

Exploring the relationship between personality traits and innovative behaviour: a mixed-methods approach

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José Manuel De Haro

*Department of Economic and Financial Studies,
Universidad Miguel Hernández de Elche, Elche, Spain, and*

Julio Vena

*Department of Business Organisation, Marketing and Sociology,
Universidad de Jaen, Jaen, Spain*

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Abstract

Purpose – This study aims to investigate the relationship between personality traits and innovative behaviour, using a mixed-methods approach to provide deeper insights into these dynamics.

Design/methodology/approach – The authors used a mixed-methods approach, integrating fuzzy set qualitative comparative analysis (fsQCA) with traditional multiple linear regression analysis. This study was conducted among 76 university graduates, using the Big Five personality model and the Innovator DNA model to assess innovative behaviour.

Findings – The findings reveal significant positive correlations between conscientiousness, extraversion and innovative behaviour. The inclusion of fsQCA allowed for a more nuanced understanding of the complex interactions between personality traits and innovative behaviour, highlighting configurations of traits that traditional methods may overlook.

Research limitations/implications – This study's sample size and focus on university graduates may limit the generalisability of the findings. Future research should explore these relationships in more diverse populations and settings to enhance generalisability.

Practical implications – The insights gained from this study can inform the development of more effective talent management strategies, helping organisations to better align personality traits with roles that demand high innovation. This approach can optimise team composition and improve innovative output.

Social implications – Understanding the configurations of personality traits that lead to innovative behaviour can help educational institutions and organisations foster environments that support diverse and innovative thinking, ultimately contributing to societal progress.

Originality/value – This research contributes to the literature by demonstrating the efficacy of fsQCA in capturing the complexities of human behaviour, particularly in the context of personality traits influencing innovation. By combining qualitative and quantitative analyses, this study provides a comprehensive perspective that enhances both methodological rigour and the depth of understanding in psychological and innovation studies.

Keywords Innovative behaviour, Big five model, Quantitative methods, fsQCA, Mixed-methods research

Paper type Research paper

1. Literature review

1.1 Innovative behaviour

Numerous studies underscore the pivotal role of innovation in organisational success, emphasising its impact on performance, competitiveness and survival (Patterson *et al.*, 2009;

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Carmeli *et al.*, 2006; Palangkaraya *et al.*, 2010). Innovation is increasingly acknowledged as a fundamental driver in the contemporary organisational landscape, crucial for establishing a competitive edge and enhancing performance (Amabile and Pratt, 2016). Research in the domain of innovation has explored various factors, including creativity, exploitation and exploration, innovative behaviour and entrepreneurial skills (Su and Zhang, 2020), highlighting the multifaceted nature of innovation and its diverse determinants and processes (De Jong and Den Hartog, 2010). Research demonstrates that individual innovative behaviour are positively associated with innovation outcomes (De Jong and Den Hartog, 2010), underscoring their significance for organisational performance and survival (Al Wali *et al.*, 2022; Carmeli *et al.*, 2006; De Jong and Den Hartog, 2010).

In this study, we explore the concept of innovative behaviour (IB), a construct with multiple definitions across the literature (Wu *et al.*, 2014). Among the various frameworks that address innovation and innovative behaviour, the model proposed by Dyer *et al.* (2008) is notable for its comprehensive integration of antecedents, the construct of innovative behaviour itself and its consequences. Chosen as the foundation for this research due to its robust validation within organisational studies, this model is derived from an extensive analysis of attributes from managers and leaders from innovatory companies such as Amazon, Google, eBay and Apple. To validate the model, an empirical study was undertaken, administering structured questionnaires to a sample of 72 innovative entrepreneurs (stratified into categories of success and failure) and 310 corporate executives.

The analysis of the results identified four distinct behavioural patterns for information acquisition – questioning, observing, experimenting and networking – that underpin the essential cognitive skill of association in the innovation process. According to the findings, innovative entrepreneurs use a variety of cognitive and behavioural strategies to foster the creation of disruptive ideas. Firstly, they use systematic questioning to challenge established paradigms and elucidate the root causes of existing problems. Secondly, they make methodical observations of the environment, with particular emphasis on the interactions between users and products or services, as a source of inspiration for new solutions. Thirdly, they adopt an experimental approach, iteratively formulating and evaluating hypotheses to explore alternative approaches to identified challenges. Finally, these entrepreneurs develop and cultivate diverse collaborative networks, integrating multidisciplinary perspectives through participation in cross-sector forums and events, thereby facilitating the cross-pollination of ideas and the generation of innovations. Entrepreneurs who adopt these behaviours are more likely to identify and exploit innovative opportunities, thereby distinguishing themselves from executives in large organisations.

