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# How Innovative and Ambidextrous are Individuals by using their Personal Characteristics?

*An Explanatory Study within High-Tech SMEs.*

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*1030681 – Master Thesis Business Administration: Innovation & Entrepreneurship*

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*An Explanatory Study within High-Tech SMEs.*

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### **Abstract**

Scholars are heavily focusing on investigating organizational ambidexterity as the driver for high performing firms. However, surprisingly little research is conducted towards individual ambidexterity and its role within small- and medium-sized firms. Where extant literature leaves gaps on how non-managerial employees attain ambidexterity and how this is related to innovative performance, this study investigates the interrelatedness between one's personal characteristics (self-efficacy and cognitive flexibility), ambidextrous behavior and innovative performance within high-tech SMEs. Quantitative research amongst 100 Dutch-based non-managerial employees is analyzed via a multiple regression analysis with a mediation effect to explain the interrelatedness between the factors at the individual level, which is explanatory in nature. The results showed that the non-managerial employees' personal characteristics do not predict ambidextrous behavior but are significantly related to innovative performance. Moreover, ambidexterity at the individual level is actively contributing to an increased level of innovative performance, for which the expected mediation effect from individual ambidexterity between one's personal characteristics and innovative performance does not play a role. Hence, employees who can balance explorative and exploitative activities during their daily job and employees who are innately self-efficient and cognitive flexible are performing better regarding innovations than colleagues or competitors. Moreover, one's educational background positively predicts the innovative performance level; therefore, it is concluded that higher levels of innovative performance require a specific high-educated background, whereas it is harder to learn innovations through experience. With this new knowledge, managers within High-Tech SMEs must learn about their employees and employ the self-efficient, cognitive flexible and ambidextrous employees on the functions that require innovative outcomes to achieve higher levels of performance within the SME.

**Keywords: High-Tech SME – Personal Characteristics – Individual Ambidexterity – Innovative Performance.**

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# 1. Introduction

*“Anything’s possible if you’ve got enough nerve.” – J.K. Rowling (Success, 2019).*

As JK Rowling mentioned regarding innovations, every innovation is possible, but you have to put effort in it, especially for small- and medium enterprises (SMEs) where unforeseen difficulties are more present than elsewhere (Chang & Hughes, 2012). Organizations need to innovate to stay competitive to achieve high levels of innovative performance, but innovating is not easy. Organizations operate in dynamic environments and are confronted with environmental changes that impact business performance. Therefore, organizations need a deterministic structure to adapt to these changes (Abatecola, 2014). To overcome low innovative performance, businesses should innovate and exploit two types of innovation: exploration and exploitation, which is called ambidexterity (Dougherty, 2008; Fauchart & Keilbach, 2009; Ford & Ford, 1994). Exploration focuses on developing new businesses, products, or services (e.g., discovery, flexibility, innovation) and is critical for long-term performance. On the other hand, exploitation focuses on developing existing activities (e.g., refinement, efficiency, implementation) and is critical for staying competitive within the current business (Mu et al. 2020; March 1991). Many scholars investigated structural ambidexterity to achieve organizational ambidexterity, meaning the structural partition between departments focusing on radical or incremental innovations (Birkinshaw & Gibson, 2004). Regarding SMEs, structural ambidexterity has its limitations due to resource scarcities, flat hierarchies, and limited employees (Chang & Hughes, 2012). According to Birkinshaw & Gibson (2004), the definition of contextual ambidexterity is more of use for SMEs due to be less sensitive to structural limitations. Contextual ambidexterity focuses on the individual employee, where the individual makes choices between exploitative- and explorative activities in a certain context or situation and therefore uses resources at hand for both purposes. Individual ambidexterity

means the individual who works autonomous and flexible regarding radical or incremental projects to achieve optimal performance within an SME (Schnellbacher et al., 2019). Understanding non-managerial employees is important, since individual level ambidexterity is considered the starting point and driver for organizational- and team level ambidexterity. Therefore, individuals are one of the drivers for innovative performance as well. One's ability to explore and exploit decides whether an employee is performing well regarding one's innovative performance (Birkinshaw & Gupta, 2013; Bledow et al., 2009). Moreover, managerial- or team level ambidexterity is widely investigated, but the knowledge regarding the ambidextrous behavior of non-managerial employees is scarce.

Recent scholars clarified on several antecedents for understanding individual ambidexterity namely, handling work stress, trust building (Zhang, Wei & Van Horne, 2019), discipline, stretch, and supportive leadership (Schnellbacher, Heidenreich & Wald, 2019). Handling work stress, trust building, and discipline are not investigated as antecedents for individual ambidexterity yet. These antecedents are related to ones' self-efficacy and cognitive flexibility, called personal characteristics. Self-efficacy explains how well an individual is disciplined to job related activities. Cognitive flexibility describes how good an individual can deal with tensions and cognitive overload, which is often present when dealing with two conflicting demands (e.g. exploration and exploitation) (Bledow & Frese, 2009; Chen et al., 2001; Good & Michel, 2013). These personal characteristics can explain how individuals achieve ambidexterity when structural ambidexterity is not exploitable since there is no capacity to divide teams between isolated activities. However, to our knowledge there is no research conducted towards the relationship between both personal characteristics, individual ambidexterity and individual innovative performance.

This study investigates how the personal characteristics (self-efficacy and cognitive flexibility) of non-managerial employees affect individual ambidexterity which further affects

innovative performance at the individual level within high-tech SMEs. Like Fu et al. (2019), who investigates ambidexterity, and new venture growth in the hospitality and tourism sector, we follow the same structure for research. Next to this, we take personal characteristics and a mediation effect into account. To explain the above-mentioned relationship, we put the following research question central:

*What is the influence of personal characteristics (self-efficacy and cognitive flexibility) of non-managerial employees on attaining individual ambidexterity, and individual innovative performance within high-tech SMEs?*

The aforementioned research gaps will be closed by answering the research question and providing knowledge regarding the antecedents of individual ambidexterity. This research contributes to literature by investigating and explaining an unexplored relationship: the effect of the personal characteristics of the non-managerial employee on innovative performance by utilizing individual ambidexterity. The interrelatedness of these variables provides new insights for understanding how individuals achieve high levels of innovative performance in SMEs while working individually without making use of several organizational resources. Practically, this research supports managerial' decision making and knowledge by providing new information for understanding how personal characteristics aids non-managerial employees to behave ambidextrous, thereby handle conflicting demands and achieve innovative performance, which ultimately stimulates organizational performance.

This study focuses on the high-tech industry as the contextual environment. The high-tech industry is characterized as a turbulent and incredibly competitive environment and is familiar with frequent market disruptions; therefore, this industry is almost obliged to be ambidextrous (Gliga & Evers, 2010, p. 106; Sarkees & Hulland, 2009). High-tech firms need



to improve current activities for efficiency and refinement and explore new capabilities for innovation (Sarkees & Hulland, 2009). Empirical evidence found that ambidexterity is highly positively related to high tech-firm' performance (Wang & Rafiq, 2014). Moreover, advanced innovative firms need resources to be successful, namely remarkable technological research capabilities, creative development, financing mechanisms, competitive human resources, entrepreneurial quality, and marketing capabilities with high flexibility and adaptability (Mowery & Rosenberg 1979; Kakati 2003; Berry 1996). These resources are severe for high-tech SMEs.

