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The Human Side of Open Innovation Adoption in SMEs: A Configurational Approach

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The Human Side of Open Innovation Adoption in SMEs: a configurational approach

Authors

Giacomo Marzi, U. of Trieste, Italy, giacomomrz@gmail.com
Mohammad Fakhar Manesh, U. of Rome Tor Vergata, mohammad.fakhar.manesh@uniroma2.it
Andrea Caputo, U. of Trento & U. of Lincoln, dr.andreacaputo@gmail.com
Massimiliano Pellegrini, U. of Rome Tor Vergata, dr.massimiliano.pellegrini@gmail.com
Bozidar Vlacic, Católica Porto Business School and CEGE, U. Católica Portuguesa, bvlacic@ucp.pt

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Giacomo Marzi, U. of Trieste, Italy, giacomomrz@gmail.com
Mohammad Fakhar Manesh, Andrea Caputo, Massimiliano Pellegrini, Bozidar Vlacic

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Abstract

SMEs' willingness to adopt Open Innovation largely depends on managerial cognitive configurations. The present study inquiries a scarcely explored aspect of Open Innovation, namely the human side of Open Innovation. As a result, we study the cognitive configurations leading toward willingness or unwillingness of OI adoption, specifically focusing on the cognitive side of the decision-makers. In doing so, we explore the role of Rational and Intuitive cognition, together with the NIH and NHS syndromes. Also, we study the effect of perceived barriers and perceived benefits that are able to affect the decisional outcome of managers in deciding to adopt, or not, Open Innovation. The present is grounded in a survey among 442 qualified and experienced managers working in SMEs. Results of a fsQCA analysis outlines different decisional profiles associated with willingness and unwillingness to adopt OI.

Keywords: Open Innovation; Cognition; Human Side; Rationality; Intuition; Barriers; Benefits; Syndromes; NIH; NSH; Adoption; Drawbacks; Decision-Making

1. Introduction

As suggested by several scholars and practitioners' studies, the survival and future of companies appear to be increasingly connected with the networking capabilities, unceasing innovation, and knowledge sharing activities (Bogers et al., 2017; H. Chesbrough, 2020; Markovic et al., 2021; McKinsey & Company, 2020a, 2020b). Moreover, the ability to create a successful network of collaboration aimed to foster innovation activities is crucial for SMEs which have fewer resources allocated to innovation and R&D compared to large companies (McKinsey & Company, 2020b; Teirlinck and Spithoven, 2013).

Open Innovation (OI) represents one of the possible routes for SMEs development and innovation, allowing companies to gain competitive advantage by accessing a network of resources and knowledge aimed to improve the innovation abilities of the actors involved (Bogers et al., 2017; H. Chesbrough, 2020; Dahlander et al., 2021). However, the decision to take one innovation route rather than another lies in the decisions of entrepreneurs, mangers, and innovators at the pinnacle of the companies (de Oliveira et al., 2015; Kor et al., 2007; Van Riel et al., 2004). This is particularly true for SMEs, where the decision-making centre is concerted in one or a few individuals, generating a situation where the cognitive processes, the perceptions, and the attitudes of the decision-makers become central (de Oliveira et al., 2015; Eggers and Kaplan, 2013; Najar and Dhaouadi, 2020; Pappas et al., 2021).

The interplay of cognitive processes, perceptions and human side of decision-making has already largely explored by the entrepreneurship literature by analysing the cognitive micro-foundations of entrepreneurial process (Eggers and Kaplan, 2013; Kor et al., 2007; Shepherd et al., 2021). However, as suggest by prior research, from the side of the micro-foundations and the human side of OI little is known (Sun et al., 2021), while such an area of study deserve additional research as seminal studies showed the crucial role of decision-makers' characteristics in fostering or neglecting the OI activities, especially in SMEs (Ahn et al., 2017;

Barrett et al., 2021; Bogers et al., 2017; Garlatti Costa et al., 2021; Najar and Dhaouadi, 2020; Rangus and Černe, 2019). In addition, some preliminary studies have explored the human side of OI focusing on CEO characteristics (Ahn et al., 2017), employee diversity (Bogers et al., 2018), and leadership styles (Rangus and Černe, 2019). However, the available studies on the topic are still scarce, especially when the focus is on the cognitive side of OI adoption and the factor leading to adoption or reluctance toward OI implementation (Aleksić et al., 2021; Bogers et al., 2017, 2018).