In this paper, we will use Dyer *et al.*'s (2008) vision of innovative behaviour as a model to define our criteria. It offers a robust and empirically supported perspective that is distinguished by its focus on the specific behavioural patterns that catalyse the generation of innovative ideas. We believe it is a valuable tool for studying and promoting innovation because of its emphasis on specific behaviours, its strong empirical foundation, its integration with social connectedness and cognitive processes and its practical relevance. Compared to other models, it provides more precise and directly applicable guidance for fostering innovation in organisational contexts, making it a preferred choice for research and practical applications in this field.

1.2 Innovative behaviour predictors

The focus of this work is on examining innovative behaviour from the perspective of antecedents or predictors. In this regard, research on predictors of entrepreneurial and innovative behaviour spans a wide spectrum (Aldahdough *et al.*, 2019). Some studies focus on

cognitive dispositions such as creativity and intelligence (Baron *et al.*, 2007; Liao *et al.*, 2017), whereas others bridge cognitive and personal attributes (Busenitz and Barney, 1997; Othman and Tengku Muda, 2018). Additional research examines competencies, skills (Ahmetoglu *et al.*, 2011) and behaviours, as well as social structures (Renzulli *et al.*, 2000). Other studies look at personal characteristics such as values, beliefs, motives (Hammond *et al.*, 2011; Namono *et al.*, 2022), need for achievement and tolerance for ambiguity (Begley and Boyd, 1987), or personality factors (Kurz *et al.*, 2018; Li *et al.*, 2017), either directly or indirectly (Su and Zhang, 2020; Tho, 2022). In sum, empirical evidence suggests that entrepreneurs' innovative behaviour is driven by a combination of cognitive traits, personality traits and social and behavioural factors.

In this regard, personality has been extensively validated as a predictor of job performance across various roles and levels, demonstrating a consistent relationship with performance outcomes (Barrick *et al.*, 2001. Guo *et al.*, 2023; Ones *et al.*, 2007) or innovative work behaviour (Farrukh *et al.*, 2022). However, the role of personality in predicting entrepreneurial success is more debated (Baron *et al.*, 2007). Among these models, the Five-Factor Model, or the “Big Five”, conceptualised by McCrae and Costa (1987), stands as the leading framework for understanding personality, widely recognised for its predictive utility across various outcomes (Rossberger, 2014). Below is a brief description of each of the factors. *Openness to Experience* measures receptiveness to new ideas. High scorers are curious, creative and imaginative, whereas low scorers prefer familiarity and tradition. *Conscientiousness* assesses organisation and persistence. High scorers are organised, reliable and disciplined, whereas low scorers are spontaneous, flexible and may procrastinate. *Extraversion* measures the tendency to seek social stimulation. Extraverts are sociable, energetic and optimistic, in contrast to introverts who prefer solitude, are reflective and need less external stimulation. *Agreeableness* assesses compassion and cooperation. High scorers are empathetic and trusting, while low scorers are sceptical, competitive and more willing to express disagreements. *Neuroticism* measures the tendency to experience negative emotions. High scorers are prone to anxiety and emotional instability, whereas low scorers are calm, resilient and self-confident.

This study explores the relationship between personality, according to the Big Five model, and innovative behaviour, as defined in the Innovation DNA model. The aim of this paper is to identify the personality factors that best predict innovative behaviour and to examine how the semi-qualitative models known as fuzzy set qualitative comparative analysis (fsQCA) can help to better understand these relationships. The fsQCA provides complementary results to those obtained by classical models, such as linear regression.

1.3 The Big Five model and Innovative behaviour

The model, which divides a person's personality into five main factors, has been related to different behaviours such as entrepreneurship and innovation (Zhao *et al.*, 2010). At this regard, some meta-analytic studies have identified a distinct personality profile that correlates with an individual's propensity to engage in entrepreneurship, characterised by high levels of conscientiousness, openness and extraversion, along with low neuroticism (Zhao *et al.*, 2010). These findings suggest the Big Five personality traits could further elucidate variations in entrepreneurial behaviour beyond mere business ownership or start-up intentions, potentially influencing activities like opportunity recognition, exploitation, innovation and value creation.