The remainder of this research is structured as follows: first, we analyze the central phenomenon's thoroughly, employing literature review and build hypotheses regarding the expected relationships. Second, we introduce the method of analysis. Afterwards, the sampling and data collection method will be elaborated. Fourth, we perform the data analysis and describe the data according to the hypothesized structure. Fifth, a conclusion and discussion will be derived from the results following from the analysis. Lastly, we provide the limitations of the study and suggest future research.

## 2. Literature review

*Literature, lots of reading, definitions, and theories. In this chapter the most important literature and theories are elaborated to clarify the constructs for the reader and to build up the hypotheses for testing the expected relationships.*

### 2.1 Individual ambidexterity

Ambidexterity cannot be considered as a homogenous construct. Ambidexterity refers to the ability to use both hands equally and in the field of management it refers to exploration and exploitation of ideas, competences and capabilities simultaneously (Benner & Tushman, 2003). Ambidexterity is mostly investigated at the organizational level (Junni et al., 2013). However, there are significant differences for which organizational ambidexterity cannot be interpreted at the individual level. Therefore there needs to be an understanding of how individuals behave ambidextrous (Birkinshaw & Gupta, 2013; Bledow, Frese, Anderson, Erez, & Farr, 2009).

According to Mom et al. (2009), individual ambidexterity is the combination of individual exploration and exploitation. Later on Mom et al. (2015) explained individual ambidexterity according to a human resource practice approach. Mom et al. (2015) states that human resource practices, such as high-performance work systems, can stimulate the individual to behave ambidextrous. Human resource practices support learning and improve job skills of the individual. Individuals that work ambidextrous increase their action repertoire, whereas exploration increases the variability of their action repertoire and exploitation increases the efficiency regarding their action repertoire (Gupta et al., 2006). Moreover, Rogan and Mors (2014) state that limited resources need to be allocated and therefore separated regarding exploration and exploitation but also acknowledge that cross-fertilization of ideas are coming from integrating exploration and exploitation. Mom, Van den Bosch, and Volberda (2007) investigated individual managers and their ambidextrous behavior. They described the

explorative behavior of managers as “*searching for, discovering, creating, and experimenting with new opportunities*” and exploitative behavior as “*selecting, implementing, improving and refining existing certainties*” (Mom, Van Den Bosch, & Volberda, 2007, p. 910). In this study the definition of individual ambidexterity for non-managerial employees (later in this study mentioned as individual ambidexterity) follows the same fundamentals. Exploration for the non-managerial employees focuses on making use of new knowledge, looking for different ways to provide solutions, and using different routines to achieve a higher level of innovative performance at the individual level. In the contrary, exploitation for non-managerial employees focuses on improving routines, learning from previous errors, transforming experience into new solutions, putting knowledge into action, and refine daily job activities (Rosing & Zacher, 2016).

Individual ambidexterity is important for SMEs, since SMEs are limited regarding their financial-, managerial-, and human capital and lack in bureaucracy, planning, and procedures. Such resources allow larger firms to implement structural partition between explorative and exploitative teams that allows these teams to focus on one project or activity at the time (Gibson & Birkinshaw, 2004). These differences are the antecedents why SMEs are facing difficulties to behave ambidextrous. Individuals within SMEs need to balance and deal with both activities with limited time to compete with larger firms (Gibson & Birkinshaw, 2004). According to the study of Rosing & Zacher (2016), individuals achieve ambidexterity by successfully dealing and integrating contradictory activities and paradoxical tensions. SMEs facilitate individual ambidexterity by creating an environment for individuals to perform incremental/routine and radical/innovative activities, which is defined as contextual ambidexterity (Schnellbacher et al., 2019).

Scholars proved ambidexterity to be an antecedent of firm performance and innovation (e.g. Cao, Gedajlovic, & Zhang, 2009; Schnellbacher et al., 2019; He & Wong, 2004). The

study of Schnellbacher et al. (2019) found empirical evidence that individual ambidexterity positively influences the performance outcomes. Next to this, the study of Jasmand, Blazevic, and De Ruyter (2012) investigated non-managerial individual ambidexterity of the customer service employees, stating that these employees exploit by fulfilling the service request and explore by identifying new customer needs, resulting in a positive relationship with job performance. The study of Rosing and Zacher (2016) concludes that individual innovative performance is increased when an individual is able to effectively deal with contradictory demands and tensions and when individuals are engaged in both type of activities (e.g. exploration and exploitation). Therefore, the following statement is hypothesized:

*H1: The level of individual ambidexterity of non-managerial employees is positively related to his/her innovative performance.*

## 2.2 Personal characteristics

Referring to the opening quote: “*Anything’s possible if you’ve got enough nerve.*” – J.K. Rowling (Success, 2019). While following this quote it is known that innovations are driven by employees. However, not every employee is suited to innovate (Mansfeld, Holzle & Gemunden, 2010). Employees are characterized with certain characteristics that aids their jobs, whereas some characteristics are beneficial to possess to innovate. Innovating is complex, especially when dealing with ‘Individual Ambidexterity’ where the individual is competing their agenda to explore and exploit. The success factor for developing innovations is largely dependent on the employees and their personal characteristics. To foster a successful innovation you need enthusiastic, flexible, and self-motivated employees (Mansfeld et al., 2010), since innovations are mostly developed voluntarily when creative ideas arise while facing an impulsive problem (Witte, 1977). Therefore, the employee needs intrinsic commitment to

accomplish the entire innovation process to make the creative idea into an innovation. However, the employee still needs to commit to their current jobs and improve incremental activities, while also putting effort into the new radical activity. To be able to switch between tasks the employee needs motivation (self-efficacy) and cognitive flexibility to do both successfully (Kokubun, Yamakawa & Hiraki, 2020; Laureiro-Martinez & Brusoni, 2017).

### 2.2.1 Self-efficacy

Self-efficacy is defined as one's intrinsic motivation to set yourself to work and it supports the attitude of an individual to confidently achieve tasks (Kokubun, Yamakawa & Hiraki, 2020). The expectancy value perspective explains that the motivation and the cognitive flexibility of an individual causes why an individual can convince themselves mentally that they are able to accomplish a task. Self-efficacy is the driver of motivation at the individual level for performing tasks that have conflicting demands or are challenging (Yu et al., 2018).

According to Chen et al. (1998), self-efficacy is highly positive for developing new products, marketing, and management; new products and services; new venturing and new ideas. Concluding that managers with high levels of self-efficacy are more risk-taking and setting higher goals to achieve ambidexterity. According to Kauppila and Tempelaar (2016), self-efficacy is considered a key personal trait that explains individual ambidexterity. The level of ambidexterity is higher for individuals that are intrinsically committed to their job. Therefore, according to Bledow and Frese (2009), individuals that pursue complex goals, self-efficacy is salient to understand why some individuals achieve these goals why some do not. As the key characteristic of ambidexterity, self-efficacy explains differences between the type of individuals that believe they are capable and confident enough to achieve high and complex goals (Chen et al., 2001). Self-efficacy broadens and enriches an individual's goalsetting, which supports individuals to expand their ability to perform new tasks and increase efficiency for

routine tasks. The increased ability to perform new tasks is crucial for performing explorative and exploitative activities (Kauppila & Tempelaar, 2016). Concluding from literature, self-efficacy supports the individual to be more confident and motivated to increase their action repertoire and goals, and therefore be able to behave ambidextrously.