Given the effects of managerial cognitive configuration on decision outcomes (Hodgkinson and Healey, 2011; Simon, 1955) and relevance of managerial representation and abstraction toward the development of OI (un)friendly culture (Ahn et al., 2017; Gavetti, 2012), we turn to the concept of managerial cognition and the dual-process theory (DPT) (Evans, 2008). By supplementing the OI intellectual domain with the tenets of the DPT, we portray the effects of cognitive style and factors affecting the willingness to adopt OI. Accordingly, DPT describes the relevance of two styles (one guided by intuitive, heuristic based and associative processes; while other predominantly deliberate and related to the careful evaluation and assessment) (Epstein and Pacini, 1999; Evans, 2008; Evans and Stanovich, 2013), when making decisions and their lasting effects on the organizational strategic choices (Vlacic et al., 2019, 2020).

In SMEs, which intrinsically have a limited capital availability, the decision to embrace the sometimes-perilous route of adopting OI could fright the decision-makers which possibly see on it a source of capital expenditure without a short-term beneficial return (Bigliardi and Galati, 2016; Greco et al., 2019; Markovic et al., 2021; Obradović et al., 2021). Decision-makers often approach OI from a careful and suspicious standpoint, leading to a final decision of not adopting OI due perceived costs, lack of organisational structure, and lack of proper supporting network (Bogers et al., 2017; Greco et al., 2019; Rangus and Černe, 2019).

As a result, the present study aims to shed a light on the complexity and the multifaced nature concerning the decision-making process leading to the willingness or reluctance toward OI adoption in SMEs at two different levels, general and context specific. The first refers to the general attitude toward the environment and the unknown, including DPT view of rational and intuitive cognition. Both types of cognitions are aspecific as they involve the cognitive style of the individual and they are not solely tied to OI evaluation, affecting the overall decision-making process as a foundational component of the human cognition (Adinolfi, 2021; Bianchi et al., 2019; Calabretta et al., 2017). The second level, instead, it is specifically tied to OI. The perceived benefits, perceived barriers, NIH, and NSH syndromes are directly involved in OI evaluation, emerging when the decision-making process is specifically directed to evaluate business decision related to OI (Antons and Piller, 2015; Greco et al., 2019; Pappas et al., 2021).

The results emerged from our analysis suggest a more precise portrait of the role of perception and syndromes that could drive or impair the adoption of OI in SMEs, with a focus on the cognitive side of the decision makers (Bogers et al., 2017). We observed that the decision to adopt OI lies on a series of different factors, showing a complex and multifaced decision pattern, intermixing different levels and combinations of perceptions about benefits and barriers associated with OI, interaction of NIH and NSH syndromes, and cognitive characteristics of the decision makers (Aleksić et al., 2021; Eggers and Kaplan, 2013).

In doing so, the present study is structured as follows. The next section presents the theoretical foundation of our study. Section 3 describe the methodology used, while Section 4 presents the results emerged from the study. Section 5 presents the discussion, the comments, and the implication of our study, while the final section portraits the concluding remarks.

2. Theoretical Foundations

2.1 Cognitive Styles

Given that individual behaviour determines innovation (Bogers et al., 2018), managerial mindset and cognitive configuration is 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). As noted by numerous scholars (Allinson and Hayes, 1996; Phillips et al., 2015), different cognitive configurations lead managerial decision making and strategic transformations (Shepherd et al., 2021; Vlacic et al., 2020). However, even though insights gained from better understanding of how managers make decisions might lead to a substantial advancement of the research field, scholars in the field of innovation and technology did not shed considerable amount of light on this topic (Dabić et al., 2021; Obradović et al., 2021).

In this paper, the focus is on cognitive configurations that are guiding managers to re-consider current innovation practices and adopt or discard OI practices (Sun et al., 2021). In this vein, the underlying cognitive styles may explain the managerial (un)willingness toward OI adoption (Stefan et al., 2022; Sun et al., 2021), particularly in SMEs, where the decision-making is centralised and reliant on the upper echelon characteristics (Ahn et al., 2017; Hambrick, 2007).

Focusing on human side of openness, Ahn et al. (2017) noted that managerial leadership is required to mitigate various challenges and it has direct effect on establishment of an OI (un)friendly culture. To gain a deeper understanding of the mechanisms underlying managerial decision making, we build upon the tenets of the DPT, which classifies cognitive styles into two different types of information processing and thinking. Namely, intuitive cognitive style represents the creative, rapid, unconscious, expertise-based style; while rational cognitive style is analytic, deductive, formal and critical (Dane and Pratt, 2007; Evans, 2008; Evans and

Stanovich, 2013; Kahneman, 2003). The DPT highlights that individuals reach decision using two cognitive styles. Even though, the cognitive styles are apparently dichotomous (Allinson and Hayes, 1996), in essence cognitive styles are task dependent and as such managers tend to shift among the styles when making the decision (Lowik et al., 2017; Luoma and Martela, 2021). For example, as noted by Payne et al. (1990) use of intuition guides managers to engage is 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 be made is that 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 towards 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 amongst 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, whilst 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 on the benefits, managerial cognitive style (Lowik et al., 2017; Luoma and Martela, 2021) tend to explain heterogenous (un)willingness to adopt OI among SMEs, which leads to the following proposition:

Proposition 1: Different Cognitive Styles influence the willingness to adopt Open Innovation in SMEs. These combinations may vary depending on context.