Specifically, it has been seen how openness has been positively and significantly linked to individual innovativeness (Ali, 2019; Yesil and Sozbilir, 2013), creativity and creative output (Abdullah *et al.*, 2016; George and Zhou, 2001; Grajzel *et al.*, 2023; Jirásek and Sudzina, 2020; Khaledi, 2014; Patterson and Zibarras, 2017), innovative behaviour (Chen *et al.*, 2010;

Hsieh *et al.*, 2011; Javed *et al.*, 2020; Patterson *et al.*, 2009; Woods *et al.*, 2018), entrepreneurship or business innovation (Anwar *et al.*, 2019; Brandstätter, 2011; Zhao and Seibert, 2006) and creativity in a meta-analytical study (Zare and Flinchbaugh, 2019),

Second, extraversion, has shown a positive and significant relationship with individual innovativeness (Ali, 2019; Grajzel *et al.*, 2023), creativity and creative output (Abdullah *et al.*, 2016; Jirásek and Sudzina, 2020; Khaledi, 2014), innovative behaviour (Chen *et al.*, 2010; Hsieh *et al.*, 2011; Patterson *et al.*, 2009), entrepreneurship or business innovation (Anwar *et al.*, 2019; Brandstätter, 2011; Leutner *et al.*, 2014; Patterson *et al.*, 2009) and creativity in a meta-analytical study (Zare and Flinchbaugh, 2019).

Agreeableness, on the contrary, has shown a positive and significant relationship with individual innovativeness (Ali, 2019), with innovative behaviour or business innovation (Anwar *et al.*, 2019; Chen *et al.*, 2010), and negative with creativity and creative output (Abdullah *et al.*, 2016), innovative behaviour (Patterson *et al.*, 2009) and entrepreneurship (Leutner *et al.*, 2014; Zhao and Seibert, 2006).

With respect to conscientiousness, it has shown a positive and significant relationship with individual innovativeness (Ali, 2019), with creativity and creative production (George and Zhou, 2001), innovative behaviour (Hsieh *et al.*, 2011), entrepreneurial character (Brandstätter, 2011; Zhao and Seibert, 2006) and creativity in a meta-analytical study (Zare and Flinchbaugh, 2019); and negative with creativity and creative production (Abdullah *et al.*, 2016; Grajzel *et al.*, 2023; Jirásek and Sudzina, 2020; Patterson and Zibarras, 2017) and innovative behaviour (Patterson *et al.*, 2009; Woods *et al.*, 2018). Finally, neuroticism, has shown a negative and significant relationship with individual innovativeness (Hsieh *et al.*, 2011), creativity and creative output (Abdullah *et al.*, 2016; Khaledi, 2014) and entrepreneurship or business innovation (Anwar *et al.*, 2019; Zhao and Seibert, 2006). The obtained inconsistent results suggest a curvilinear relationship between low neuroticism and innovative potential (Patterson *et al.*, 2009).

In summary, and from the above data, it can be established that the factors openness, and extraversion show a positive relationship with IB, whereas the relationship between agreeableness, conscientiousness, neuroticism and IB is not clear.

1.4 Traditional quantitative analysis and semi-qualitative fsQCA methodology

Traditionally, works related to psychology and business or studies about personality and behaviour have been treated through traditional methodologies, maintaining this trend to date (e.g. Ahmad *et al.*, 2023; Basco *et al.*, 2022; Colladon *et al.*, 2023; İrengün and Arikboğa, 2015; Leal-Rodríguez and Albort-Morant, 2019). Thus, authors such as Ahmad *et al.* (2023) tried to identify a new model of adoption of CSR green purchasing intention through structural equation modelling (SME). This has been the main methodology used in this field, where others such as Basco *et al.* (2022) have used it in the field of family business. Leal-Rodríguez and Albort-Morant (2019) used this type of methodology to explain innovative experiential learning practices to improve academic performance, whereas others have used logistic regression to explain psychological or entrepreneurial phenomena (Colladon *et al.*, 2023).

