

The impact of CEO's personality traits (Big 5) and Human Resources Management Practices on the Innovation Performance in SMEs

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Personality traits have an impact on the decision making process of CEOs and are predictors of the success of innovation in SMEs. The primary objective of this study was to explore whether a relationship exists between combinations of personality traits and innovation performance in SMEs. Furthermore, the study investigated the impact of personality traits and HRM practices in combination on the firm's innovation performance. The five-factor model of personality (Extraversion, Conscientiousness, Openness to experience, Agreeableness and Emotional Stability) was the central focus of this study. For this purpose, the sample of 35 CEOs operating in the Twente Region in the Netherlands have been surveyed and analyzed with the help of the fuzzy set qualitative comparative analysis. The findings of this study demonstrate that CEOs with high level of *Extraversion* and *Agreeableness* will have a significant impact on the innovation performance in SMEs. Furthermore, the findings highlight that HRM practices and CEOs personality traits jointly affect the firm's innovation performance and should be regarded as complements rather than substitutes.

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Keywords

Big 5 personality traits, upper echelon theory, innovation management, HRM practices, CEO, SMEs

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1. INTRODUCTION

Nowadays, innovation in small and medium sized enterprises (SMEs) is increasingly gathering strength in the business world in order to be able to compete effectively. Innovation is defined as “*the process of turning opportunities into new ideas and of putting these into widely used practice*” (Tidd & Bessant, 2009:15). In line with this, two features will play important roles in boosting the innovation performances in SMEs in the long-term. The first one is the Chief Executive Officer (CEO). Various studies stress the importance of a CEO who has a crucial part, especially in SMEs (Lefebvre, 1992; Lefebvre, 1997; Westerberg et al. 1997; Thong, 1999). Since SMEs have highly centralized structures, the CEO is the one who makes critical decisions (Thong, 1999). Furthermore, a CEO is owner who has personal contact to key managers and is ultimately responsible for the strategic decision making of the firm (Thong & Yap, 1995; Finkelstein & Hambrick, 1996). Decisions made by the CEO affect the innovation performance in organizations, in a positive as well as in negative ways. This is the reason why firms are relying on CEO's knowledge and skills for influencing the innovation performance in a positive way. Thus, lack of technical skills and knowledge might restrict the adoption of new innovation (Thong, 1999).

The second feature is Human Resources Management (HRM). HRM practices are a topic in the fields of HRM which has a significant impact on the firm's innovation performance. According to Delery and Doty (1996), HRM practices are composed of the implementation of policies and practices to ensure that a firm's human capital leads to the achievement of its business objectives. HRM practices differ from firm to firm and from country to another. This is why CEO's are expected to select those practices that enhance the firm's competitive advantage (Jiménez-Jiménez & Sanz-Valle, 2008). Additionally, the authors assume that innovation *resides in its employee's competences and motivation* (Jiménez-Jiménez & Sanz-Valle, 2008:1208). In order to develop innovation and to succeed, it is vital that the CEO develop HRM practices aiming at motivating and retaining employees who ensure the effective functioning of the firm (Tan & Nasurdin, 2011).

Notably, the Chief Executive Officer (CEO) and HRM practices are seen as two vital features for influencing the innovation performance. But how a CEO is making critical decisions in terms of innovation strategies is depending on his or her personality traits. Personality traits are characteristics originating from within an individual to give a person their individuality (Haslam, 2007; Burger, 2010). According to various psychologists, the “Big Five Model” is the best representation of trait structure as it allows describing various traits in terms of five basic dimensions: *Agreeableness*, *Conscientiousness*, *Emotional Stability*, *Openness* and finally *Extraversion* (McCrae, 1990; Lefebvre, 1992; Saucier, 1994; Judge et al., 1999). The available literature investigated the relationship between big five personality traits and innovation performance. Nevertheless, to my knowledge, the existing literature has not yet investigated the impact of combinations of various personality traits on the innovation performance in SMEs. For instance, Smith et al. (2001) found that a weak relationship existed between CEOs' personality traits and the firm's performance because traits do not work in isolation. In similar fashion, Lefebvre (1992) asserts that a CEO plays different roles during the innovation process. Consequently, combinations of various traits are needed in order to foster the firm's innovation performance. Furthermore, the existing

literature has not yet investigated the impact of CEO's personality traits combined with HRM practices which can jointly affect the firm's innovation performance in a positive way.

The aim of this study is to explore how combinations of CEO's personality traits affect the innovation performance of Dutch SMEs. Furthermore, the study investigates whether personality traits and HRM practices in combination lead to a positive impact on the firm's innovation performance and thus should be regarded as complements. In contrast, HRM practices and the “Big 5” can be regarded as substitutes if CEO's personality traits and HRM practices are not depending on each other. In this way, both conditions will not have a joint effect on the innovation performance. The research question is as follows:

How is the innovation performance in SMEs affected by diverse combinations of CEO's personality traits (Big five) and how do HRM practices contribute?

The paper is structured as follows. Section 1 provides an overview of the proposed research topic. Section 2 covers a literature review based on the main variables of this study followed by a representation of the hypotheses that will be tested. Section 3 deals with the research design. Section 4 describes the method used in this study followed by section 5 which presents the results and the interpretations of the execution of the analytical method. Finally, the paper is completed by a discussion consisting of a contribution, limitation and future research part.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 The importance of the CEO and HRM practices to innovation in SMEs