2.2 NIH and NSH syndromes

Adoption of OI practices requires managers and employees to become ambidextrous learners (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 represent a requirement for efficient knowledge-transactions (Cruz-González et al., 2015). In the case of OI, the increase of openness and adoption of heterogeneous external knowledge and knowledge sharing, may cause complexity and internal resistance to changes often characterised as Not-Invented Here (NIH) (Katz and Allen, 1982) and Not-Shared-Here (NSH) syndromes (Burcharth et al., 2014).

The NIH syndrome represent one of most constraining factors toward OI adoption, as it portrays the 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 represent another hesitating viewpoint toward openness, illustrated through the workforce purposeful generation of barriers toward knowledge outflows (Burcharth et al., 2014; Najar and Dhaouadi, 2020).

The NIH and NSH concerns emphasize the importance of human elements and micro-level understanding (Stefan et al., 2022). Accordingly, managerial activities of boundary-spanners and knowledge brokers (Fleming and Waguespack, 2007), are often under effects of attitudinal factors such as NIH and NSH (Burcharth et al., 2014; Chesbrough, 2003). Managers

are well aware of intra-organizational challenges associated with creating and capturing value generated throughout open innovation 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 & Crowther, 2006). Under the effects of NIH and NSH syndromes managers tend to neglect opportunities that external collaborators can provide (Lichtenthaler, 2011) and diminish the innovative output and performance (Burcharth et al., 2014). Despite of their relation, in essence the NIH and NSH are differentiated by the direction toward which the syndrome is oriented, as NIH syndrome tends to undermine acquisition of external knowledge (i.e., outside-in) while the NSH syndrome tends to challenge external exploitation of knowledge (i.e., inside-out) (Chesbrough & Crowther, 2006).

Even though OI practices enable SMEs access to critical resources, legitimacy and reputation building, increase awareness of new technological trends and generates high-value creation potential (Baum et al., 2000; West et al., 2014; West and Bogers, 2014), decision-makers are subject to bounded rationality (Simon, 1955), which gives a rise to impediment and lack of optimal actions. Therefore, to reduce uncertainty, managers tend to follow routines behaviour of and search for knowledge in close proximity giving a rise to the NIH and NSH syndromes. This is especially true in the case of OI, as knowledge search processes are portrayed by uncertainty and risk. Given that NIH and NSH sets constraints for the adoption of OI practices, we propose the following:

Proposition 2: Combinations of NIH and/or NSH syndromes contribute to reduce the willingness to adopt Open Innovation in SMEs. These combinations may vary depending on context.

2.3 Perceived Benefits and Barriers

Global competition and increased interconnection mean that SMEs are eager to the increase efficiency of their value creation processes by acquiring knowledge and generating uncontested market position. To do so, managers tend to consider adopting OI practices (Albats et al., 2021; Barrett et al., 2021; van de Vrande et al., 2009). 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 return from engaging in OI practice.

Scarcely researched although acknowledge by scholars for its relevance, effects of managerial cognitive configurations on OI remain overlooked and require further research (Dabić et al., 2021; Stefan et al., 2022). For example, Brunswicker & Vanhaverbeke (2015, p.1242) conceptualized OI as "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 the SMEs innovation practices. Acting as facilitator, managers represent a focal intermediary, as such our manuscript focuses on individual level cognitive processes and the effects of managerial cognition on (un)willingness to adopt OI (Brunswicker and Vanhaverbeke, 2015; Najar and Dhaouadi, 2020).