What all these methodologies have in common is that they offer a unique solution to some postulates of a match that must be understood as complex. It is precisely for this reason that QCA models emerge, which allow proposing different paths to reach the same result, known as the principle of equifinality (Pappas and Woodside, 2021). These models have the advantage of applying both qualitative and quantitative approaches (Ordanini *et al.*, 2014) with fsQCA being the ones that best-fit reality by offering to model variables between 0 and 1 (Fiss, 2011). However, the main advantage of these models arises when we compare them

with other variance-based methodologies such as those raised above, as they overcome much of their limitations and allow working with large sample sizes (>3,000) but also with a limited number of subjects (<15) (Liu *et al.*, 2017). While these traditional methodologies coexist in a competitive environment as far as the significance of their variables is concerned, QCA models draw on asymmetric relationships to reach different outcomes, i.e. the different variables (conditions in these models) combine to reach an outcome that can be reached through different combinations (Pappas and Woodside, 2021). Finally, in this field, other authors have made different approaches with QCA (e.g. Laouiti *et al.*, 2022)

This study aims to evaluate the impact of incorporating complementary semi-qualitative methods in predicting the relationship between personality and innovative behaviour. The analysis will focus on the correlation between personality traits as defined by the Big 5 model, and innovative behaviour (IB), as conceptualised under the Innovator's DNA model. The goal is to identify which personality traits are the most accurate predictors of innovative behaviour considering two different methodologies. So, we established the following Proposition:

- PO.* The incorporation of semi-qualitative analysis tools, such as the fsQCA methodology, improves the accuracy of predictions made using traditional quantitative analysis methods such as linear regression.

While the comparison of results obtained through different technologies has been explored in previous studies (e.g. Basco *et al.*, 2022), to our knowledge, this is the first study that emphasises this methodology in elucidating the innovative DNA derived from various personality traits. These techniques are particularly effective in studies concerning human behaviour and personality (Pappas and Woodside, 2021). They can assist psychologists and corporations in identifying diverse personality combinations that contribute to an individual's innovative DNA. This understanding can facilitate the creation of diverse work groups with varying personalities that can provide mutual feedback, thereby enhancing overall performance.

2. Method

2.1 Participants

This study was conducted among graduates from various academic disciplines at Miguel Hernández University and the University of Jaen, Spain. A survey was distributed among graduates from two universities using convenience sampling. This university audience is highly relevant for the study of personality behaviour, as demonstrated by previous studies (Lievens *et al.*, 2009; Tho and Trang, 2015; Tho, 2017). University graduates, being at a critical stage of personal and professional development, are ideal for examining the relationship between personality traits and various outcomes.

The survey included 76 graduates, 61% of whom were female and 39% male, with an average age of 24 years. The initial sample comprised 88 subjects. However, 12 participants who declared participation in high-ability programs were excluded from the final study. As for the sample size, it is more than sufficient to ensure full saturation of the model in a QCA methodology. For this purpose, the 2k rule is followed, where k is the number of conditions (Rihoux and Ragin, 2009). Thus, our model has a total of five conditions, yielding 32 possible combinations, which is sufficient in size. Regarding the linear regression, although no hypotheses are established with respect to the results obtained, a contrast power of 95.26% is achieved for a multiple regression with five predictors and a sample of 76 people using the G-Power programme, thus avoiding type 1 and type 2 errors (Bearden *et al.*, 1982). The participants were required to complete a questionnaire on their innovative behaviour,

based on the model proposed by [Dyer et al. \(2008\)](#). The questionnaire also included questions about their personality traits. Personality traits were assessed using the Ten Item Personality Inventory (TIPI; [Romero et al., 2012](#)), a condensed version of the Big Five Personality Inventory. This inventory measures the following dimensions: conscientiousness, extraversion, agreeableness, openness and neuroticism. The scale was introduced as comprising ten items, with each item corresponding to a distinct personality trait. Participants were instructed to evaluate their level of agreement with each statement (e.g. "I view myself as extroverted, enthusiastic") using a seven-point Likert scale. On this scale, a score of 1 signified "strongly agree", whereas a score of 7 denoted "strongly disagree".