*H2: Self-efficacy positively influence Individual Ambidexterity.*

Besides the expected relationship between self-efficacy and individual ambidexterity, is self-efficacy expected to relate with innovative performance at the individual level directly. According to Chen et al. (1998) increased amounts of self-efficacy of an individual cause cognitive awareness that he or she is able to perform specific tasks and allows them to have control over certain activities and events. Individuals with higher levels of self-efficacy are more intrinsically motivated, put more effort into jobs, and are more persistent while having setbacks, which results in higher levels of performance. Bandura (1977), Stajkovic and Luthans (1998), and Judge and Bono (2001) did all find significant relationships between high levels of self-efficacy and performance during day-to-day tasks, because ones' individual belief for accomplishing an upcoming task. Therefore, the following hypothesis is expected to be present in this study:

*H3: Self-efficacy is positively related with innovative performance of the non-managerial employee.*

Subsequently, the increase of one's ability to behave ambidextrous due to being self-efficient, increases the level of innovative performance since these are related. Therefore, the following

hypothesis assumes that due to self-efficacy an individual can behave more ambidextrous, which causes higher levels of innovative performance. The relationship will then be mediated.

*H4: The positive relationship between Self-Efficacy and Innovative Performance is mediated by Individual Ambidexterity.*

### 2.2.2 Cognitive Flexibility

Cognitive flexibility is defined as the mental process of an individual to flexibly overcome inertia and deal with a certain problem at hand (Laureiro-Martinez & Brusoni, 2017). Cognitive flexibility is seen as a personal characteristic of an individual, which aids the decision making. For example, when situations are unstructured or chaotic, the level of one's cognitive flexibility is key to bring mental structure to the situation and supports the individual with working towards a problem-solving idea (Laureiro-Martinez & Brusoni, 2017). Moreover, cognitive flexibility explains the relevance of how an individual can respond to rapid changing environments, such as innovations and competition in the high-tech industry which is at central in this study. In general, within an organization there are two important choices whenever a problem arises. (1) The problem is known, and an individual relies on old habits (routines) for dealing with the problem or (2) the problem is new and the individual needs to explore new routines or work arounds to overcome the problem (innovate). Cognitive flexibility is the characteristic that explains how well and how quick an individual deals with these two types of choices (Eisenhardt, Furr, and Bingham, 2010).

According to Eisenhardt, Furr, and Bingham (2010), individual ambidexterity is related to cognitive flexibility. Balancing or alternating explorative and exploitative activities are both competing with an individuals' cognitive agenda. Most successful managers are cognitively able to be ambidextrous by doing these activities simultaneously (Gibson & Birkinshaw, 2004).

However, balancing or simultaneous, individuals need to be cognitively flexible to be ambidextrous and perform both activities (e.g., exploration and exploitation). The dynamic contexts where most high-tech firms are in, are challenging the cognitive capacity even more. These rapid changes within an industry (especially high-tech industries) demands for flexibility from the individual to switch easily between tasks and to respond to those changes properly. Such contexts are characterized by complexity, dynamism, and time-constraints (Good & Michel, 2013), where individuals are challenged to manage their ambidextrous behavior. The relationship between cognitive flexibility and individual ambidexterity is explained by Good and Michel (2013) as “Individual Ambidexterity, the individual-level cognitive ability to flexibly adapt within a dynamic context by appropriately shifting between exploration and exploitation to achieve tasks.”. Derived from the aforementioned literature, the following hypothesis is formulated:

*H5: Cognitive flexibility positively influence Individual Ambidexterity.*

Prior studies showed that cognition aids ambidextrous behavior of an individual. However, ones' cognitive flexibility aids an individuals' performance to accomplish a task as well (Louridas, 1999; Kortte et al., 2002). Individuals that are cognitively able to switch flexibly between tasks do have more concentration and motivation to put into the job, which results in better performance (Kortte et al., 2002). According to Wu et al. (2013) innovative performance is found to relate with creativity and learning which comes from ones' individual cognition to think creatively. When an individual is able to be cognitive flexible, the individual is able to think of more creative and different ideas that increases a tasks' performance. Eisenhardt et al. (2010) investigated the micro foundations of performance at the individual level. Individuals are performing better when they are able to effectively manage two conflicting agendas (i.e.



exploration vs. exploitation). There are three underlying concepts that explains why managers perform better when they are cognitive flexible. (1) Abstraction: abstract thinking creates a better understanding of the two conflicting demands, (2) Cognitive variety: a diverse collection of cognitive maps that supports the problem-solving thinking, and (3) Interruption: supports an individual to pause the thinking and to reassess the solution or way of thinking. These three underlying constructs explains why high levels of cognitive flexibility leads to better innovative performance. Therefore, the following hypothesis is expected to be significant and positive:

*H6: Cognitive flexibility positively influences innovative performance of the non-managerial employee.*

Due to the fact that ‘Cognitive Flexibility’ is both expected to relate positively with ‘Individual Ambidexterity’ and ‘Innovative Performance’ the relationship is expected to be mediated by Individual Ambidexterity. Therefore, the following hypothesis will be tested:

*H7: The positive relationship between Cognitive Flexibility and Innovative Performance is mediated by Individual Ambidexterity.*

### 2.3 Conceptual model

After reviewing extant literature, we hypothesized five relationships to investigate the influence of personal characteristics on innovative performance of the non-managerial employee within high-tech SMEs, by means of individual ambidexterity as a mediator. By doing so we try to find answer on the research question:

*“What is the influence of personal characteristics (self-efficacy and cognitive flexibility) of non-managerial employees on attaining individual ambidexterity, and individual innovative performance within high-tech SMEs?”*

The conceptual model consists of four variables of which there are two independent variables, one mediating variable, and one dependent variable. We hypothesize that, next to the direct effects, individual ambidexterity functions as mediating variable between the relationship of the two independent variables (self-efficacy and cognitive flexibility) and innovative performance. With this conceptual model we are able to test each effect on innovative performance directly and indirectly via the mediator.

