational cognition was negated (○RC), showing again possible biases and preconceptions toward OI, as per Configuration R1. Such evidence was robust for Configuration R3, where intuitive cognition (○IC) was also negated (Adinolfi, 2021; Ahn et al., 2017). The major difference between Configuration R1 and the Configurations R2 and R3 lies in the role of perceived barriers. In both Configurations R2 and R3, the perceived barriers created a vicious circle with syndromes that move the decision-makers away from OI. While Configuration R1 showed decision-makers that did not see the benefits of OI because of a combination of non-rationality and NIH, in Configurations R2 and R3, the combination of barriers and syndromes frightened decision-makers in adopting OI. Such configurations resulted from excessive perceived costs and organisational changes needed to implement OI, in association with a low predisposition toward inbound and outbound activities (Ahn et al., 2017; Greco et al., 2019; van de Vrande et al., 2009).

Moving to the last two configurations (R4, R5) associated with a reluctance to adopt OI, decision-makers on these paths used cognitive judgment to decide to opt-out from OI (Bianchi et al., 2019). In both Configurations R4 and R5, at least a cognitive aspect was present, showing a rational or balanced judgement about the role of OI.

Configuration R4 showed the profile of a rational decision-maker that was risk-adverse and somehow apprehensive of rivals when it comes to shared knowledge. The low levels of OI adoption resulted from a rational evaluation of the barriers together with a lack of interest in sharing/selling knowledge developed internally (NSH). In this case, OI was seen as not a profitable way to exploit knowledge developed internally, in combination with an excessive consideration of barriers to implement OI (Ahn et al., 2017; Bigliardi and Galati, 2016; Leckel et al., 2020).

Configuration R5 presented the profile of balanced decision-makers, apparently not interested in innovating through OI. The profile showed a decision-making process based on cognitive aspects, both rational and intuitive; thus, a balanced and all-rounded evaluation of OI was made (Adinolfi, 2021). The decision-makers depicted by Configuration R5 also negatively evaluated the benefits of OI (○PBE), and their perception of barriers was central. Thus, barriers and costs related to them offset the benefits of OI. Notably, in this configuration, the low willingness to adopt OI was not affected by preconceptions and biases, as the two syndromes were absent (Ahn et al., 2017; van de Vrande et al., 2009). Therefore, this configuration (R5) showed the profile of a decision-maker that, after careful assessment of OI's implications, came to the decision that OI was not convenient or appropriate for their businesses (Barrett et al., 2021; Bigliardi and Galati, 2016). Indeed, some situations may structurally limit the ability of an SME to reap the benefits of OI. For example, when the product's market size is expected to be large and capable of generating significant benefits for the company, managers tend to avoid the use of OI, as well as when significant R&D funding and grants are available for the company (Lee et al., 2019). The same applies when the cost of formal intellectual property rights mechanisms are too extensive, not allowing SMEs to fully protect their knowledge. In this case, SMEs adopt a defensive tactic, keeping their internally generated knowledge undisclosed (von Briel and Recker, 2017). Finally, maintaining the relation network with OI partners is far from inexpensive, and strained resources can limit the adoption of OI in SMEs due to its interactions and relational costs (von Briel and Recker, 2017).

6. Implications

This study contributed to the emerging stream of literature interested in the human side of OI, by focusing on both positive and negative outcomes of decision-makers' in OI adoption (Bogers et al., 2017, 2018; West and Bogers, 2014), and it raised a series of implications for both theory and practice.

6.1. Theoretical implications

From the theoretical side, we expanded the discussion around the human side of OI by drawing a more accurate picture of the role of decision-makers' cognition and perceptions about OI (Bhimani et al., 2022). At the cognitive and decision-making levels, the human side of OI has been identified as an area of investigation, with scarce empirical evidence (Bogers et al., 2017). With the present study, we confirmed and unpacked in detail what some seminal studies already sensed, namely, the key role of cognitive facets in the decision to adopt OI or not (Ahn et al., 2017; Bogers et al., 2017, 2018). Having a sample composed of SMEs, where top-management teams and/or entrepreneurs were pivotal to the decision-making process, allowed us to focus our exploration on cognitive configurations and perceptions leading to a positive or a negative OI adoption (Ahn et al., 2017). The decision-making process behind OI was understood with a multi-level approach. General and non-contextual cognitive styles, which are always in play regardless of the type of decision to be made, intermix with context-specific elements such as the perception of benefits and barriers and the syndromes affecting OI (Bogers et al., 2017, 2019). This nexus of patterns also confirms the correctness of the choice of not relying only on linear methods, which may not be able to fully understand the extent of this complexity, creating the necessity to include additional non-linear studies in the field of OI, and more generally, in the field of management (Dabić et al., 2021; Woodside, 2013, 2014).

Finally, while scholars have recently explored the drawbacks of OI, it is emerging that OI is not a panacea for every company's innovation needs, which largely depend on the context, the human factor, and the type of innovation project carried out (Audretsch and Belitski, 2022; Brunswicker and Chesbrough, 2018; Lee et al., 2019; Lu and Chesbrough, 2021; von Briel and Recker, 2017), as also shown in the present study.