2.2 Data analysis

In response to the proposed proposition, an initial traditional linear regression analysis is conducted to identify the personality factors that characterise this innovative DNA in university graduates. Subsequently, a fsQCA is performed, by using the fsQCA software ([Pappas and Woodside, 2021](#)). The purpose of this analysis is two fold:

- (1) firstly, to compare these findings with those derived from a conventional model like the one mentioned above; and
- (2) secondly, to discern the various personality combinations that culminate in an innovative DNA.

The use of mixed methods has been used in similar studies (e.g. [Tho and Trang, 2015](#); [Tho, 2017](#)). This analysis will be executed following the proposal of [Pappas and Woodside \(2021\)](#).

3. Results

As shown in [Table 1](#), all these variables exceed the minimum of 0.6 established by [Nunnally \(1994\)](#) in the Cronbach's alpha statistic. This value suggests moderate reliability and is primarily affected by the low sample size ([Zakariya, 2022](#)). Nevertheless, it is a scale that has been widely validated in the literature, which we have preferred to retain to demonstrate the applicability of mixed methods to this type of work.

As outlined in the preceding section, our initial step was to conduct a linear regression analysis. This approach, in conjunction with structural equation modelling, has been predominantly suggested in comparable studies ([İrengün and Arıkboğa, 2015](#)). For this analysis, the total score on the Innovative DNA was considered as the dependent variable. At the same time, the five analysed personality traits (extraversion, agreeableness, conscientiousness,

Table 1. Reliability analysis of the constructs

Construct	Cronbach's alpha	Source
Innovator DNA	0.83	Dyer et al. (2008)
Extraversion	0.81	y Romero et al. (2012)
Agreeableness,	0.74	
Conscientiousness	0.85	
Neuroticism	0.61	
Openness	0.67	

Source: Authors' own work

neuroticism and openness) were treated as independent variables. The results of this analysis are presented in the subsequent [Table 2](#).

Upon examining this solution, it is evident that both extraversion and conscientiousness independently account for the innovative DNA in a university graduate, whereas the remaining proposed personality factors do not contribute significantly to explaining this innovative DNA. Naturally, this model has its limitations, such as the small sample size obtained. In studies of this nature, it appears challenging to explain behavioural variables through a single pathway, as suggested in this initial methodology. Alternative methods, such as the fsQCA ([Liu et al., 2017](#)), tend to be more effective in studies concerning behaviour and personality. We will present this alternative approach in Section 4.

According to [Pappas and Woodside \(2021\)](#), the data first meets the condition of asymmetry. This means that fsQCA models can identify different sets of conditions leading to the same outcome ([Fiss, 2011](#)). This is possible even when the correlations between these variables and the outcome variable (analogous to a dependent variable in a traditional model) are not high, thus presenting an asymmetric relationship ([Pappas and Woodside, 2021](#)). As shown in [Table 3](#), this condition is satisfied with all correlations being below 0.7 ([Rihoux and Ragin, 2009](#)).

Following the methodology proposed by the same authors, the second step involves verifying the presence of necessary conditions. A necessary condition is one that must be present for the outcome to manifest ([Rihoux and Ragin, 2009](#)). This is determined when the consistency of the condition in relation to the outcome exceeds 0.9 ([Pappas and Woodside, 2021](#)). As indicated in [Table 4](#), in this case, there are no necessary conditions identified for an individual to possess innovative DNA.

Table 2. Summary of the results obtained with the linear regression model

Variable	Beta (SE)	t-Value (p-value)
Constante	14.16 (6.89)	2.05 (0.04)**
Extraversion	1.96 (0.62)	3.15 (0.00)***
Agreeableness	0.11 (0.71)	0.15 (0.88)
Conscientiousness	1.37 (0.55)	2.51 (0.01)**
Neuroticism	0.36 (0.63)	0.57 (0.57)
Openness	0.79 (0.69)	1.14 (0.25)

Notes: ***Significative at 1%; and ** at 5%

Source: Authors' own work

Table 3. Correlations between variables

Variable	ADN	Ext	Afa	Resp	Est	Ap
ADN innovador	1					
Extraversion	0.55	1				
Agreeableness,	0.35	0.49	1			
Conscientiousness	0.41	0.24	0.13	1		
Neuroticism	0.44	0.58	0.51	0.21	1	
Openness	0.45	0.44	0.53	0.35	0.59	1