There have been various studies on the role of the chief executive officer (CEO) on firm performance. Especially in small-medium sized (SMEs) companies, the role of the CEO is seen as crucial as he/she is a strategic decision maker that gathers, processes information, develops strategy and directs implementation throughout the firm (Lefebvre, 1992; Lefebvre, 1997; Thong, 1999; Wincent & Westerberg, 2005; Arendt et al., 2005). Various authors agree that the CEO plays a crucial role on a firm's innovation performance (Miller & Toulouse, 1986; Lefebvre, 1992; Thong & Yap, 1995; Lefebvre, 1997). The CEO is an entrepreneurial figure who is crucial in determining the innovative attitude of a small business (Thong & Yap, 1995) and can be seen as “*important and powerful sponsor of the adoption of innovation*” (Kimberly et al., 1981:672). Likewise, the CEO in SMEs plays the role of a champion whose presence is “*a prerequisite for any innovation to be adapted*” (Lefebvre, 1992:20). Innovation, a necessary component of business conduct and strategy to maintain competitiveness, is a critical investment decision made by the CEO at the firm level. It can be classified into four dimensions, in particular product and process innovation and incremental and radical innovation (Poutsma et al., 1987). Process innovations introduce new methods or production system and aim at improving the production process. Product innovations develop, disseminate and produce new capital goods or services. Incremental innovations represent minor improvements or simple changes in current technology and thus require low degree of

knowledge whereas radical innovations represent revolutionary change and depend on extensive and in-depth knowledge (Dewar & Dutton, 1986). In line with this, diverse innovation types are depending on knowledge and skills in order to develop innovation. For instance, Thong (1999) argues that lack of technical skills might restrict the adoption of new innovation in SMEs. KSA (knowledge, skills, and abilities) are important sources for developing new innovations leading to competitive advantage through the implication of unique and valuable knowledge (Lopez-Cabral et al., 2009). With regard to product and process innovation, value and uniqueness of knowledge are both required. On the one hand, uniqueness of knowledge creates differentiation through “*content specificity of knowledge and its difficulty in being transferred to other organizations*” (Lopez et al., 2009:488). On the other hand, value of knowledge is the exploitation of opportunities to improve the efficiency and effectiveness of a firm (Lepak & Snell, 2002).

In order to develop innovation and to stay competitive, not only CEO's individual knowledge which is rare, socially complex and therefore inimitable is crucial (Burton, 2001; Hitt et al., 2001), but also HRM practices, such as training and learning are vital drivers for innovation (Hsieh et al., 2011). A distinction can be made between collaborative HRM practices and knowledge HRM practices. On the one hand, collaborative HRM practices put emphasis on team orientation, training activities, team-based appraisal and compensation while on the other hand knowledge-based HRM practices focus on the selection of best people in terms of their capabilities (Lopez-Cabral et al., 2009). Laursen (2002) and Laursen and Foss (2003) claim that HRM practices have a positive impact on innovation performance for the following reasons: first, HRM practices lead to decentralization. In this way, the utilization and discovery of local knowledge is allowed. Second, teams brought together are able to share knowledge and skills that existed separately prior to the introduction of teams resulting in process as well as product improvements. Third, rewarding employees for minor process improvement will increase incremental innovation. Finally, job-rotation allows engineers to understand technological problems faced by colleagues.

2.2 The Big-Five Model

Since the CEO is the principal decision maker and ultimately responsible for the strategic decision making of the firm, his or hers personality traits have a significant impact on strategic decisions made and on the adoption of particular HRM practices in order to develop innovation (Lefebvre, 1992). The upper echelon theory points out that executives' personalities and experiences have an influence on choices made by them (Hambrick, 1984). In regard with the upper echelon theory, this paper will focus on the big five personality traits theory, also called the “Big five”, in order to explore the effect of personality traits on innovation performance. Personality traits can be defined as constructs that explain why people react to the same situation in a different way (Farrington, 2012). The focus on the “Big 5-Model” is interesting for the following reasons. First, the big five model allows to explore multiple personality traits that can be differentiated into five dimensions (Extraversion; Agreeableness; Openness; Conscientiousness and Emotional Stability). Second, the five personality factors are reliable for differentiating personality traits (Saucier, 1994; McCrae & Costa, 1997). Third, the dimensionality of the big 5 model can be generalized across all cultures (Saucier, 1994). Even though the project is focusing on CEOs operating in the Netherlands, it can be

assumed that not all CEOs are from Dutch origin. In addition, CEOs who experienced working in different cultures might adopt specific cultural traits. This is why the use of the big five model is suitable which will be discussed subsequently.

Extraversion

Extraversion includes characteristics such as sociability, talkativeness, assertiveness and dominance. High level of extraversion indicates that an individual is outgoing and optimistic (McCrae & Costa, 1997; Judge et al., 1999; Barrick et al., 2003). Individuals low in extraversion tend to spend time alone and are independent and quiet while individuals high in extraversion tend to be active, introduce discussions and stimulate social interactions (Foulkrod et al., 2009).

Agreeableness

Agreeableness is the degree to which someone shows personal warmth, cooperation and trust. Highly agreeable individuals are easy to get on with as they represent the tendency to be kind, cooperative, modest, attentive to others as well as flexible, forgiving and courteous (McCrae & Costa, 1992; Barrick et al., 2003; Bono & Judge, 2000).

Conscientiousness

Conscientiousness is the degree to which someone shows dependability, responsibility, achievement orientation and perseverance. Individuals high in conscientiousness are hardworking and self-disciplined (Barrick et al., 2001) and have a tendency to reduce uncertainty and receive specific feedback on performance (Judge et al., 2002).

Emotional Stability

Emotional Stability is the tendency to be anxious, defensive or compulsive. Individuals high in emotional stability remain calm when faced with difficulties (McCrae & Costa, 1997; Foulkrod et al., 2009). The reverse of emotional stability is called neuroticism. Neurotic individuals are worried, anxious and emotionally unstable (Foulkrod et al., 2009).

Openness

Openness to experience refers to the degree to which someone is open to new experience, creative, thoughtful and curious. Individuals high in openness reveal tolerance for ambiguity and seek out risks and excitement while individuals who reveal a low level in openness prefer the familiar in order to avoid risk (McCrae, 1990; Judge et al., 2002).

2.3 Hypotheses Development

2.3.1 Hypotheses development in regard to the Big 5 dimensions

Since personality traits influence decisions made by CEOs (Lefebvre, 1992) and the CEO has a key role in innovation of SMEs (Miller & Toulouse, 1986; Lefebvre, 1992; Lefebvre, 1997; Thong & Yap, 1999), it is arguable that personality traits lead to different decisions influencing the firm's innovation performance in a positive way. Lefebvre (1992) is claiming that the CEO plays different roles during the innovation process. This is why combinations of traits, skills and attitudes are required. Thus, the first hypothesis can be formulated as follows:

H1: Combinations of CEO's personality traits will have a positive impact on the innovation performance in SMEs.