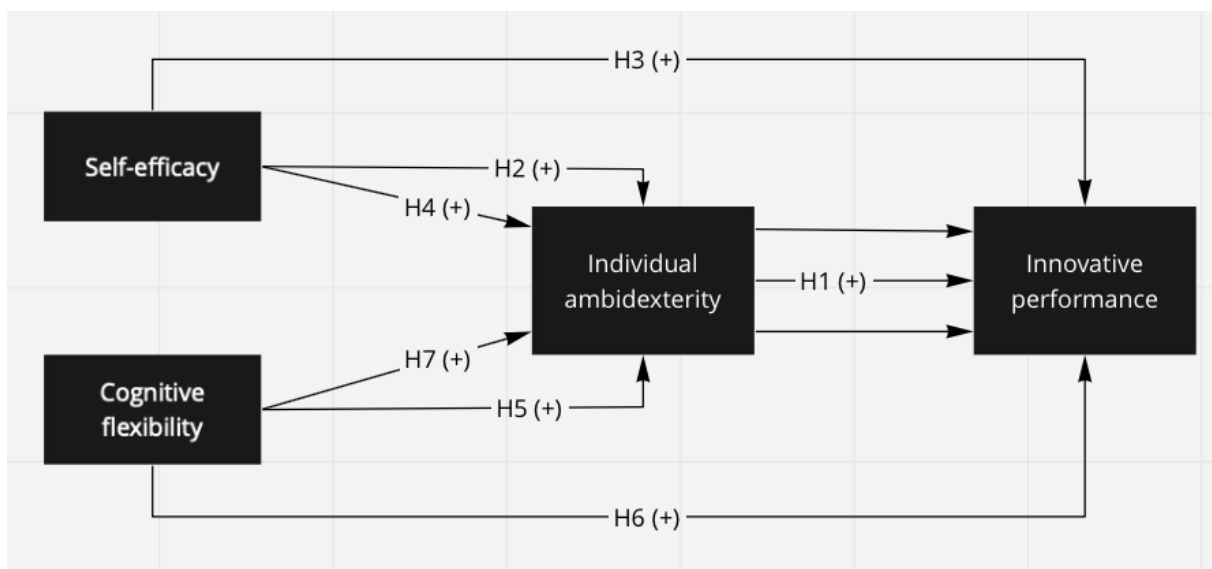


Figure 1: Conceptual model

### 3. Methodology

*Methodology, known for its data, precision, sensitivity, relevancy, and accuracy. In this chapter we elaborate on the methodological requirements and choices that are necessary for this research. The methodology in place is crucial for the interpretability and usability of this study to measure the innovative performance of non-managerial employees.*

#### 3.1 Methodological approach

To answer the research question, which is mentioned in chapter 2, we used a quantitative approach to explain the relationship between personal characteristics of non-managerial employees and innovative performance through ambidextrous behavior, which is all measured at the individual level. A quantitative approach is chosen due to the subject of research where we follow the approach of extant literature in the field of ambidexterity, and innovative performance (e.g., Fu et al., 2020; Junni et al., 2013; Rosing & Zacher, 2016). Next to this, explaining a personal trait in a social world is difficult to measure via qualitative questions (Allen, 2017). Personal characteristics are not considered tangible assets; for example, verbally explaining what level of self-efficacy you possess is harder than reflecting on specific situations related to self-efficacy and rating them on a 7-point Likert scale. Thereby, with numerical data we obtain the most reliable data without socially desirable answers from respondents. Appendix I provides an overview of all the items used in the survey to measure the variables.

In this study, we try to test possible antecedents (e.g. self-efficacy and cognitive flexibility) and the relationships between extensively investigated constructs (e.g. ambidexterity, and innovative performance). However, to our knowledge, the interrelatedness of personal characteristics, individual ambidexterity, and innovative performance has not been investigated before. It is expected that personal characteristics influence the dependent variable

directly and indirectly via individual ambidexterity. Therefore, the type of research is deductive and explanatory in nature, where the ‘why’ question is at central (Bleijenbergh, 2015).

Explanatory research is part of the research design, which connects the research problem with empirical research (Van Wyk, 2012). According to the definition of deductive research, researchers start with theory, build up hypotheses, and finally test the hypotheses to validate the theory (Bleijenbergh, 2015).

### 3.2 Sampling and data collection

The investigated population for this study is the high-tech industry, more specifically we targeted high-tech SMEs. In general, high-tech firms operate in hyper-competitive environments dealing with creative destruction (Gliga & Evers, 2010). Creative destruction, known as quick changes and adaptations of new products and innovations that replace old ones (Gliga & Evers, 2010). Due to these reasons, high-tech firms need high levels of innovative performance and quick development processes to meet market demands and -requirements. High-tech SMEs, who compete with large resource-funded organizations (i.e. Google, Microsoft, etc.), need to utilize resources and spend time efficiently to develop higher levels of ambidexterity for exploitative and explorative innovations in order to outperform larger firms (Sarkees & Hulland, 2009). Within this study, SMEs are defined as organizations with less than 250 employees (European Commission, 2020). According to the OECD (Organization for Economic Co-Operation and Development) and the Oslo methodology (Zakrzewska-Bielawska, 2010), high-tech firms are defined as firms that relatively invest a lot in R&D and have introduced at least one technological innovation (e.g. new product improvement or technological improved process). Therefore, in this study we use the combination of both definitions and reached out to small- and medium sized firms with a maximum of 249 employees, that relatively invest a lot in R&D and introduced or implemented at least one

technological product of process. Moreover, the respondents need to be non-managerial which means that they do not lead a team but are allowed to work at any position/department in the organization, which causes that this research is investigating the individual level within an organization.

To answer the research question, we collected primary data gathered via a survey with validated measurement scales. The program we used for developing and distributing the survey was Qualtrics, which is a flexible and user-friendly program for the respondents. Moreover, Qualtrics is an easy-to-use tool for transporting the gathered data into SPSS. The required participants for this study are chosen via non-probability sampling and snowball sampling (Hair, 2013). Non-probability sampling means that each participant is allowed to participate if they meet the requirements for this study mentioned in the former paragraph (Hair, 2013). Second, in order to increase the response rate we used snowball sampling which means that each respondent, that is contacted directly, is asked for new contacts or organizations within their network that meet the requirements of this study to participate. The population for this study is non-managerial employees working in high-tech SMEs located in the Netherlands. The participants were approached by directly contacting organizations that meet the requirements of this study or via incubators for high-tech SMEs and startups (Mercator Launch, high-tech campus Eindhoven, and Kiemt). The contacted organizations distribute the survey internally to each non-managerial employee or connected SME/Startup (i.e. non-probability- and snowball sampling). The required sample size for statistical power, validity, and generalizable results are approximately 100 respondents (Hair, 2013). The general rule for the minimum required sample size is at least 15 to 20 respondents per predictor variable in order to use multiple regression analysis with a mediation effect (Hair, 2013). The respondents who received the survey were asked to answer all questions in the same order. We did not included routings, and all questions are formulated in the “I” sentence. Moreover, the researcher included force response which

helps with avoiding missing data in the final data set. All questions in the survey are measured on a 7-point Likert scale with responses ranging from (1) “strongly disagree” to (7) “strongly agree.”. According to Finstad (2010) a 7-point Likert scale is more powerful regarding the usability of the electronical distribution of surveys.

Lastly, the researcher is aware of the possible problems regarding the generalizability since the fact that the respondents are recruited via a non-probability sampling strategy and that the sample size is at its minimum, since there are 100 respondents included within the data set (Hair, 2013).

### 3.3 Measures

All scales used for investigating the variables are derived from existing literature. Therefore, we can conclude that the items used for measuring the particular variable are valid and reliable. In each paragraph there are some exemplary questions incorporated. For the entire set of items we refer to Appendix I: Overview of measurements.

#### *Dependent variable*

‘Innovative performance’ is the only dependent variable in our conceptual model. Innovative performance is measured with a four-item scale, derived from the study of Welbourne et al. (1998). We controlled for the fact that innovative performance is a multilevel construct (i.e. product-, technological-, team-, or organizational innovative performance) (e.g. Cabello-Medina et al., 2011; Carayannis & Provan, 2008). Hence, a measurement scale for the role-based performance of an innovator at the individual level is chosen (Welbourne et al., 1998). In this study the respondent was asked to give self-evaluated answers, whether he or she is innovative. An exemplary item for innovative performance is “I come up with new ideas”. The

measurement scale of Welbourne et al. (1998) is often used and validated for measuring innovative performance with a Cronbach's alpha of .90.