It is indisputable that SMEs benefit positively from OI collaborations. Due to their inherently limited capabilities (van de Vrande et al., 2009; Lee et al., 2010), OI enable increased innovative performance, establishment of multifaced decision making and generating shorter offering generation time (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, necessity to close and protect the generated assets and workforce absorptive capacity (Teirlinck and Spithoven, 2013). By examining individual level and capturing micro-foundations of paradox of openness,

Stefan et al. (2022) revealed the "dark side" of open innovation related to the potential failures and high-costs associated with organizational openness. Thus, the process behind the decision whether or not to adopt OI tend to be challenging and often perceived through the worst-case scenarios (Chesbrough et al., 2018). This restrictive approach towards openness could be particularly highlighted among SMEs due to limited opportunity for trial and error learning processes, caused by liabilities of smallness, lack of the financial and human resources, capabilities, and ultimately less formalized practices (Albats et al., 2021; van de Vrande et al., 2009). Additionally, SMEs restrictions toward OI exist due to information asymmetry (Brunswicker and Vanhaverbeke, 2015) and potential lack of focus on core competitive advantages due to necessity for maintaining partner proximity (Boschma, 2005). Next, a lack of resources and restrictions with respect to support independent R&D, cause SMEs to co-create innovative solutions with external sources. Hence, managers are fostered to blur the organizational boundaries and become even more open which in turn 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 practice (Ullrich et al., 2018)[1].

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

Proposition 3: Perceived Benefits and Barriers about Open Innovation influence the willingness to adopt Open Innovation in SMEs. These combinations may vary depending on context.

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

3. Methodology

3.1 Data collection

This study deployed a survey method to collect data from qualified and experienced managers working in SMEs. In our case, we pulled the sample from managers working in companies with less than 250 employees. We defined SME based on the European Union's classification.

Based on the relevant literature and the researchers' experience in the field, we first designed a preliminary draft of the questionnaire. The draft was tested for accuracy of the content with several executives working in UK SMEs and then for comprehension and duration with MBA and postgraduate students from a UK University.

Based on the received feedbacks the questionnaire was adjusted and distributed. 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 the survey (Berinsky et al., 2014). The final dataset was composed of 434 respondents.

In detail, 170 (39.17%) responses come from manufacturing companies, while 264 (60.83%) responses come from service companies. 63 (14.50%) have less than 5 employees, 198 (45.60%) have between 5 and 50 employees, and 173 (39.90%) have between 51 and 250 employees. 240 (55.3%) respondents defined the industry where the company operates as high-tech, while 194 (44,70%) defined it as low-tech. 138 (31.80%) respondents stated that B2C market is their main operational market, while 296 (68.20%) consider B2B market as their main one. 147 (33.90%) respondents were senior manager; 187 (43,10%) were middle manager, 51 (11,80%) were junior manager, 49 (11.30%) were the owners of the company. Regarding the experience of the respondents in the industry, 186 (42.80%) stated between 1 and 5 years, 113 (26.00%) between 6 and 10 years, 135 (31,20%) more than 10 years. Finally, 289 (66.60%)

were male, 144 (33.20%) were female, 1 (0.20%) was other. This resulted in a sample of diverse and experienced managers and entrepreneurs, working in various sectors, therefore avoiding single-source bias (Caputo et al., 2019).

When using self-administered surveys, respondents may give directional responses (Paulhus, 1991). To assure that response bias does not jeopardise the validity of our data, we run a series of robustness checks (Podsakoff et al., 2003). We did not find any statistically significant difference when comparing responses of early and late respondents, or randomly divided groups of respondents. We checked for common method variance using the Harman one-factor method, which showed that the first factor accounted for less than 10% of the total variance, suggesting no serious common method bias (Caputo et al., 2019; Podsakoff et al., 2003).

3.2 Measures

The scales used in the study were derived from previously published pertinent research to ensure validity (see Table 1). 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. (Bianchi et al., 2019); these items concerned rationality when making decisions. *Intuitive cognition* (IC) was measured with the 5-item scale from Bianchi et al. (2019); these items concerned intuition when making decisions. *NIH syndrome* (NIH) was measured with the 3-item scales adapted from Burchart (2014). *NSH syndrome* (NSH) was measured with the 4-item scales adapted from Burchart (Burcharth et al., 2014). *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 scale adapted from Pappas et al. (2021); these items concerned the perceived barriers to adopting OI.

Willingness to Adopt OI (WA) was measured with a 5-item scale adapted from Pappas et al. (2021); these items concerned the willingness of adopting OI.

3.3 fsQCA

fsQCA mainly investigates various cases that enact a specific phenomenon in complex situations (Ragin, 2008). The approach sets off conventional quantitative methods since they are unable to examine causal complexity among different variables. Specifically, fsQCA provides the opportunity to look at the negated condition of having different variable in different configurations that highly revamp decision-makers' willingness to opt for OI. In addition, a further analysis is conducted for the configuration that may also lead to negative willingness of decision-makers in adopting OI.