Source: Authors' own work

Table 4. Need analysis

Condition	Consistency	Coverage
Extraversion	0.78	0.80
Agreeableness	0.72	0.74
Conscientiousness	0.75	0.77
Neuroticism	0.75	0.76
Openness	0.80	0.76

Source: Authors' own work

Finally, a truth table is computed, preserving solutions that achieve a consistency greater than 0.8 (Rihoux and Ragin, 2009). This truth table results in three types of solutions: complex, parsimonious and intermediate. While some authors, like Glaesser (2022), advocate for retaining the complex solution (which excludes logical remainders) over the other two, the more prevalent approach is to use the set of intermediate solutions. This set is then combined with the analysis of the parsimonious solutions (which include logical remainders) to interpret the results obtained (Pappas and Woodside, 2021). This methodology will be adhered to in this study.

Table 5 presents a range of solutions for cultivating an innovative DNA in university graduates, with a focus on “parsimonious” and “intermediate” models that surpass a coverage level of 0.8 (Fiss, 2011). Two personality traits emerge as “core conditions” across all three solutions: extraversion and conscientiousness (Grandori and Furnari, 2008). These core conditions exert a more significant influence on innovative DNA development compared to other factors. Path 1 characterises innovative DNA as emerging in environments devoid of stability. Individuals following this path exhibit extraversion, agreeableness and conscientiousness. This solution demonstrates a moderate coverage (0.22) and high consistency (0.92). Path 2, the most prevalent, encompasses these same core traits in conjunction with openness, suggesting that neuroticism plays a minimal role. This path boasts the highest coverage (0.52) and consistency (0.95). Path 3, while exhibiting lower coverage (0.18), maintains high consistency (0.95). Individuals following this path display extraversion, conscientiousness and neuroticism, but lack agreeableness and openness. Collectively, these solutions yield a comprehensive coverage of 0.57 and a remarkable

Table 5. Truth table summary

Main dimensions and value	Solution 1	Solution 2	Solution 3
Extraversion	●	●	●
Agreeableness	•	•	X
Conscientiousness	●	●	●
Neuroticism	X		•
Openness		•	X
Raw coverage	0.22	0.52	0.18
Unique coverage	0.11	0.28	0.04
Consistency	0.92	0.96	0.95
Solution coverage	0.57		
Solution consistency	0.94		

Source: Authors' own work

consistency of 0.94, underscoring the multifaceted nature of factors that contribute to the development of innovative DNA in university graduates.

4. Discussion

This study analysed the relationship between personality and innovative behaviour using quantitative methods (regression). The results partially support that extraversion and conscientiousness positively predict innovative behaviour. However, openness, agreeableness and neuroticism do not find a sufficient level of significance. These findings align with previous research (Chen *et al.*, 2010; Hsieh *et al.*, 2011; Patterson *et al.*, 2009).

One potential explanation for the association between extraversion and innovative behaviour lies in its facilitation of networking, a critical element of the proposed DNA of innovation model. Individuals with higher extraversion tend to engage in more interactions and form stronger social networks, leading to enhanced access to diverse information and perspectives, increased opportunities for collaboration and improved resources mobilisation. Conscientiousness may contribute to innovative behaviour by enabling individuals to overcome challenges and persistently pursue goals. This personality trait manifests in various ways, including increased effort, enhanced organisation and goal-oriented behaviour.

The quantitative analyses revealed that while extraversion and conscientiousness significantly predict innovative behaviour, other personality traits like openness, agreeableness and neuroticism did not demonstrate a meaningful relationship with the dependent variable. Our findings regarding openness diverge from previous research, such as Chen *et al.* (2010), which reported a positive association with innovative behaviour. This discrepancy necessitates further investigation to reconcile these contrasting results and refine our understanding of the complexities involved. It is also important to consider the differentiation within innovative behaviour in exploration and exploitation activities. Authors such as Park and Kim (2021) have highlighted differences in the influence of personality factors depending on the phase. Individuals with high levels of openness to experience tend to engage more in exploration activities, while those with high levels of conscientiousness are more involved in exploitation activities. This aspect is crucial to consider when interpreting the overall results.