#### *Mediating variable*

'Individual ambidexterity' is measured according to the measurement scale of Mom et al. (2009). Mom et al. (2009) developed the measurement scale especially for ambidextrous behavior at the individual level for managers, where both explorative and exploitative activities are included. Each factor (e.g. exploration and exploitation) included 7 items loading significantly and contained a Cronbach's alpha of above 0.85 (Mom et al., 2009). The measurement scale is thoroughly tested for validation by integrating the characteristics of exploitation and exploration according to the definition of March (1991), which investigated ambidextrous behavior of managers. Moreover, the measurement scale is tested via qualitative interviews with managers and several quantitative methods to increase the content validity, reliability, unidimensionality, and convergent- and discriminant validity, which were all sufficient during the studies (Mom et al, 2009). In this study we calculate the ambidexterity score by multiplying the scores of exploration and exploitation. This way of calculating the ambidexterity score is valid according to the study of Lee and Lee (2016).

#### *Independent variable*

'Self-efficacy' is measured on an eight-item scale, developed by Chen et al. (2001). The scale of Chen et al. (2001) was the first measurement scale that was developed according to a holistic perspective, where other researchers were limited in their conceptualization and defined self-efficacy as a task-specific or state-like construct (Gist & Mitchel, 1992; Lee & Bobko, 1994). Chen et al. (2001) was able to develop a valid and reliable general self-efficacy scale focusing on human traits. The definition used for the development of the measurement scale for general

self-efficacy is “one’s belief in one’s overall competence to effect requisite performance across a wide variety of achievement situations.”. Exemplary question for the self-efficacy scale is “I will be able to achieve most of the goals that I have set for myself.” (Chen et al. 2001).

‘Cognitive flexibility’ is measured with the developed scale of Martin and Rubin (1995), which contains 12 items. The scale of Martin and Rubin (1995) was designed based upon three cognitive flexibility aspects: (1) ones’ awareness that there are alternative options available in any situation; (2) ones’ willingness to be flexible and adapt to the situation; and (3) self-efficacy in being flexible. All three dimensions highly relevant for understanding one’s ambidextrous behavior in uncertain situations. Some items are purposely phrased negatively, in order to increase the validity and an unbiased response set. For example, “I avoid new and unusual situations.” The responses on these negatively phrased questions will be reversed coded for interpreting all results equally.

#### *Control variables*

Control variables are important for all types of quantitative studies, since external variables can interrupt or change the relationship between cause and effect. In order to control for the variables in this study we follow the study of Mom et al. (2009) and others. The control variables included, are ‘age’, ‘gender’, ‘education’, ‘tenure within their profession’, and ‘firm size’. First, we follow the study of Mom et al. (2009) where ‘age’ is controlling the relationship. It is assumed that the younger the employee the better he can deal with conflicting demands and perform on activities (Ambos et al., 2008). Age is measured in six categories “1” = 18-24, “2” = 25-34, “3” = 35-44, “4” = 45-54, “5” = 55-64, and “6” = 65 and over. Second, ‘gender’ is measured in “1” = male, “2” = female, and “3” = other. Third, ‘education’, which is associated with one’s cognitive flexibility and therefore influencing individual ambidexterity (Papadakis



et al. 1998). ‘Education’ is categorized in five categories according to the Dutch school system: “1” = graduated from high school, “2” = graduated from universities of applied sciences (HBO), “3” = bachelor’s degree (WO), “4” = master’s degree and “5” = doctoral degree. Fourth, ‘tenure within their profession’ which is related to experience and according to Mom et al. (2009) related with ones’ level of ambidexterity. The more an individual in experienced the more he or she is able to deal with dynamic situations and demand (Daft & Lengel, 1986, p.555). ‘Tenure within their profession’ is measured in years and asked as an open question. Fifth, ‘firm size’ is found to be significant for indicating how many resources a firm has (Penrose, 1959), which is especially important since we investigate SMEs for which resources can predict the creativity and thus performance level. Within this study, we follow the study of Zakrzewska-Bielawska (2014), where SMEs are limited towards organizations that has 250 employees or less. We dummy ‘firm size into’ “1” = small sized firms and “2” = medium sized firms. Small sized firms are categorized from 1 to 49 employees and medium sized firms are ranging from 50 to 250.

### 3.4 Data analysis

#### *Data preparation*

In order to start with the analysis, all the data received from the participants is exported into SPSS. First, the data is checked for missing values and since the survey is built with forced response the missing data cannot be due to an underlying pattern, also known as MAR (Missing At Random). Therefore, the missing data in the sample will be eliminated via list wise deletion (Hair, 2013).

Afterwards an Exploratory Factor Analysis (EFA) is conducted to increase the validity and reliability of the outcomes after analyzing the effects related to the dependent variable. The researcher specifically chose for conducting an EFA to check if the validated measurement scales are indeed measuring to the assigned factors, since in ambidexterity literature many

different measurement scales are used (Rosing & Zacher, 2016). Hence, the EFA has the objective to test the hypothesized measurement model (Jöreskog, 1969).

When all items are measured and assigned to its belonging factors the new scales will be built, 'Self-Efficacy', 'Cognitive Flexibility', 'Individual Ambidexterity' (which is the combined score of 'Exploitation' and 'Exploration' (following the study of Gibson & Birkinshaw, 2004; Fu et al., 2019), and lastly, 'Innovative Performance'.

After we reduced the missing values and built the measurement scales, we test for assumptions to prepare the data set for our analysis. To answer the research question we conduct a multiple regression analysis with a mediation effect. Attached to the multiple regression analysis with mediation, five assumptions have to be met. (1) interval or ratio measurement level, (2) normality of the error term distribution, (3) linearity of the phenomenon measured, (4) independence of the error terms (multicollinearity), and (5) constant variance of the error terms (homoscedasticity). (1) As proposed in the former paragraph, all variables are measured on a 7-point Likert scale which is allowed to interpret as an interval measurement scale (Hair, 2013). The control variables 'age' (nominal), 'gender' (nominal), 'education' (ordinal), and 'firm size' (ordinal) that has more than two categories will be dummy coded to allow them into the analysis. The negatively phrased items that are used in the survey will be reversed coded to analyze all response in the same direction (Hair, 2013). Afterwards, (2) the normal distribution will be checked via the skewness and kurtosis and corrected for normality if needed. (3) Linearity is checked with polynomial terms. (4) Multicollinearity is not allowed in the analysis because otherwise the independent variables are correlating too much with each other. Multicollinearity can be checked with the Tolerance values which need to be larger than  $>.20$ . (5) homoscedasticity assumes that the variance is equally distributed which is checked with a P-P plot. The plot may not result in a strange pattern, for example, a horn or a dot. After

committing to all these assumptions we can proceed to the analysis of multiple regression (Hair, 2013).