4. Results

The results meet the minimum requirement, as shown in Table 1, indicator loadings are above 0.70, supporting the indicators' reliability. Only two indicators show lower loadings but, as the corresponding constructs present satisfactory levels of internal consistency, reliability, and convergent validity, the analysis follows Hair et al. (2017) and retains the indicators. All composite reliabilities are above 0.70, thus confirming the measures' internal consistency and reliability.

Furthermore, the average variance extracted (AVE) values exceed the threshold of 0.50, supporting the construct measures' convergent validity.

TABLE 1 ABOUT HERE

4.1 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 all calibrated to a fuzzy set scale. To do this, we followed Ragin (Ragin, 2008) and set the degree of membership of each causal condition between 0 and 1, where 0 represented "nonmembership" and 1 represented "full membership". According to the calibration process we identified three key qualitative anchors to perform the fuzzy set calibration on the condition using 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 threshold, we followed best practices in fsQCA research and adopted the percentile method (Veríssimo, 2018; 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 point as 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 statistics and calibration values for all conditions are shown in Table 2.

TABLE 2 ABOUT HERE

The fsQCA results for target variables suggest that they yield multiple intriguing configurations where the interest is considered either to have positive willingness to adopt open innovation or to have negative willingness among the decision-makers. The following tables (Table 3 and Table 4) show the results of the fsQCA analysis. Four solutions are associated with high levels of WA, leading to OI adoption. Instead, five solutions are associates with low levels of WA, leading to a non-OI adoption. Both sets of solutions presents high levels of

coverage and consistency in line with the methodological requirements (Ragin, 2008), letting us to further comment them in the next section.

TABLE 3 ABOUT HERE

TABLE 4 ABOUT HERE

5. Discussion

The results obtained from fsQCA analyses confirm the effects of each factor investigated, showing a series of configurations that lead to high or low willingness to adopt OI. As introduced, two levels of decision-making process are explored in the present study. The first, comprising RC and IC, which are not specifically tied to the OI as intrinsic in every decision-making process (Adinolfi, 2021; Bianchi et al., 2019; Calabretta et al., 2017). The second one, which includes NIH, NSH, perceived benefits, and perceived barriers, is specifically tied to the evaluation made by decision-makers in adopting or not OI, with a direct assessment of possible returns and drawbacks associated with OI (Ahn et al., 2017; Antons and Piller, 2015; Greco et al., 2019).

When the level of decision complexity is high, a pure rational evaluation could detrimental while the inclusion of intuitive cognition could be beneficial (Adinolfi, 2021; Antons and Piller, 2015; Bianchi et al., 2019; Boffelli et al., 2020; Calabretta et al., 2017; Eggers and Kaplan, 2013; Kaufmann et al., 2014). As a matter of fact, decision-makers always combine, intentionally or not, their rational and intuitive cognition in their decisional outcomes (Bianchi et al., 2019; Calabretta et al., 2017; Keller and Sadler-Smith, 2019). Therefore, even if the rational cognition in evaluating perceived benefits, perceived barriers, NIH, and NSH could be predominant in the decision-making process associated with OI adoption, the

interweaving nexus of decisional construct produce a series of outcomes showing the interplay between rationality and intuition (Bawack et al., 2021; Duarte and Pinho, 2019; Pappas et al., 2021).

5.1 Solutions associated with positive WA

Starting from the solutions associated with positive and high levels of WA, fsQCA shows four possible solutions, reflecting four different decisional profiles (Bawack et al., 2021; Pappas et al., 2021).

Solution 1, which represents the largest proportion of cases, portrays the central role of the rational, well informed, decision maker accounting for the benefits associated with OI. In Solution 1 IC and NIH are absent, remarking the significant role of rationality as driver 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, not fearing the be open to external environment.

Solution 2, instead, portraits the profile of antithetical decision-makers, relying on intuition, open to share and sell the knowledge internally developed, optimistic in coping with the barriers associated to adopt OI (Adinolfi, 2021; Bianchi et al., 2019; Kaufmann et al., 2014). In solution 2, RC is absent while IC is present, showing a decision mainly grounded in instinctive feeling, heuristics, and previous experiences (Bianchi et al., 2019). To achieve a high level of willingness to adopt OI, Solution 2 also requires the absence of NSH and perceived barriers. The absence of NSH highlights the awareness of the decision-makers about opportunities associated with knowledge sharing among partners cooperating in an open network (Aleksić et al., 2021; Barrena-Martínez et al., 2020; Burcharth et al., 2014). The absence of perceived barriers remarks the positive attitude toward openness together with the

confidence in partnering and networking with companies to grasp for shared goals (Ahn et al., 2017; Aleksić et al., 2021; Boffelli et al., 2020)