Various researchers assert that CEOs in SMEs are seen as risk takers and connect innovation to risk-seeing persons (Lefebvre, 1992; Lefebvre, 1997; Miron et al., 2004; Lin et al., 2009). According to Miron, Erez and Nayeh (2004), risk taking is an important characteristic of a culture of innovations. Furthermore, creativity is associated with innovation and is a “precursor for innovation” (Miron et al., 2004:177). In other words, creativity is needed in order to generate new ideas leading to shift in perspective of existing practices. As stated in the previous section, individuals high in openness reveal tolerance for ambiguity, seek out risks and are creative (McCrae, 1990; Judge et al., 2002). In regard to this, Miller and Toulouse (1982) found out that aggressive, confident and active CEOs will undertake risky and innovative strategies. A CEO who is confident will frequently introduce new products and invent production technologies because they are convinced of their abilities. In respect to these statements, openness to new experience and extraversion are vital personality traits of CEOs that affect the firm's innovation performance. Nevertheless, it is pointed out that the impact of the CEO on innovation occurs through the support of the team (Yadav et al., 2007). Although, the CEO is the ultimate decision maker, teams are brought together in order to share knowledge resulting in process and product innovation (Laursen, 2002). Thus, it can be assumed that the CEO needs to be attentive to others, cooperative, stimulate social interactions and introduce discussions with team members. Thereupon, agreeableness and extraversion are necessary traits that influence decisions made aiming at fostering the firm's innovation performance.

In regard to the above stated statements, the following hypotheses are formulated:

H1a: CEOs with high level of extraversion and openness to new experience affect the firm's innovation performance.

H1b: CEOs with high level of extraversion and agreeableness affect the firm's innovation performance.

A combination of these traits will not be investigated as I assume that a highly aggressive CEO who tends to undertake risky strategies and who is confident about his/hers own capabilities to introduce new products and services will unlikely trust team members or be attentive to others as it can be expected that CEOs will likely assert their own ideas to develop innovation.

To my knowledge, the existing literature provides little information on emotional stability and its reversed term neuroticism. Nevertheless, Judge et al. (1999) predicate that neurotic individuals experience diverse problems due to emotional instability (or neuroticism), such as negative mood, anxiety and depression. A high level of emotional stability indicates that a CEO is able to remain calm when faced with difficulties McCrae & Costa, 1997; Foulkrod et al., 2009). This is important, especially when a CEO is undertaking risky strategies or is dealing with ambiguity. Thus, the following hypothesis can be formulated:

H1c: CEOs with high level of openness and emotional stability affect the firm's innovation performance.

Finally, Hsieh et al. (2011) found out that the traits agreeableness, conscientiousness and extraversion have an impact on innovation. The more obvious, the more excellent the innovation performance. In line with this, openness will be included in order to explore whether this trait, which is seen important for innovation, will have a positive impact on the innovation performance in SMEs.

H1d: CEOs with high level of agreeableness, consciousness, extraversion and openness to new experience affect the firm's innovation performance.

2.3.2 Hypotheses development in regard to HRM practices

In order to develop innovation and to stay competitive, not only personality traits are vital but HRM practices as well. HRM practices, such as training and learning are vital drivers for innovation and have a positive impact on innovation performance (Laursen, 2002; Laursen & Foss, 2003; Jiménez-Jiménez & Sanz-Valle, 2008; Hsieh et al., 2011). Jiménez-Jiménez and Sanz-Valle (2008) claim that the utilization of teams is essential in order to enhance the innovation performance as innovation is too complex to be developed and achieved by a single individual. In addition, knowledge and skills are vital aspects of HRM practices that contribute to the development of (new) innovations leading to sustainable competitive advantage (Lopez-Cabrazalez et al., 2009). For instance, creative people dealing with novel and ambiguous problems display a valuable and irreplaceable knowledge / skills which lead to competitive advantage as they are acquiring unique and rare knowledge that is difficult to imitate by competitors (Mumford, 2000). As I expect HRM practices and personality traits to have both a positive impact on the innovation performance, it can be assumed that the CEO's personality traits combinations and the adoption of particular HRM practices will jointly lead to a positive innovation performance in SMEs.

H2: CEO personality traits and HRM practices will jointly influence the firm's innovation performance.

The first combination refers to openness to new experience, extraversion and collaborative HRM practices. As already mentioned, creativity is key for innovation to be developed successfully. It depends on knowledge sharing of teams who are relying on internal as well as external knowledge, for example through networks (Nadkarni & Herrman, 2010). It can be assumed that an extravert CEO who is open to new experience and simultaneously who put emphasis on training activities that focus on team building and the participation in cross-functional teams and networks will likely foster the creativity of teams for developing innovation and share ideas with its team which positively affect the innovation performance. Therefore, the following hypothesis will be investigated:

H2a: CEOs with high level of openness and extraversion together with the use of collaborative HRM practices will influence the firm's innovation performance.

The second combination refers to openness to new experience, extraversion and knowledge-based HRM practices. The reason for this combination is due to the fact that innovation is associated with creativity which is depending on knowledge and skills in order to build firm-specific knowledge that is inimitable and which consequently leads to sustainable competitive advantage (Lopez-Cabrazalez et al., 2009). In

addition, CEOs who are creative, confident, active and aggressive are prerequisite in order to foster the creativity and frequently launch new products or services to the market. Thus, a CEO who reveals a low level in both traits will face difficulties in developing innovation.

The question that rises is whether knowledge-based HRM practices which put emphasis on developing firm-specific knowledge/skills, selection of the best all-around candidate and mentoring activities striving for the development of firm-specific knowledge and therefore competitive advantage (Lepak & Snell, 2002; Lopez-Cabrales et al., 2009; Nadkarni & Herrman, 2010) are able to compensate a CEO with a low level of openness to new experience and extraversion.

H2b: CEOs with low level of openness and extraversion but high level of knowledge HRM practices will influence the firm's innovation performance.

Finally, it is alleged that CEOs with high level of consciousness are achievement-oriented, hardworking and independent (Barrick et al., 2001). Nadkarni and Herrman (2010) are claiming that CEOs who are achievement-oriented and independent tend to take control and responsibilities for strategic activities and will likely monitor and closely control employees. In that way, closely controlled decision-making will restrict employees to share information freely, to be creative and autonomous because CEOs can be regarded as dominant individuals who are confident of their own capabilities to develop and foster innovation. However, innovation depends on creativity, autonomy and imagination of people (Farrington, 2012). Additionally, HRM practices are relying on team activities and internal/external information sharing. In line with this, a CEO with a high level of consciousness and extraversion might compensate a low level of collaborative HRM practices to impact the innovation performance in a positive way. Thereupon, the following hypothesis will be investigated:

H2c: CEOs with high level of consciousness, extraversion and a low level of collaborative HRM practices will influence the firm's innovation performance.