### *Multiple regression for mediation*

To give answer on the research question we conduct a multiple regression analysis with one mediator (e.g., ‘Individual ambidexterity’), which mediates for two variables, namely ‘self-efficacy’ and ‘cognitive flexibility’. Therefore, we can conclude that ‘individual ambidexterity’ mediates two effects. SPSS is able to run the analysis correctly with all variables included in one model. The add-on tool for testing the mediation effect is Process. In Process we test each direct effect and mediation effect for all the hypotheses. For a mediation there are five possible effects. Regarding the mediation effect of ‘individual ambidexterity’, and ‘innovative performance’ we expect five possible relationships namely, (1) a direct effect between ‘Self-efficacy’ or ‘Cognitive flexibility’ and ‘Innovative performance’ (C); (2) an effect between ‘Individual ambidexterity’ (mediator) and ‘Innovative performance’ (b); (3) an effect between ‘Self-efficacy’ or ‘Cognitive Flexibility’ and ‘Innovative performance’ under control of the mediator (‘individual ambidexterity’) (C’); (4) an effect of ‘Self-efficacy’ or ‘cognitive flexibility’ on ‘Individual ambidexterity’ (a); and (5) an indirect effect of ‘Self-efficacy’ or ‘Cognitive flexibility’ on ‘Innovative performance’ when the mediator changes by one unit (ab). Afterwards we can derive conclusions whether there is no, a partial-, or a fully mediated effect.

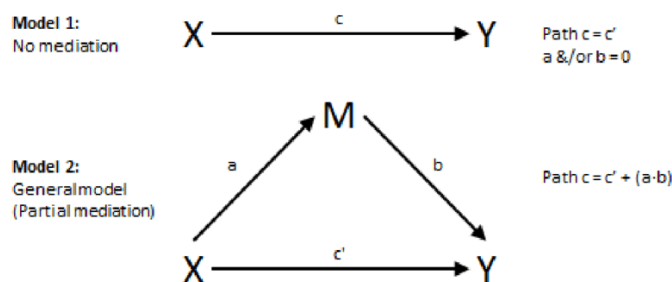


Figure 2: Expected relationships mediation (Figueredo et al., 2013)

### 3.5 Research Ethics

While conducting a research where primary data from others is collected, a researcher has to be aware of how results could affect and effect ones' individual image, confidence, or job. Therefore, the researcher distributes anonymous surveys and provides each participant the possibility to withdraw their participation out of the research. Second, all results are used with integrity and seen by the eyes of the researcher and supervisor only. Third, the results will be published without mentioning respondents or firm names. The results that show how well an individual performs on innovative capabilities by means of their personal characteristics are anonymous. Therefore, the organizations cannot make assumptions or catastrophic changes to ones' job. The results will be handed over to each participant that participated in the study by delivering the results via mail. The study will not be published but only handed in at our institutional department of Management and the supervisors connected to this study.

## 4. Results

### 4.1 Data preparation

The first step for conducting the analyses is to check for inconsistencies and missing data in the sample, and respectively, correct for it. The total respondents that filled in the survey counts 108 in total. From the 108 respondents there are 8 missings per variable. After running a frequencies table (Appendix II) with all the variables included, the researcher noted that all the variables did have the same missings from the same respondents, meaning the researcher can assume that the respondents did not finished their survey. According to Hair et al. (2010) it is important to check for (suspicious) patterns within your missing data. When these patterns are found, it could imply that certain characteristics (e.g. gender or age) of the respondents are related to the missings. In such a case we speak of MAR (Missing At Random). When MAR is the cause of the missing data it could have implications on the results and generalizability of the outcomes.

Looking to the frequency table (Appendix II) for this study, the researcher concluded that all variables did have the same missings, therefore, we can assume that the missing data is not due to underlying reasons. Moreover, each question in the survey was built with forced response, thus the respondents were not able to proceed without answering. When deleting the missing records the researcher can choose for several methods for handling missing data. Listwise deletion is one of these methods, where the entire record is deleted from the dataset (Field, 2013). When choosing for listwise deletion the generalizability of the remaining results remains the highest since the results are kept in its original value (instead of mean substitution). Hence, eight records were deleted from the dataset, which left the researcher with 100 respondents in total.

The second step for preparing the data is to reverse code the negatively phrased answers in order to measure all the responses in the same meaningful direction. The items that are

recoded are ‘I avoid new and unusual situations.’, ‘I feel like I never get to make decisions.’, ‘I seldom have choices when deciding how to behave.’, and ‘I have difficulty using my knowledge on a given topic in real life situations.’ (Appendix I).

Third, as described in chapter three, the four constructs that are used for the analysis are measured with validated measurement scales derived from other scholars containing multiple items that measures one construct. In order to start the analysis the multiple items are combined into a new mean score of all the items together into the new variable (i.e. Self-efficacy, Cognitive Flexibility, Individual Ambidexterity, and Innovative Performance).

Lastly, the control variables ‘Age’ and ‘Education’ are recoded into dummy variables in order to meet the interval measurement level which is required for conducting a multiple regression analysis (Field, 2010). The control variable ‘Gender’ is not necessary to recode into a dummy variable since there is no respondent that is defined as ‘other’, hence only male and female are present in the data set.

## 4.2 Factor Analysis

Exploratory Factor Analysis (EFA) is chosen in order to test the theory-based items if they truly measure the assigned constructs. The goal of a factor analysis is to reduce data into meaningful summarized factors, which allows the researcher to interpret the variables easier while not losing information (Hair et al., 2013).

Before conducting the analysis, there are choices to make for setting up the analysis correctly. These are the extraction- and rotation method. The extraction method is Principal Axis Factoring, since the researcher tries to confirm if the attached items are indeed predicting the latent construct. It is similar as testing the measurement model for a construct, and similar to a formative measurement model with arrows headed from the construct towards the items. In other words the measures alone cannot explain the construct in total, but the items together

form the construct (Hair et al., 2013). The rotation method used for the factor analysis, is orthogonal rotation (or: Varimax). This rotation method is selected since oblique rotation did not find any correlations higher than .30, which is the critical value for using oblique rotation (Appendix III). The following steps for a Factor Analysis are looking for (1) a value larger than .50 (.80 preferred) for the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and, (2) the Bartlett's test of sphericity, which needs to be significant. KMO compares the correlation and partial correlations between the items, of which the Bartlett's test of sphericity tests that the correlations are not equal to zero when significant.

Furthermore, starting with the first factor analysis the researcher noted that nine factors were extracted, which is too much for this research and not according to the expectations from literature. Therefore, a parallel analysis was conducted in order reduce the factors to a limited number that is allowed with this sample size ( $N = 100$ ) and number of items (items = 34). Concluding from the parallel analysis the fixed number of factors that are extracted is five, which is in agreement with literature (i.e. 'Self-Efficacy', 'Cognitive Flexibility', 'Exploration', 'Exploitation', and 'Innovative Performance').

Based on these fixed factors the second factor analysis is conducted. The five factors with all the 34 items included had a sufficient KMO (.728) and a significant Bartlett's test. The latent root criterion indicates that the five extracted factors are above the critical value of +1. Regarding the cumulative proportion of variance were the five factors explaining 55,2%, which is good. However, the items did not show a simple structure, which is the goal of the data reduction in factor analysis, meaning that the items are considered cross loaders and thus does not load on one factor only. The criterium for a cross loader is when the difference between the largest and second largest loading is smaller than .20 (Hair et al., 2013). Next to this, there was one item that showed a violation regarding the communalities after extraction (critical value  $<.20$ ). The problematic item for the communalities was CF\_8 (.177).