Solution 3 shows the decisional profile of enthusiastic, benefits driven, decision-makers that are mainly driven by the possible beneficial business opportunities emerging from adopting OI (Kim and Ahn, 2020). In Solution 3, both RC and IC are negated, showing that the positive WA is not mainly driven by a rational and/or intuitive evaluation while the decision about OI adoption is focused and assessed via the perceived benefits (Adinolfi, 2021; Kim and Ahn, 2020). To reach the desired outcome, decision-makers should not be negatively influenced by NSH syndrome, that is absent. It highlights, similar to Solution 2, that OI is far more perceived as an opportunity for business development when decision-makers are open to share and sell the knowledge developed internally (Aleksić et al., 2021; Barrena-Martínez et al., 2020). As such, Solution 3 portraits the profile of "open-minded" decision-makers seeing OI as an opportunity of business development, not fearing to be open to external environment (Ahn et al., 2017; Aleksić et al., 2021; Bogers et al., 2018).

Finally, Solution 4 draws the profile of balanced decision-makers (Barrett et al., 2021). The decisional profile emerging from solution 4 shows that a residual number of decision-makers perform a balanced evaluation of OI relying on both rational and intuitive cognition when positively evaluate OI for their business. Solution 4 requires the absence of both NIH and NHS syndromes, while it does not require the presence of perceived benefits or barriers. This solution highlights that the evaluation is mainly performed by the use of cognitive judgement, possibly because it is not possible for the decision maker to asses in advance the possible benefits and/or barriers (Adinolfi, 2021; Ahn et al., 2017; Burcharth et al., 2014; Greco et al., 2019). We can therefore reconnect the Solution 4 to a group of decision makers that are open to inbound and outbound flows of knowledge and innovation, as shown by the absence of NIH and NSH.

5.2 Solutions associated with negated WA

Moving to the negated condition of willingness to adopt OI, 5 solutions emerged from the fsQCA analysis. It is worth noting that solutions with a negated WA are not symmetrical to the ones with positive WA, instead they offer different decisional combinations (Duarte and Pinho, 2019; Ragin, 2008). It remarks that the decisional profiles leading to a negated WA follow a different cognitive route, deserving additional commentary (Bogers et al., 2017; Greco et al., 2019; Rasoolimanesh et al., 2021).

An interesting finding emerging from the negated state of WA refers to negated state of rational cognition (○RC) together with the absence or negation of IC in solutions 1, 2, and 3. The three solutions are emerging when the decision makers have low rational reasoning, not associated with a high intuitive cognition picturing a possible negative preconceptions and bias toward OI by some decision-makers (Ahn et al., 2017; Bogers et al., 2018; Burcharth et al., 2014). It appears that in Solution 1, 2, and 3, decision of negated WA are primary driver by the two syndromes, NIH and NSH, which are possible markers for a preconception and a suspicions attitude toward openness and OI (Bogers et al., 2017; Burcharth et al., 2014; Greco et al., 2019; van de Vrande et al., 2009).

Solution 1, which accounts the highest unique coverage for the negated WA, portraits the profile of decision-makers uninterested and unresponsive toward OI. In Solution 1, perceived benefits are negated (○PBE) while the perceived barriers are absent suggesting that decision-makers are not afraid of the possible barriers to OI adoption, instead, they do not perceive the benefits of OI in their business. The presence of NIH remarks the intention of decision-makers to keep their business close, seeing the externally sourced innovations with suspect, deeming it as inferior to the internally developed ones (Greco et al., 2019). Solution 1 also shows the negation of rational cognition (○RC) and absence of intuitive cognition,

suggesting that the evaluation of OI is associated with low levels of rational reasoning and influential level of intuition. Such a combination of negated and absent cognitive elements remarks possible biases and preconception abut OI, generating a dangerous situation when OI is not adopted due to a possible superficial assessment of it (Adinolfi, 2021; Ahn et al., 2017; Bogers et al., 2018; van de Vrande et al., 2009).