3. METHODOLOGY

In order to test the proposed hypotheses of this study a questionnaire has been conducted and executed with 197 CEOs in the Netherlands. The questionnaire contains questions adopted by various CEOs in regard to previous studies about CEOs' personalities (Saucier, 1994), HRM practices (Lepak & Snell, 2002; Lopez-Cabrales et al., 2009) and preferred innovation activities (He & Wong, 2004). Moreover, general questions, for example about the age, education or industry types have been asked. The successive subsections cover a detailed description of the sample, measurements and the method used for this study.

3.1 Sample Characteristics

This study relies on a small sample consisting of 35 firms, all operating in the Twente Region. Table 1 summarizes the main characteristics of the sample. Looking at the table, it is notable that the majority of the interviewees are employed in the metal products industry followed by the electronics industry. Furthermore, 44,1% of the sample is engaging in the deployment of capacity, knowledge and skills to manufacture products to order and thus favor exploitative activities followed by 38,2% that is engaging in the development,

manufacturing and sales of own products whereas only 2,9% engage in the development, manufacturing and sales of components as supplier. In sum, the table indicates the preference of exploitative activities by CEOs.

Table 1: Main characteristics of the sample

Industry		Firm Activity*	
Industry – plastics and rubber products	2,9%	Development, manufacturing and sales of own products	38,2%
Industry – metal products (no machines)	37,1%	Development, manufacturing and sales of own components as supplier	2,9%
Industry – electronics, electronic components and wire	2,9%	Deployment of capacity, knowledge and skills to manufacture products to order	44,1%
Industry – machines and appliances	25,7%	Development, deployment ad sales of expertise and services	14,7%
Others	31,4%		
Total	100%		100%

Notes*: The first two firm activities are related to explorative activities whereas the last two are related to exploitative activities.

3.2 Measurements

For the purpose of this study, three measurements are used, namely personality traits, HRM practices and innovation activities.

3.2.1 Personality traits (Big 5 Model)

The measurement of the personality traits refer to the previous study of Saucier who determined 40 items that can be measured for this study by using a five point Likert Scale. In order to validate which particular traits belongs to which basic group of the five dimensions (agreeableness, openness, consciousness, extraversion, emotional stability) the reliability of each dimension has been tested by computing Cronbachs Alpha (0.74 for Openness; 0.70 for Agreeableness; 0.71 for Conscientiousness; 0.71 for Extraversion and 0.73 for Emotional Stability). Since a value of 0.70 and above is recommended for Cronbachs Alpha, the values are satisfactory (Nunnally, 1978). Table 2 summarizes all traits according to the respective dimensions. The traits used for the purpose of this study are in bold.

Table 2: The Big 5 Dimensions and the respective traits

OPENNESS	EXTRAVERSION	EMOTIONAL STABILITY	AGREEABLENESS	CONSCIOUSNESS
Creative	Extroverted	Temperamental	Warm	Efficient
Artistic	Talkative	Unenvious	Sympathetic	Organized
Intellectual	Energetic	Relaxed	Cooperative	Systematic
Imaginative	Bold	Moody	Kind	Practical
Unintellectual	Withdrawn	Touchy	Cold	Disorganized
Philosophical	Quiet	Fretful	Rude	Inefficient
Uncreative	Shy	Jealous	Unsympathetic	Sloppy
Deep	Bashful	Envious	Harsh	Careless

3.2.2 Innovation Performance

The innovation performance is measured in connection with two innovation activities, in particular exploitative and

explorative activities. Following He and Wong (2004), exploitation and exploration are conceptualized as two separate dimensions of innovation since an organization will face difficulties and complications by adopting both activities simultaneously. Both activities are measured on a five point Likert Scale ranging from “very important” to “very unimportant”. Furthermore, features of each activity have been used from the study of the authors He and Wong (2004) with 4 items indicating a firm’s preference for exploration and 4 items indicating a firm’s preference for exploitation. In order to determine the values for exploration and exploitation, a descriptive analysis has been executed with exceptionally attention paid to the mean values of each activity. The descriptive analysis results in a value of 3.55 for exploitation and 3.52 for exploration which are both satisfactory to regard a firm as innovative. To check for reliability Cronbachs Alpha has been computed which is also satisfactory (0.78 for exploration and 0.84 for exploitation).

3.2.3 HRM practices

HRM practices are measured on a seven point Likert Scale in regard to previous study of Lepak & Snell (2002) and Lopez-Cabral et al. (2009). A distinction can be made between knowledge HRM practices which contain 12 items and collaborative HRM practices containing 9 items. Cronbachs Alpha was computed in order to check for reliability resulting in a value of 0.86 for HRMK and 0.79 For HRMC which are both satisfactory.

4. DATA ANALYSIS

The analytical method used for this study is the fuzzy set qualitative comparative analysis (fs/QCA). This approach is an analytical, set-theoretic technique that uses Boolean Algebra in order to analyze combinations of attributes (Fiss 2007, 2011; Ragin, 2008). The method consists of four steps which will be discussed in-depth below. The reason for the particular use of this technique is that it allows the explicit conceptualization of cases as combinations of attributes which in turn give cases their unique nature (Fiss, 2007). In order to explore whether the combinations of specific traits are affecting a firm’s innovation activity, the fs/QCA is helpful to answer the sub-question of how combinations of CEOs’ personality traits jointly affect the innovation activity. In addition, with the help of fs/QCA different paths can be identified that lead to the same outcome which distinguish it from classical linear regression analysis (Fiss, 2007). Finally, Berg-Schlosser et al. (2009) claim that the fs/QCA method can deal with small sample sizes (10 to 50). Since the current sample size for this project is 35, the fs/QCA method is appropriate.