With respect to agreeableness the lack of a significant relationship with innovative behaviour necessitates re-evaluating its role in the model. Conflicting evidence from other studies requires further exploration. Finally, with the neuroticism factor, the predicted negative relationship with innovation, supported by prior research, was not observed in our data. This necessitates excluding this factor as a predictor in the current model.

Nevertheless, semi-qualitative analysis using fsQCA methodology presents a contrasting picture, suggesting the inclusion of previously discarded personality factors (openness, agreeableness and neuroticism) in predicting innovative behaviour. Specifically, Table 5 demonstrates several “solutions” where these factors contribute to innovation in specific combinations:

- *Solution 2 (highest coverage and consistency)*: Openness and agreeableness join extraversion and conscientiousness in predicting innovation, regardless of neuroticism.
- *Solution 1 (second-best)*: High neuroticism does not impede innovation if combined with extraversion, agreeableness and conscientiousness.

These semi-qualitative solutions offer more nuanced predictions compared to those solely derived from quantitative analyses (e.g. linear regression). They support our proposition: incorporating fsQCA improves prediction accuracy compared to traditional quantitative methods. This is due to the principle of equifinality, which is the basis of this methodology

and by which different solutions to complex problems are established (Pappas and Woodside, 2021), which seems much more appropriate when dealing with something as difficult to explain as the relationship between personality factors and innovative behaviour. In summary, the results show that while traditional models assume a single combination of personality factors best predicts innovative behaviour, alternative methodologies reveal multiple sets of personality factors that equally lead to innovative behaviour. This enriches the findings from this type of research.

5. Conclusions

The incorporation of semi-qualitative analysis offers three principal benefits in psychological research.

Firstly, it enhances real-world reflection by recognising that psychological relationships often exhibit complexities beyond simple linear dependencies. By considering “intermediate levels” and various factor combinations, fsQCA captures nuanced interactions that might be missed in purely quantitative analyses. This leads to more accurate predictions and prevents dismissing individuals based solely on specific scores (e.g. high neuroticism) without considering the combined influence of other traits. This approach can reduce false negatives in selection processes.

Secondly, the methodology expands the realm of predictive analytics by illustrating that innovative behaviour does not conform to a single, uniform pattern but emerges from a variety of personality trait combinations. This revelation, afforded by fsQCA, enhances our understanding and forecasting of innovation, recognising its complex and multifaceted nature. By acknowledging the diverse pathways to innovative behaviour, this approach significantly widens the scope for analysis and solution generation, providing a more nuanced understanding of how personality traits interplay to foster innovation.

Thirdly, the integration of semi-qualitative analysis, exemplified by fsQCA, alongside quantitative methods enhance research by providing a more comprehensive understanding of studied phenomena. This complementary approach enriches the explanatory capacity of quantitative results, adding depth and insight. FsQCA does not replace but rather enriches quantitative analysis, offering a broader perspective on the intricate dynamics underpinning innovative behaviour and its relation to personality traits.

The *implications* of the findings of this study are key to improving human talent management in organisations. They indicate that the assignment of staff to roles, projects, or missions should consider the diversity of personality profiles to maximise their contribution to innovation. This nuanced approach could optimise human resource management by leveraging how different personality traits foster innovation in various organisational contexts.

This study supports the use of more sophisticated methods to *select personnel* for roles demanding high innovation by considering combinations of personality traits rather than isolated traits. For example, an individual with high openness to new experiences but low meticulousness might excel in generating ideas but face challenges in execution. In contrast, someone with high extraversion and low neuroticism might be ideal for leading innovative projects. This multidimensional approach allows individual skills to be precisely aligned with the requirements of innovative roles, potentially improving productivity and job satisfaction.

The findings also highlight the importance of designing *talent development programmes* that promote innovation by combining personality traits. Specialised training should adopt a holistic approach to cultivating innovative skills. For example, while linear regression analysis did not show a link between openness to experience and innovation, fsQCA analysis

did when combined with other traits. This suggests the need for a multidimensional evaluation of personality. Programmes should enhance traits like openness and conscientiousness or low neuroticism and conscientiousness through integrated interventions such as creativity workshops, stress management, change management and team-building activities. Incorporating collaborative projects that apply these traits in real situations is also recommended to reinforce innovative skills in organisational settings.