The items that were violating the rule of simple structure were SE\_3, CF\_8, EXPLR\_2, EXPLT\_1, IP\_1, CF\_4, EXPLR\_6, SE\_4, EXPLR\_5, SE\_6, CF\_12. The items are deleted chronologically based on the worst values for cross loaders or communalities (Appendix III). After 11 iterations the simple structure is met with one remaining cross loader, which is kept within the analysis based on theoretical grounds. Namely, IP\_3 is a cross loader and should be deleted as well. However, based on the rule of Raubenheimer (2004) it is not desirable that a factor has less than three items because it has a too low explanation power. Next to this, looking to the context of the formulation of IP\_3, it has similarities with the phrasing of the items from Cognitive Flexibility (e.g., 'CF\_6: I am willing to work at creative solutions to problems' vs. 'IP\_3: I find improved ways to do things'). Based on these arguments the researcher chose to remain IP\_3 into the analysis and accept it as a cross loader.

After all the iterations done and deleting the items one-by-one, the KMO increased from .728 to .756, indicating an increased adequacy of the data. The five factors are predicted by the following items: 'Self-Efficacy' is explained by five items instead of seven; 'Cognitive Flexibility' is explained by nine items instead of twelve; 'Exploration' is represented by four items instead of seven items; 'Exploitation' remains six instead of seven items; and 'Innovative Performance' remains three instead of four items (Appendix IV).

Before we are allowed to compute new scales the researcher has to conduct a reliability analysis in order to check if the new combination of items is truly reliable to measure the factor (Field, 2013).

#### 4.3 Reliability Analyses

The most familiar way for testing the consistency of items measuring a factor is the reliability analysis, with a coefficient known as Cronbach's alpha. The Cronbach's alpha has a critical value of at least .70 (Field, 2013). The reliability analysis shows if it is necessary to delete more



items for an increased reliability, which is expressed via an increased Cronbach's alpha coefficient. The rule for deleting an item is when the Cronbach's alpha increases at least .05, otherwise it is not meaningful and could even worsen the scale. After evaluating the 'Cronbach's alpha if item deleted' for each factor the researcher chose to delete one more item for the factor 'Cognitive Flexibility'. Hence, CF\_9 was deleted since the Cronbach's alpha increased from .813 to .822, which is an increase of .09. Moreover, CF\_9 was loading on a factor that was different from the other 'Cognitive Flexibility' items (Appendix III). Thus, more reason to delete the item. In the table below there is an overview of the factors' reliability coefficient, and the number of items included. The Cronbach's alpha for each factor is sufficiently high ( $>.70$ ) to interpret the items as valid measures for the variable.

<b>Factor</b>	<b>No. Items</b>	<b>Cronbach's Alpha</b>
Self-Efficacy	5	.730
Cognitive Flexibility	8	.822
Exploration	4	.811
Exploitation	6	.830
Innovative Performance	3	.794

Note: Cronbach's Alpha  $>.70$  is sufficient.

*Table 1: Reliability analysis*

## 4.4 Descriptive statistics

### *Univariate statistics*

When looking to the demographic (control) variables, the researcher investigates how the data is represented. The data represents 65% male versus 35% female; regarding the age there is 28% in the category 25-34; 26% in the category 35-44; 25% in the category 45-54; and the data is lesser represented by the youngest and oldest respondents (e.g. 10% = 18-24, 11% = 55-64). A possible explanation for the distribution of the respondents' age could be due to the distribution via online channels (e.g. LinkedIn or QR codes), which the middle-aged employees are more actively participating on. Regarding the level of education, the respondents that graduated from 'university of applied sciences' and 'bachelor's degree' are represented the highest (e.g. 32% vs. 31%). The mean for one's 'tenure in its current profession' is approximately 12 years and ranging from a minimum of 1 up until 39 years maximum, which indicates that the respondents are quite experienced and widespread from beginners to experts. Lastly, the 'firm size' is somewhat equally represented, which provides an interesting overview of whether small- or medium sized firms are scoring different or the same on the level of 'innovative performance' in relationship with 'personal characteristics' and 'individual ambidexterity'. Since the fact that literature concludes that employees within smaller firms are more creative and innovative when there are less resources available within the firm.

The descriptive statistics for the main variables are mostly positively answered. The mean score for 'Self-Efficacy' is 5.55 (i.e. between 'somewhat agree' and 'agree'), meaning that respondents think, in general, they are intrinsically motivated and disciplined to their job without overstating themselves; 'Cognitive Flexibility' has a mean score of 5.76, which indicates that the employees in SMEs are cognitively able to structure conflicting demands and switch between tasks; 'Exploration' scored 5.15 on average; 'Exploitation' has a score of 5.41; and 'Innovative Performance' scored 5.51 on average, which implies that employees are

convinced that they innovate regarding products, processes, and routines during their daily jobs. All variables are scoring between ‘somewhat agree’ and ‘agree’. Noteworthy to mention is that there are no extreme values divergent from strongly disagree or strongly agree, which could indicate that respondents provided socially desirable answers without extreme values; had a hard time evaluating themselves; or that they find themselves agreeable with the statements without strongly expressing their opinion. For all the descriptive statistics please refer to Appendix V.

#### *Bivariate statistics:*

To interpret the bivariate statistics, the scale for ‘individual ambidexterity’ is computed in order to find significant relationships between ‘individual ambidexterity’ and the other variables in the model.

Appendix V includes the table that explains the bivariate statistics between the relationship of each variable. The bivariate relationship is measured with the Pearson Correlation coefficient ( $r$ ), and the significance levels between each variable. The Pearson Correlation coefficient indicates the strength and the direction of the relationship for which the significance level indicates how significant the correlation is (Field, 2010).

Starting with the independent variables it is interesting to see that the strongest relationship with ‘Self-Efficacy’ and ‘Cognitive Flexibility’ is with the dependent variable ‘Innovative Performance’ (e.g.  $r=.417$ ,  $n=100$ ,  $p<.001$ ;  $r=.344$ ,  $n=100$ ,  $p<.001$ ). This could be the first indication that the hypotheses related to the direct effects without control of other variables is confirmed. The interpretation of the relationship is that ‘Self-Efficacy’ and ‘Cognitive Flexibility’ amongst non-managerial employees is indeed stimulating one’s ‘Innovative Performance’.

Second, 'Self-Efficacy' is strongly related to 'Education' ( $r=.455$ ,  $n=100$ ,  $p<.001$ ), meaning that when the non-managerial employee is higher educated, he or she has more intrinsic motivation for the job, and more confidence of accomplishing their job. Moreover, 'Self-Efficacy' is also related to 'Gender' ( $r=-.212$ ,  $n=100$ ,  $p<.05$ ), which means that women are underperforming in 'Self-Efficacy' related to men. This could indicate that women are more insecure regarding the accomplishment of their task or that women are more introvert and does not evaluate themselves to highly compared to men.

The third interesting relationship is that 'Cognitive Flexibility' is negatively related to an increasing 'Firm Size' ( $r=-.296$ ,  $n=100$ ,  $p<.01$ ), which was already the expectation according to literature. Employees within small firms needs to deal with more unstructured problems and, therefore, forcing the employees to be cognitively flexible which stimulates the brain (Eisenhardt, Furr, and Bingham, 2010).

Lastly, the dependent variable 'Innovative Performance' is significantly related to almost every variable, except for 'Age' and 'Tenure'. This indicates that someone's experience and age is not increasing the level of one's innovative performance. The significant relationships are respectively large, highly significant, and positively related for 'Self-Efficacy', 'Cognitive Flexibility', 'Individual Ambidexterity', and 'Education' which is expected according to literature. 'Gender' and 'Firm Size' are significant and negatively related to 'Innovative Performance'. Hence, females are scoring lower regarding 'Innovative Performance' and an increased firm size is also negatively related to 'Innovative Performance'. The latter could be explained by the larger a firm the less creativity within the organization due to more bureaucracy, procedures, or structural separations as explained by Birkinshaw and Gibson (2004).