Step 1: Calibrating fuzzy sets

The analysis starts with a transformation of the conditions (variables) values into a range from 0 to 1. A value of 0 indicates that the condition falls into the category of “full non-membership” whereas a value of 1 means that the condition falls into the category “full membership”. An intermediate value of 0.80 indicates the category of “mostly but not fully membership” and a value of 0.40 could mean “more or less out of full-membership” (Ragin, 2008). In order to transform the values, an initial crucial step is important. This step requires the researcher to determine threshold values for full membership (fuzzy score = 1), for full non-membership (fuzzy score = 0) and for the crossover point (fuzzy score = 0.5). For this purpose, I used percentiles as thresholds, namely the 75th percentile as threshold for full membership, the 25th

percentile for full non-membership and finally the 50th percentile as threshold for the crossover point. Table 3 presents the descriptive of the conditions which lists the mean value, standard deviation and the percentiles. The transformation of the interval scales into fuzzy set conditions has been executed by making use of a “calibration” procedure in the fs/QCA 2.0 Software. The calibrated dataset for all 35 cases are listed in Appendix 1.

Table 3: Descriptives of the conditions

Variable	Mean	SD	Percentiles		
			25%	50%	75%
Openness (OPN)	3.49	0.93	2.7	3.52	4.12
Extraversion (EXT)	3.87	0.91	3.2	3.6	4.4
Emotional Stability (EMO)	3.6	0.86	3	3.5	4.2
Agreeableness (AGR)	4.2	0.77	3.4	4.1	4.7
Consciousness (CONS)	3.9	0.97	3.1	3.8	4.5
HRM1 (HRMC)	4.9	1.26	4.15	5.05	5.8
HRM2 (HRMK)	4.72	1.24	3.9	4.85	5.6
Exploration (EXLPOR)	3.52	1.19	2.6	3.6	4.2
Exploitation (EXPLOI)	3.55	1.17	2.7	3.65	4.3

Notes: The conditions used in fs/QCA are mentioned between brackets ().

Step 2: Analysis of necessary causal conditions

The next step covers an analysis of necessary causal conditions followed by an analysis of sufficient causal conditions which will be discussed in the following step. In order that the outcome (Y) occurs, it is necessary that the causal condition (X) is (almost always) present (Ragin, 2008). In other words, the outcome is a subset of the cause ($X \geq Y$). For the assessment of necessity conditions, the following formula has been used:

$$\text{Consistency } (Y_i \leq X_i) = \sum [\min (X_i, Y_i) / \sum (Y_i)];$$

with Y_i as the value of the i-th outcome Y, X_i as the value of the i-th condition X and min as the selection of the lower of both values (Ragin, 2008).

Consistency indicates whether an empirical connection is significant or not (Ragin, 2008). The analysis is executed with the help of the fs/QCA software for the outcome of “high” exploration (EXPLOR)¹ and “low” exploration (explor) as well as “high” exploitation (EXPLOI), the inversed outcome of “low” exploitation (exploit) and the conditions in relation to the Big five: openness (OPN and opn), extraversion (EXT and ext), emotional stability (EMO and emo), agreeableness (AGR and agr) and consciousness (CONS and cons). In order to assess the consistency value, a threshold needs to be determined. For this purpose, a threshold of 0.80 is used (Fiss, 2011). The results of the analysis are reported in Appendix 2. In order to illustrate the results of necessary conditions for the respected outcomes, the use of the graphical X-Y-plot can be applied. The X-axis represents the causal condition while the

¹ Uppercase letters denote to conditions that represents values near 1 whereas lowercase letters, for example “opn” denote to conditions representing values near to 0 (Schneider & Wagemann, 2006).

Y-axis represents the outcome. Cases below the diagonal line in Figure 1 indicate a high membership values in the condition and represents the necessary causal condition (Ragin, 2008). In contrast, cases above the diagonal line signifies a high membership values in the outcome and represents the sufficient causal condition (Ragin, 2008). As it can be seen from the Figure, the majority of cases lie below the diagonal line which confirms the allegation of necessity of condition.

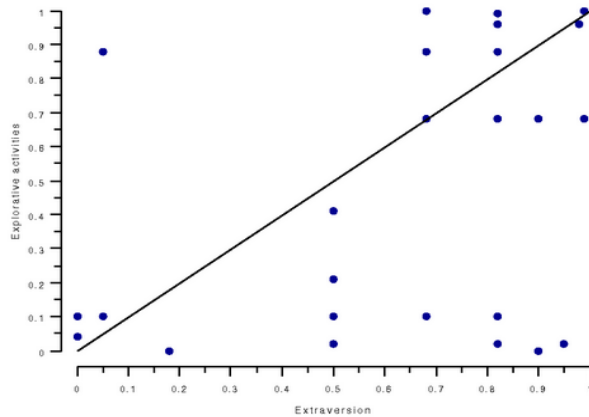


Figure 1. Extraversion as Necessary Condition for Exploration

Step 3: Analysis of sufficient causal conditions (Truth table creation and analysis)

Having analyzed the necessary conditions is a crucial step for the analysis of sufficient causal conditions and consequently the main analysis of truth tables (Schneider & Wagemann, 2006). The analysis of sufficient causal conditions starts with the construction of the truth table consisting of all possible combinations of causal conditions with an increase of 2^k combinations where k means the number of causal conditions. For each combination, four possible solutions exists (Byrne & Ragin, 2009):

1. All the cases characterized by that combination are instances of the outcome.
2. All the cases characterized by that combination are not instances of the outcome.
3. Some cases characterized by that combination are instances of the outcome while others are not.
4. Some combinations have no cases, called “remainders” and are excluded as it is not possible to say whether the outcome happened or not.

In this study, there are 7 conditions in total (including HRM practices) which lead to 128 combinations (2^7), whereby not all combinations are expected to have cases and are called “logical remainders”. There are various methods² to deal with logical remainder. In this study, logical remainders are treated as the outcome is 0 in order to take only the observed cases

² The first method to deal with “logical remainders” is to treat the outcome as 0 and to consider only the observed cases (complex solution). The second method is the determination of the best outcome through the fs/QCA software which leads to oversimplifying solutions (parsimonious solution). The third method is the determination of the outcome value by the researcher according to theory and is called intermediate solution (Schneider & Wagemann, 2006).

into account. The threshold is set at 0.70 which is the minimum consistency value that should be used (Ragin, 2008). The reason for the use of this threshold derives from the fact that the sample size for this study is rather small ($n=35$). Next to the consistency value, the coverage value is also of importance. Coverage indicates the “*empirical relevance or importance of a set-theoretic connection*” (Ragin, 2008:45). The higher the coverage, the more cases are covered by the combination of conditions. In order to test the proposed hypotheses, the truth table is used in order to derive to the intermediate solution. Thus, own combinations are created by selecting the conditions of interest which are analyzed by the use of the fs/QCA software. The explicit use of the intermediation solution is due to the fact that it allows the researcher to determine whether the conditions need to be “high” or “low”. In this way, it is possible to specifically test the hypotheses of this study. The results will be explained in the next section.