In addition, the study suggests that *team management implications* are as significant as individual development, advocating for the creation of multidisciplinary innovation teams that deliberately integrate individuals with diverse personality profiles. This approach leverages complementary strengths, optimising performance. For example, combining individuals with high openness to experience for idea generation and those with high conscientiousness for implementation enhances project outcomes. Diverse teams boost the innovation process and help develop a robust innovation ecosystem. This strategy also promotes mutual learning, interdisciplinary collaboration and a dynamic organisational culture.

Finally, this study highlights the importance of *organisational aspects* in fostering innovation. Promoting a culture of experimentation and tolerance for failure can enhance traits like extraversion and low neuroticism in leaders, increasing innovative behaviour. Providing resources and time for experimentation and examining how organisational culture influences personality traits and innovation is crucial. Promoting values of cooperation and shared responsibility can amplify the effects of training programmes. In summary, a holistic approach aligning organisational culture with individual and team development is essential for optimising innovation.

The study's limitations include its sample size and characteristics, which may restrict the generalisability of the findings. Our study focused on students and recent graduates, which may limit variability in work experiences and organisational contexts. However, this educational homogeneity controlled for confounding variables, enabling a more accurate analysis of personality traits on innovative behaviour. This group, at a critical stage of professional development with high plasticity and innovative potential, is particularly relevant for our research. Future studies should explore these relationships in more diverse populations to enhance generalisability.

In addition, the reliance on self-report measures could potentially overstate the relationships between variables. Despite these constraints, the research reaffirms the significant impact of personality traits on innovation processes, underscoring the nuanced interplay between individual differences and innovative capabilities.

We recognise that the implementation of personality traits within organisational contexts may interact in complex ways with pre-existing organisational cultures, which may limit the generalisability of our findings. We have also investigated the unintended consequences of selecting and promoting individuals based solely on certain traits to drive innovation. One such consequence is the potential reduction of diversity in the workplace, which could weaken collective creativity. To mitigate these risks, it is crucial to implement specific strategies. These strategies include offering trainings that encourage a variety of innovative behaviours and implementing more holistic evaluation systems. In addition, it is critical to consider the ethical implications of applying this knowledge. It is essential to adopt an ethical and equitable approach that promotes diversity and respects individual rights, avoiding any type of discrimination based on personality traits.

However, while researchers have accumulated experience across various interventional study types, there remains a need for further refinement in methodologies, particularly in integrating qualitative data into specific interventional study designs (Fetters and Molina-Azorin, 2020).

To this end, it is important to identify opportunities for improvement in *future research*. Some of these are proposed below:

Firstly, future studies should use larger and more diverse samples to better understand how personality influences innovative behaviour. The current sample's limitations suggest the need for broader research to improve generalisation. Exploring personality traits' influence across different organisational contexts, such as multinational corporations versus start-ups, and various industries would validate findings, identify contextual moderators and enhance the theoretical framework on innovation. This would provide practical insights for talent management and organisational interventions. Comparative research could reveal sector-specific patterns, crucial for adapting innovation strategies effectively. Validating findings across broader populations would help develop a comprehensive behavioural model, enhancing predictive power in organisational and educational settings.

Secondly, this study highlights the need for more research on the complex interactions between personality traits and innovative behaviour. Future research should explore combinations of traits not extensively analysed, such as the interaction between agreeableness and conscientiousness in high-pressure contexts. This could provide insights into how these traits interact in environments demanding high innovation and adaptability. Such research would enhance theoretical understanding and have practical implications for talent management and designing organisational interventions to foster innovation.

Thirdly, considering the role of contextual and situational factors in innovative behaviours, (Anderson *et al.*, 2014), two future research lines are proposed. First, examine how situational traits like adaptability and resilience interact with traditional personality traits to influence innovation, providing a nuanced understanding of stable characteristics and adaptive responses. Second, explore the moderating role of organisational culture in the relationship between personality traits and innovative behaviour. This could reveal how cultural elements enhance or inhibit innovation-related traits. Studies like those by Al Wali *et al.* (2020, 2021) provide a foundation for such research. These lines would expand our understanding of innovative behaviour and offer insights for designing organisational cultures that maximise innovation. Results could inform effective talent management and development strategies, aligning individual traits with contextual and cultural factors.

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Corresponding author

José Manuel De Haro can be contacted at: jharo@umh.es