Similarly, Solution 2 and Solution 3 show the portraits of the hesitant and troubled to openness decision- makers. In these two solutions, rational cognition is negated showing again a possible biases and preconceptions toward OI, as per Solution 1. Such evidence is robust for Solution 3, where also intuitive cognition (○IC) is negated (Adinolfi, 2021; Ahn et al., 2017). The major difference between Solution 1 and the Solutions 2 and 3 lies in the role of perceived barriers. In both solutions 2 and 3, the perceived barriers create a vicious circle with syndromes that move away the decision-makers from OI. While Solution 1 shows decision maker that do not see the benefits of OI because of a combination of non-rationality and NIH, in Solution 2 and 3 the combination of barriers and syndromes frights decision-makers from adopting OI. Such solutions result from excessive perceived cost or organisational changes needed to include OI in their business together with the low predisposition to inbound and outbound OI activities (Ahn et al., 2017; Greco et al., 2019; van de Vrande et al., 2009)

Moving to the last two solutions associated with a low willingness to adopt OI, they picture the decisional configurations of decision-makers not willing to adopt OI after an informed decision-making counting on their cognitive evaluation (Bianchi et al., 2019). In fact, in both Solutions 4 and 5, at least a cognitive aspect is present, showing a rational or a balanced judgement about the role of OI.

Solution 4 shows the profile of the rational, risk-adverse, not prone to sold decision-makers. The evaluation of the low interest in adopting OI results from a rational evaluation of the barriers together with the lack of interest in selling the knowledge developed internally

(NSH). In this case, the decision-makers rationally evaluate OI as not suitable for their business as could not be convenient to sell the knowledge developed internally. Also, the barriers to implement OI are perceived as high. The combination of not convenience to sell knowledge, together with high perceived barriers, results in a rational evaluation of not willingness to adopt OI (Ahn et al., 2017; Bigliardi and Galati, 2016; Leckel et al., 2020).

Solution 5 presents the profile of balanced decision-makers not interested in innovating through OI. The profile emerged, shows a decision-making process based on both cognitive aspects, rational and intuitive, and therefore considered as balanced in the OI evaluation. (Adinolfi, 2021). In such a case, the result of a low willingness to adopt OI comes from an all-rounded use of both cognitive styles, not influenced by the two syndromes. The decision makers in Solution 5 negatively evaluate the benefits of OI (○PBE), while the perceived barriers are relevant. Thus, the barriers are overcoming the benefits, possibly because the OI framework is not suitable for their type of business (Bigliardi and Galati, 2016; Greco et al., 2019). Notably, in this solution, the low willingness to adopt OI is not influenced by the possible aforementioned biases and preconceptions about OI as no negated conditions of cognitive styles nor syndromes are present (Ahn et al., 2017; van de Vrande et al., 2009). It let us to interpret this solution as a profile of decision-makers that, after careful asses of the OI's implications, come out with the decision that OI is not convenient or appropriate for their businesses (Barrett et al., 2021; Bigliardi and Galati, 2016)

5.3 Implications

The findings from the present study shed a light on the emerging topic of human side of OI, focusing on both positive and negative outcomes of decision-makers' perceptions about OI adoption (Bogers et al., 2017, 2018; West and Bogers, 2014). Data showed that the willingness to adopt OI is highly influenced by decision-makers' cognition, perceived barriers and benefits,

and the interplay of NSH and NIH syndromes (Ahn et al., 2017; Bigliardi and Galati, 2016; van de Vrande et al., 2009). The role of perceptions about the benefits and barriers associated with OI are relevant, showing a tangled decisional process behind OI adoption. Data are also showing that our findings are valid with no differences for all the categories of SMEs in the sample, namely small, medium, high-tech, low-tech, manufacturing, and service.

The present study expands 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 (Bogers et al., 2017). At cognitive and decision-making level, the human side of OI has been identified as an area of investigation, with scarce empirical evidences (Bogers et al., 2017). With the present study, we confirmed and unpacked what some seminal studies already sensed, the key role of cognitive facets in the decision to adopt or not OI (Ahn et al., 2017; Bogers et al., 2018). Having a sample composed of SMEs, where the entrepreneurs, managers or innovators are usually at the pinnacle of decision-making process, allowed us to focus our exploration on their perceptions and feelings about OI in conditions leading to a positive or a negative OI adoption (Ahn et al., 2017).

We noticed that outcome of willingness to adopt OI originates from a series of factors that can be hardly controlled directly by the decision-makers, for example their cognitive styles. However, our findings open some interesting perspective for policymaking and education. In fact, while is not possible to efficiently act on the cognitive characteristics of individuals like their rationality or intuition, it is possible to work on the perception of benefits and barriers, as well as NIH and NSH.