5. RESULTS

5.1 Results in relation to the impact of combinations of CEOs personality traits on the innovation performance

This section covers the results obtained from the execution of the fs/QCA analysis in regard to the proposed hypotheses. Starting with the first hypothesis (H1a), it is assumed that CEOs who have a high level of openness and extraversion will influence the firm’s innovation activities in a positive way as it is argued that CEOs undertake risky and innovative strategies if they are creative, confident and active (Miller & Toulouse, 1982; McCrae, 1990; Judge et al., 2002). The results of the analysis demonstrate:

$$EXT*opn \leq EXPLOR \text{ (Consistency: 0.71; Coverage: 0.41)}$$

$$EXT*opn \leq EXPLOI \text{ (Consistency: 0.80; Coverage: 0.44)}$$

This indicates that the proposed combination is influencing the firm’s innovation performance for both innovation activities exploration and exploitation. Nevertheless, a low level of openness is required. An explanation for this can be derived from Lefebvre who claims that notwithstanding CEOs are seen as risk-takers in SMEs, in reality they will tend to reduce risk and uncertainty in order to protect the firm’s long-term survival (Lefebvre, 1997). Individuals with a low level of openness prefer the familiar in order to reduce risks which can be confirmed for the innovation activity exploitation in terms of a high consistency value of 0.80.

The next hypothesis (H1b) tested refers to the combination of extraversion and agreeableness. It is assumed that CEOs need to be attentive to others, cooperative, stimulate social interactions and introduce discussions with team members with whom they work with (Foulkrod et al., 2009). The results of the analysis show:

$$AGR*EXT \leq EXPLOR \text{ (Consistency: 0.73; Coverage: 0.68)}$$

$$AGR*EXT \leq EXPLOI \text{ (Consistency: 0.67; Coverage: 0.60)}$$

Although the solution shows that agreeableness and extraversion influence both innovation activities, the hypothesis is specifically apply to the innovation activity exploration as the consistency value signifies. The analysis of this combination results in a consistency value of 0.73 for exploration which is above the threshold (0.70) and 0.67 for

exploitation which is below the proposed threshold. This is reasonable since it is found that confident CEOs frequently introduce new products and thus favor product innovation because they are convinced of their abilities (Miller & Toulouse, 1982). In regard to this, exploration is preferred as it involves the creation of innovative technologies and new markets for which cooperation and idea sharing is prerequisite (Nonaka, 1994).

Continuing with the next hypothesis (H1c), it is assumed that openness and emotional stability are necessary because a high level of emotional stability indicates that a CEO is able to remain calm when faced with difficulties and risks. The results of H1c highlight:

$EM*opn +^3 em*OPN \leq EXPLOR$ (Consistency: 0.63; Coverage: 0.65)

$opn*em \leq EXPLOI$ (Consistency: 0.66; Coverage: 0.57)

The consistency values are below the threshold (0.63 for exploration and 0.66 for exploitation). Yet, the existing literature does not provide a lot of information on emotional stability and its reversed traits neuroticism. It can be assumed that the ability to remain calm in course of uncertainties is a challenge that needs professional background as it is the CEO's responsibility to protect the firm's survival (Lefebvre, 1997; Lin et al., 2009). In other words, if CEOs have already faced uncertainties before, they will likely remain calm while confronted with ambiguity or uncertainty as they already have experiences in handling with a difficult situation of this type.

As already mentioned, Hsieh et al. (2011) found out that agreeableness, conscientiousness and extraversion have an impact on innovation. The more obvious, the more excellent the innovation performance. The following hypothesis (H1d) refers to the previous statement with a consideration of openness as forth traits in order to explore whether the inclusion of openness influences the innovation activities or not. The results shows that a high level of openness next to a high level of conscientiousness, agreeableness and extraversion lead to a lower consistency value which is below the threshold (0.66 for exploration and 0.68 for exploitation). Previous studies point out that hardworking individuals want to receive quick feedback and are likely to centralize decision making which can limit the ability of undertaking complex innovation projects (Miller & Toulouse, 1986; Papadakis & Bourantas, 1998). Consequently, they will favor incremental innovation for which only simple changes are needed and will rather make use of exploitative activities. The exclusion of openness to new experience results in a high level of conscientiousness, extraversion and agreeableness. Hence, the suggested statement of the authors is holding true but for the outcome of exploration due to the fact that CEOs who are active and confident frequently introduce new products and thus favor product innovation for which explorative activities are essential (Miller & Toulouse, 1982). Additionally, hardworking and self-disciplined CEOs are positively affecting the development of innovation. Consequently, if the CEO reveals all three traits, creativity and risk-taking (openness to new experience) is not prerequisite in order to create innovation.

In sum, the presumption that combinations of a CEO's personality traits will have a positive impact on the innovation

performance in SMEs as the CEO plays different roles during the innovation process (Lefebvre, 1992) can be hold true especially for explorative activities. In addition, the analysis demonstrates that openness to new experience has a negative impact on the innovation activities which is surprisingly as explorative activities are depending on the creation of new technologies for which creative individuals are needed.