6.2. Practical and policy implications

Our findings showed how willingness or reluctance to adopt OI was highly influenced by decision-makers' cognition style, perceived barriers and benefits, and the interplay of the NSH and NIH syndromes (Ahn et al., 2017; Bigliardi and Galati, 2016; van de Vrande et al., 2009). The results did not show significant differences across several categories of SMEs; similar patterns were depicted for small or medium firms, in relation to technological intensity, either high-tech or low-tech firms, and across industries (i.e. manufacturing or services) (Iammarino et al., 2012; Marzi et al., 2021). We noticed that the outcome of willingness or reluctance to adopt OI originates from a series of factors that can be challenging for decision-makers to directly control (e.g. their cognitive styles). A debate has started surrounding the effects of OI for companies, which are often positive but sometimes not clear (Lu and Chesbrough, 2021). Through the present study, we noticed that managers,

entrepreneurs, and innovators were aware of the risks and the eventually limited benefits coming from adopting OI unconditionally. The results confirmed the suspicious attitudes of several decision-makers toward integrating OI in their companies. This verified the crucial role of cognition in innovation practices, a topic that has been largely ignored by mostly focusing on the 'hard' facets of innovation management (Eggers and Kaplan, 2013; Lee et al., 2019; Sassetti et al., 2018). Although it is not possible to efficiently act on the cognitive characteristics of individuals, such as their rationality or intuition, it is possible to work on their awareness, perception of benefits and barriers related to OI, as well as NIH and NSH, aiming to assist decision-makers in understanding the correct innovation paths for their companies using OI or not.

Therefore, our findings create some interesting perspectives for policymaking and education. Perceived barriers can be dismantled by appropriate policy intervention aiming to favour OI adoption and networking, such as clearer regulations and collaboration grants (Barrett et al., 2021; De Marco et al., 2020; Stojčić, 2021). This is true for emerging and transition economies, where innovation network of SMEs play a crucial role in the welfare of counties (Stojčić, 2021).

Policymakers should consider raising awareness of the benefits of OI, improving the perceived value of openness, as shown by different success stories coming from family companies (Casprini et al., 2017), ICT companies (Di Minin et al., 2016) or manufacturing SMEs (Greco et al., 2019), and from OI practices (Lu and Chesbrough, 2021). The same applies for the syndromes, where appropriate R&D grants and policy intervention allow for creating a network of companies, universities, and other public institutions where the actors are prone to share generated knowledge (De Marco et al., 2020; Iammarino et al., 2012). Finally, the perceptions of suitability and benefits of OI in SMEs could be also enhanced by appropriate educational and training programmes (particularly the lifelong learning interventions) aimed to raise awareness about the importance of networking, while providing managerial competences to succeed in implementing OI within new and existing companies (Barrena-Martínez et al., 2020; Barrett et al., 2021; Sharifi et al., 2014). Educational programmes can also reduce suspicious attitudes toward externally sourced innovation, therefore reducing the two syndromes explored in the present study (Greco et al., 2019). Such programmes could be effective when implemented together with policy interventions, such as innovation grants or ecosystem/cluster building (De Marco et al., 2020; Stojčić, 2021).

7. Conclusions and limitations

In this study, we explored the cognitive configurations and syndromes affecting the adoption or reluctance of OI in SMEs. Grounded in DPT, we explored how rationality, intuition, NIH, NSH, perceived barriers, and perceived benefits can shape the decisions of managers, entrepreneurs, and innovators in adopting OI. Our study showed that the adoption of OI lies in a complex and multifaceted decision pattern. First, via a linear PLS-SEM approach, we identified the major cognitive drivers involved in the adoption of OI, with a human-centric approach. However, as managerial decisions rarely rely on direct and linear processes (Woodside, 2013, 2014), we further investigated the phenomenon via fsQCA analysis. The results presented four decisional patterns associated with willingness to adopt OI, while five decisional routes were associated with its reluctance. Our findings, in connection with our title, allow us to note that decision-makers in SMEs have only two options: 'Do or do not. There is no try', quoting the sage Yoda from the Star Wars films.

We, therefore, expanded the field of the human side of OI (Bogers et al., 2018) by exploring some cognitive configurations behind the adoption of OI in SMEs. Our approach paves the way to fully include managerial cognition in the research stream related to OI, with many promising avenues (Aleksić et al., 2021; Eggers and Kaplan, 2013). While we focused on the willingness to adopt OI, future studies should investigate how and whether the cognitive sphere of managers, entrepreneurs, and decision-makers may also affect the success and implementation of an OI project (Adinolfi, 2021; Ahn et al., 2017). One of the limitations of the study also lies in this aspect—the willingness to adopt a strategy is not always translated into a factual plan (Pappas et al., 2021). However, another limitation may pertain to the decision-makers' experience, or rather the lack of it, which could influence the willingness to adopt OI. Without being familiar with the OI approach, the evaluation may be superficial. Another interesting future research project would be integrating these findings with other cognitive evaluations which come from the overall human capital of companies—whether, on the one hand, entrepreneurs and managers strongly shape the strategy of an SME, and, on the other hand, employees and other organizational factors play a vital role, reducing or reinforcing the likelihood of the success of an OI strategy (Bigliardi and Galati, 2016). Finally, our sample was composed of UK-based SMEs. While this allowed a better comparison with the extant studies on OI, it is necessary to replicate our findings in different geographical contexts, especially for those countries and areas having transition or developing economic systems.

CRediT authorship contribution statement

Giacomo Marzi: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Mohammad Fakhar Manesh:** Methodology, Formal analysis, Writing – original draft, Writing – review & editing. **Andrea Caputo:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Funding acquisition. **Massimiliano Matteo Pellegrini:** Conceptualization, Writing – original draft, Writing – review & editing. **Božidar Vlačić:** Methodology, Writing – original draft, Writing – review & editing.

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