The perceived barriers can be dismantled by appropriate policy intervention aiming to favour OI adoption such as clearer regulations and collaboration grants (Barrett et al., 2021; De Marco et al., 2020; Leckel et al., 2020; Sieg et al., 2019). Policy makers should consider raising the awareness about 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). The same applies for the syndromes, where appropriate R&D grants and policy intervention allow creating a network companies, universities, and other public institutions where the actors are prone to share the generated knowledge (De Marco et al., 2020; Wynarczyk, 2013). Finally, the perceptions of the suitability and the benefits of OI in SMEs could be also enhanced by appropriate educational programmes aimed to raise awareness about the importance of networking while giving the managerial competences to succeed in the implementation of OI within new and existing companies (Barrena-Martínez et al., 2020; Barrett et al., 2021; Sharifi et al., 2014). Appropriate educational programmes are also able to reduce the suspicious attitude toward the externally sourced innovation, therefore reducing the two syndromes explored in the present study (Bissola et al., 2017; Gimenez-Fernandez et al., 2021).

6. Conclusions and Limitations

The results of our analyses sketched a more precise portrait of the decision-maker's cognitive schemata which could drive or impair the adoption of OI in SMEs (Bogers et al., 2017). Our study proposes a complex and multifaceted decision pattern that leads to such adoption. The decision-making process is understood a multi-level approach; a general and a-contextual cognitive style that is always in play regardless the type of decision to be taken, intermixes with context-specific elements such as the perception of benefits and barriers and the syndromes (NIH and NSH) affecting OI.

Our approach paves the way to fully include the managerial cognition (Aleksić et al., 2021; Eggers and Kaplan, 2013) in the research stream related to OI with interesting promising avenues. While we focused on the willingness to adopt OI, future studies should inquire how and whether the cognitive sphere of entrepreneurs and decision-makers may also affect the

success and the implementation of an OI project (Adinolfi, 2021; Ahn et al., 2017). In this aspect also lies one of the limitations of the study; the willingness to adopt a strategy is not always translated into a factual plan (Pappas et al., 2021). Yet, 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 would be integrating these findings with other cognitive evaluations coming from the overall human capital of firm. If on the one hand, entrepreneurs and managers strongly shape the strategy of an SME, on the other hand, also employees and other organizational factors may play a vital role, reducing or reinforcing the likelihood of success of an OI strategy (Bigliardi and Galati, 2016).

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Tables

Table 1 – Items and Loadings

Constructs and Items		**Loadings**	**Mean (SD)**	**Composite Reliability [b]**	**AVE [c]**
Rational Cognition (RC)					
RC1	I double-check my information sources to be sure I have the right facts before making decisions.	0.780	5.970 (0.877)	0.888	0.666
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	0.522
NSH2	I have often sold/revealed own knowledge and technologies to other companies	0.573			
NSH3	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	0.538
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			

Constructs and Items		Loadings	Mean (SD)	Composite Reliability [b]	AVE [c]
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			

a. All Item Loadings > 0.5 indicates Indicator Reliability
b. All Composite reliability > 0.7 indicates Internal Consistency
c. All Average Variance Extracted (AVE) > 0.5 as indicates Convergent Reliability (Fornell and Larcker (1981)

Table 2 – fsQCA statistics and calibration

	Mean	SD	Minimum	Maximum	Calibration (Fuzzy Score) 0.05	0.50	0.95
RC	5.970	0.877	1.000	7.000	4.500	6.000	7.000
IC	4.921	1.065	1.000	7.000	3.000	5.000	6.500
NIH	2.283	0.855	1.000	5.333	1.000	2.333	3.667
NSH	3.663	1.154	1.000	7.000	1.667	3.667	5.667
PBE	5.652	0.758	3.333	7.000	4.444	5.667	6.917
PBA	3.855	1.053	1.000	7.000	2.000	4.000	5.600
WA	4.804	1.187	1.000	7.000	2.400	4.800	7.000

Table 3 – Configurations that lead to positive willingness to adopt OI

	Solutions			
Configurations	1	2	3	4
RC	●	○	○	●
IC	○	●	○	●
NIH	○			○
NSH		○	○	○
PBE	●		●	
PBA		○		
Consistency	0.896651	0.928595	0.908346	0.915014
Unique coverage	0.079730	0.063756	0.058731	0.051905
Raw coverage	0.400977	0.388984	0.388984	0.382774
Overall solution consistency	0.854435			
Overall solution coverage	0.673067			

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

Table 4 – Configurations that lead to negative willingness to adopt OI

	Solutions				
Configuration	1	2	3	4	5
RC	○	○	○	●	●
IC			○	○	●
NIH	●	●	●		
NSH		●		●	
PBE	○				○
PBA		●	●	●	●
Consistency	0.877699	0.930472	0.919196	0.903828	0.939595
Unique coverage	0.079268	0.016633	0.013271	0.049543	0.036675
Raw coverage	0.554071	0.45781	0.437096	0.349309	0.330568
Overall solution consistency	0.84654				
Overall solution coverage	0.732335				

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