5.2 Results in relation to the impact of combinations of CEOs personality traits and HRM practices on the innovation performance

The first hypothesis in regard to the big five traits and HRM practices refers to openness to new experience, extraversion and collaborative HRM practices. As already mentioned creativity is key for innovation and depends on knowledge sharing of teams who are relying on internal as well as external knowledge (Nadkarni & Herrman, 2010). Therefore, a CEO needs to be creative, thoughtful, talkative and needs to foster training activities aiming at enhancing the information exchange between team members. In regard to this, the results of hypothesis H2a show the follows:

$HRMC*EXT*opn \leq EXPLOR$ (Consistency: 0.72; Coverage: 0.74)

$HRMC*opn*ext \leq EXPLOI$ (Consistency: 0.71; Coverage: 0.70)

The intermediate solution for exploration indicates that a high level of extraversion and collaborative HRM practices but a low level of openness will lead to the expected outcome. A high level of extraversion and collaborative HRM practices indicate that extravert CEOs are likely to stimulate discussion and are sociable which is recommended for team building and the participation in cross-functional teams and networks. A low level of openness indicates that individual creativity solely is not sufficient, but rather it serves as a source of team creativity (Woodman et al., 1993). This is why a low level of openness is needed in order that team members are able to demonstrate and share their own ideas with the CEO rather to focus only on the CEO's creativity as variety of ideas is needed in the development of innovation. In addition, Nadkarni and Herrman (2010) point out that creativity depends on knowledge sharing of teams who are relying on networks. In contrast to exploration, it is notable that a low level of openness and extraversion but a high level of collaborative HRM practices will impact the firm's exploitative activities in SMEs. One explanation could be that exploitative activities are not depending on external networks as they put emphasis on the incremental change of existing innovations in regard to the current environment but rather on internalizing knowledge bases (Nonaka, 1994). In addition, incremental changes are not depending on a high level of creativity. Finally, the solution indicates that collaborative HRM practices can compensate a CEO who reveals a low level of openness to new experience and extraversion in regard to exploitative activities. In other words, teams that are brought together and who share ideas and who are creative and active are able to enhance the innovation performance if the CEO is not highly creative and active.

The next hypothesis (H2b) refers to openness to new experience, extraversion and knowledge-based HRM practices. I assume that knowledge-based HRM practices which put emphasis on developing firm-specific

³ The sign "+“ represents the Boolean function “OR“

knowledge/skills, selection of the best all-around candidates and mentoring activities are able to compensate a CEO with a low level of openness to new experience and extraversion. The results signify that the hypothesis hold true if a CEO reveal a high level of extraversion. Since it is the CEO's responsibility to select the most capable people, it is necessary that he or she is able to stimulate social interactions in order to become acquainted with the members he/she is going to select and work with. This is especially important if the CEO selects newcomers. In order to explore their talents, it is therefore necessary that the CEO is talkative, outgoing and introduce discussions. In line with this, the results highlight the importance of both conditions which are needed in order to influence the innovation performance.

$HRMK*EXT*opn \leq EXPLOR$ (Consistency: 0.73; Coverage: 0.63)

$HRMK*EXT*opn \leq EXPLOI$ (Consistency: 0.72; Coverage: 0.32)

The last hypothesis (H2c) is exploring the combination of a high level of consciousness and extraversion but a low level of collaborative HRM practices. The results demonstrate that for both innovation activities, the hypothesis is holding true. This is due to the fact that CEOs who are dominant, confident of their capabilities and independent are closely monitoring employees and therefore restrict employees to share information freely and to be creative (Nadkarni & Herrman, 2010). Although, innovation depends on creativity, autonomy and imagination of people (Farrington, 2012) the results highlight that it is possible that a highly conscious and extravert CEO is able to compensate collaborative HRM practices.

$hrmc*EXT*CONS \leq EXPLOR$ (Consistency: 0.77; Coverage: 0.44)

$hrmc*EXT*CONS \leq EXPLOI$ (Consistency: 0.71; Coverage: 0.37)

In sum, the combinations of CEO traits and HRM practices that are expected to influence the firm's innovation activities are found to be both of importance in relation to the firm's innovation performance. HRM practices and CEO's personality traits can be regarded as complements. The results have showed it is possible that HRM practices compensate CEO's personality traits and vice versa in order to foster innovation and consequently the innovation performance in SMEs.

6. DISCUSSION

6.1 Contribution

The primary objective of this study was to investigate the relationship between CEOs' personality traits and innovation performance in means of innovation activities by integrating insights from the upper echelon theory which suggests that executives' personalities and experiences have an influence on choices made by them (Hambrick, 1984). In similar fashion, the CEO plays different roles during the innovation process so that combinations of traits, skills and attitudes are required (Lefebvre, 1992). In contrast to existing literature, this paper is contributing to the innovation management literature by focusing on combinations of personality traits (Big five) that jointly have an impact on the innovation performance in SMEs rather than focusing on the five personality traits

dimension separately. The results show that extraversion and agreeableness play a vital role for the innovation performance in SMEs. In order to develop innovation, a highly extravert and active CEO is required in order to stimulate social interactions. As the development of innovation occurs through the support of the team, it is important that the CEO shows personal warmth and trust to its team. Hence, the results support the assumption that combinations are needed because they do not work in isolation (Smith et al., 2001). Furthermore, the results show that a high level of openness to new experience does not affect the innovation performance in SMEs as expected. There are several reasons why a low level of openness to new experience is sufficient. First, openness to new experience is associated with creativity and risk for which budget, expertise and resources are needed. However, it is claimed that SMEs lack of resources and expertise so that CEOs are less willing to take risk (Lee et al., 2010). Second, SMEs are characterized by a small number of people operating in the organization which might lead to homogeneity of knowledge. Even though, the CEO is the ultimate decision maker, creativity and knowledge sharing is occurring when teams interact with each other, share and discuss ideas. Therefore, homogeneity of knowledge can restrict the firm's ability to frequently introduce new products. Third, SMEs lack of formal communication systems which are necessary for the diffusion of new knowledge among teams (Vinten, 1999).

The second contribution is the approach of the research gap in the innovation management literature in regard to Human Resources Management practices. It is pointed out that HRM practices are important for idea generation and that unique and firm-specific knowledge is needed in order to maintain competitive advantage (Lepak & Snell, 2002; Bledow et al., 2009; Lopez et al., 2009). The results point out that the relationship between HRM practices and the Big 5 is a crucial one as they are able to compensate each other. For instance, the results show that a CEO who reveals a low level of openness to new experience and extraversion can affect the innovation performance if the collaborative HRM practices are high. And a highly conscious CEO can compensate a low level of collaborative HRM practices. Therefore, both HRM practices and the CEO personality traits are jointly foster the innovation performance in SMEs and should be regarded as complements.

6.2 Limitations and future research

This paper has several limitations that need to be considered. The first limitation is regard to the sample size of the study. Only 35 CEOs are taken into consideration due to the limited time period. Although the statistical method used in this study, namely the fuzzy set/qualitative comparative analysis, allows the investigation of a small sample size, a larger sample is recommended for future research in order to obtain more accurate findings.

The second limitation is based on the generalization of findings that need to be treated carefully. The interviewees were all operating in the Twente Region in the Netherlands that cannot be generalized to the entire small-medium enterprises. In order to increase the precision of the relationship between CEOs' characteristics and the innovation performance as well as the adoption of HRM practices, a variety of CEOs is appropriate to make the sample more representative. That is why future research should obtain databases from which samples of SMEs throughout the Netherlands can be drawn.

Continuing with the third limitation, the study is limited to five personality dimensions. On the one hand, the “Big Five Model” is seen as the best representation of trait structure as it allows describing various traits in terms of five basic dimensions (McCrae, 1990; Lefebvre, 1992; Saucier, 1994; Judge et al., 1999). On the other hand, it is claimed whether these five broad dimensions are enough to incorporate all relevant information needed in order to explore a firm’s performance (Bergner et al., 2010). Factors, such as education, professional background or age might influence decisions taken by CEOs in regard to innovation strategies and thus to the firm’s innovation performance. Furthermore, the traits used for the purpose of this study are narrowed into a small size of traits for each dimension in order to increase the reliability which might lead to a better or worse outcome. Accordingly, future research should investigate whether other traits are more suitable for predicting a firm’s innovation performance.

Finally, the use of the fs/QCA method should also be considered and treated with care. The advantage of this analytical method is that it allows the investigation of a small sample size and the analysis combinations of attribute (Fiss, 2007, 2011; Ragin, 2008). Nevertheless, the results obtained from the analysis are dependent very much on the assumptions and decisions made by the researcher while producing the analysis. In line with this, future research should explore whether another transformation of conditions (variables) values or the selection of particular threshold should be utilized.

6.3 Conclusion

To conclude, the study gives evidence of the fact that CEOs personality traits are influencing the development of innovation. Especially, combinations of the Big 5 traits are needed as traits do not work in isolation. Furthermore, the findings highlight that HRM practices and CEOs personality traits jointly affect the firm’s innovation performance and should be regarded as complements rather than substitutes.

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APPENDIX 1: Calibrated Data Set

Case Number	OPN	EXT	EM	AGR	CONS	HRMC	HRMK	EXPLOR	EXPLOI
1	0.23	0	0.89	0.39	0.55	0.08	0.04	0.04	0.17
2	0.1	0.99	0.78	0.92	0.98	0.73	0.06	1	0.99
3	0.6	0.82	0.95	0.59	0.27	0.27	0.35	0.02	0
4	0.93	0.98	0.89	0.95	0.94	0.95	0.48	0.96	0.35
5	0.6	0.82	0.89	0.88	0.4	0.73	0.93	0.96	0.17
6	0.96	0.82	0.78	0.59	0.7	0.04	0.42	0.1	0.01
7	0.44	0.82	0.01	0.39	0.7	0.57	0.04	0.88	0.94
8	0.93	0.9	0.89	0.88	0.89	0.86	0.42	0	0
9	0.04	0.82	0.89	0.76	0.56	0.79	0.48	0.68	0.98
10	0.93	0.9	0.35	0.39	0.7	0.46	0.13	0.68	0.99
11	0.73	0.5	0.14	0.04	0.17	0.2	0.72	0.1	0.83
12	0.23	0.68	0.61	0.82	0.27	0.03	0.25	1	0.98
13	0.73	0.82	0.78	0.39	0.94	0.2	0.06	0.88	0.35
14	0.93	0.05	0.78	0.39	0.39	0.65	0.83	0.1	0.83
15	0.73	0.18	0.35	0.59	0.02	0.98	0.48	0	0
16	0.6	0.5	0.61	0.07	0.17	0.03	0.86	0.02	0
17	0.93	0.05	0.99	0.02	0.1	0.03	0.06	0.1	0.35
18	0.98	0.82	0.98	0.59	0.96	0.94	0.72	0.99	0.61
19	0.23	0.5	0.61	0.88	0.5	0.69	0.56	0.41	0.17
20	0.44	0.5	0.05	0.59	0.83	0.36	0.65	0.41	0.61
21	0.73	0.82	0.61	0.39	0.86	0	0.3	0.1	0.61
22	0	0.50	0.78	0.59	0.39	0.02	0	0.88	0.83
23	0.6	0.68	0.35	0.14	0.39	0.24	0.01	0.68	0.83
24	0.93	0.99	0.14	0.99	0.7	0.9	0.2	0.68	0.98
25	0.73	0.68	0.23	0.59	0.7	0.46	0.65	0.1	0.17
26	0.23	0.95	0.35	0.59	0.93	0.98	0.2	0.02	0.61
27	0.23	0.99	0.61	0.99	0.98	0.99	0.97	0.68	0.83
28	0.58	0.5	0.35	0.22	0.56	0.46	0.98	0.41	0.35
29	0.93	0.82	0.78	0.39	0.06	0.94	0.65	0.99	0.35
30	0.93	0.99	0.01	0.97	0.99	0.94	0.83	0.68	0.83
31	0.05	0	0.61	0.95	0.3	0.69	0.35	0.1	0.61
32	0.96	0.68	0.14	0.97	0.07	0	0.35	0.68	0.17
33	0.96	0.68	0.98	0.99	0.99	0.94	0.99	0.88	0.98
34	0.98	0.82	0.01	0.39	0.39	0.99	0.87	0.88	0.01
35	0.58	0.5	0.05	0.24	0.3	0.69	0.78	0.21	0.83

APPENDIX 2: Consistency values for necessary causal conditions

Causal condition	EXPLOR	explor	EXPLOI	exploI
OPN	0.71	0.65	0.71	0.80
Opn	0.47	0.53	0.47	0.41
EXT	0.87	0.75	0.63	0.71
ext	0.34	0.41	0.57	0.47
EMO	0.65	0.61	0.63	0.70
Emo	0.53	0.59	0.55	0.52
AGR	0.75	0.72	0.59	0.68
Agr	0.41	0.50	0.58	0.56
CONS	0.74	0.70	0.60	0.59
Cons	0.48	0.47	0.61	0.59
HRMC	0.71	0.65	0.55	0.59
Hrmc	0.48	0.51	0.63	0.58
HRMK	0.55	0.55	0.58	0.61
Hrmk	0.63	0.66	0.60	0.61

Note: Values in bold indicate necessary conditions with a consistency threshold of 0.80 or above.