Construct		SeEf	CogFl	IP	IndAmb	Age	Gender	Education	Tenure	Firm size
<b>Self-Efficacy (SeEf)</b>	r	1								
	N	100								
<b>Cognitive Flexibility (CogFl)</b>	r	.132	1							
	N	100	100							
<b>Innovative Performance (IP)</b>	r	.417**	.344**	1						
	N	100	100	100						
<b>Individual Ambidexterity (IndAmb)</b>	r	.059	.031	.464**	1					
	N	100	100	100	100					
<b>Age</b>	r	-.033	.055	-.112	.070	1				
	N	100	100	100	100	100				
<b>Gender</b>	r	-.212*	.056	-.208*	-.155	.167	1			
	N	100	100	100	100	100	100			
<b>Education</b>	r	.455**	.111	.445**	.161	.055	-.266*	1		
	N	100	100	100	100	100	100	100		
<b>Tenure within profession (in years)</b>	r	-.001	-.080	-.143	.137	.823**	.080	-.019	1	
	N	100	100	100	100	100	100	100	100	
<b>Firm size</b>	r	.336	-.293**	-.259**	.006	.248*	.092	-.253*	.300**	1
	N	100	100	100	100	100	100	100	100	100

Note: \* significant at p <.05; \*\* significant at p <.01

Table 2: Bivariate statistics

## 4.5 Multiple regression with Mediation

Multiple linear regression with mediation is an extension for a normal multiple linear regression which analyses the direct- and (possible significant) indirect relationships. Linear stands for the relationship between the independent- and dependent variable that behaves linearly when the predictor variable increases or decreases (Field, 2010). Multiple regression with mediation calculates the relationship between the dependent-, mediator-, and multiple independent variables via the ordinary least squared method (OLS). The purpose of OLS is that the researcher strives for the most efficient and clean estimations of the model parameters (b-coefficients) in order to generalize the outcomes as most specific as possible for the population (Hair et al., 2013). Therefore, to conduct this analysis there are five assumptions needed to be met in order to increase the cleanness and efficiency of the analysis.

### 4.5.1 Assumptions

#### *Measurement level*

All variables need to be metrically scaled (ratio or interval) in order to conduct a multiple regression. The variables (e.g. Self-Efficacy, Cognitive Flexibility, Individual Ambidexterity, and Innovative Performance) are all measured on a 7-point Likert scale, which is allowed to interpret as quasi-interval (Hair et al, 2013). Regarding non metrically scaled variables there are transformations needed, called dummy variables. Within this research the only non-metrically scaled variables are the control variables, except ‘tenure’, ‘gender’, and ‘firm size’, since these variables only exist out of two categories. Therefore, it is not necessary to dummy code these variables. The control variables ‘education’ and ‘age’ are dummy coded as follows, one category is labeled as one and the others as zero, this is done for all the categories in order to make it metrically scaled.

### *Normality of the error term distribution*

To check for normality is not strictly required for multiple regression. However, it could influence the other assumptions. Therefore, the normality is checked via the frequency tables and histograms provided in Appendix V and VI. The control-, independent-, mediation-, and dependent variables are normally distributed when the skewness and kurtosis are within the range of -3 and +3 (Hair et al., 2013). All the predictor- and outcome variables are slightly negatively skewed but not violating the assumption of normality. The negatively skewed pattern can be grounded since the means are all positively scaled around 5 (somewhat agree), which causes a left skewed distribution as shown in the frequency table (Appendix V), and the histograms (Appendix VI). Moreover, all the variables are meeting the requirement of +3 and -3. Hence, the variables are normally distributed and therefore there is no need to transform the variables.

### *Linearity of the phenomenon measured*

Controlling for linearity is important because for a multiple regression each independent variable needs to be linear related to the dependent variable. When this is not the case is damages the efficiency of the analysis. When variables are not considered linear, they need to be transformed into polynomials (Field, 2010). The linearity assumption is checked via scatter plots, where each independent variable (including the mediator) is plotted against the dependent variable (appendix VIb). Each variable was showing a linear relationship in combination with the dependent. Therefore, the variables do not have to be transformed and thus it is assumed that the variables are linear.

### *Independence of the error terms*

Independence of the error terms controls for independency amongst each predicted value in relationship with the other predictions (Hair et al., 2013). Independence of the error terms is also known as Multicollinearity and checked via Tolerance and VIF values. The Tolerance values should exceed .20, whereas the VIF values should remain below 10. In Appendix VIc the multicollinearity statistics are included, which shows acceptable values for the VIF and Tolerance values.

### *Constant variance of the error terms (Homoscedasticity)*

Heteroscedasticity, also known as unequal variance of the error terms is the violation that should be avoided in order to have constant variance of the error terms, which is known as homoscedasticity. Heteroscedasticity can be detected by plotting the residuals against the dependent variable which must show a clear random pattern. When the residuals are heteroscedastic (unequal), then the pattern could look like a dot, diamond or other consistent pattern. This is obviously not the case (Appendix VIId).

#### 4.5.2 Mediation Analysis

In order to interpret the model that explains the relationship between the predictor- and mediator variables and the dependent variable, the researcher used a stepwise approach to see whether the addition of variables increases the variance explained by the model (Hair et al., 2013). In increase in variance explained means that the dependent variable's variation is better explained by the independent variables. Hence, three models are analyzed to clarify the usability of the mediator and the control variables. Subsequently, the first model predicts the relationship between the predictor variables (e.g. 'Self-Efficacy' and 'Cognitive Flexibility') and the outcome variable ('Innovative Performance'); the second model adds the mediator variable



(‘Individual Ambidexterity’) to the first model; lastly, the third model adds the control variables into the analysis together with all the other variables.

Table 3 presents the model summary including to the most important values for predicting the model. The last model (3) shows the highest prediction power for explaining the dependent variable, ‘Innovative Performance’ is explained by 41,5% of the variance in the model ( $R^2 = .415$ ,  $F(13,86) = 4.69$ ,  $p < .001$ ), relative to the second model without control variables explaining 25,8% of the variance ( $R^2 = .258$ ,  $F(2,97) = 16.91$ ,  $p < .001$ ). This increase of 15,7% is significant, meaning that the control variables are important to include since this indicates that variables such as ‘tenure’, ‘age’, ‘gender’, ‘education’ or ‘firm size’ are supportive for predicting ‘Innovative Performance’ more accurate. To check for the usability of the model, the researcher uses the ANOVA test values. ANOVA stands for the analysis of variance, which analyses the residual output (Field, 2010). The residual output explains the predicted value of the model and what the difference is between the observed and predicted values for the dependent variable for each data point in the analysis. Looking to the ANOVA (F score) for model 3 it is concluded that the model is usable and significant ( $F(13,86) = 4.69$ ,  $p < .001$ ). All models and hypothesis are tested on a significance level of .05.

Model	R	R <sup>2</sup>	Adj R	Std E	F	Df1	Df2	Sig.	Variables
1	.508	.258	.243	.877	16.91	2	97	<.001	Predictors
2	.508	.258		.769	16.91	2	97	<.001	Predictors, Mediator
3	.645	.415		.683	4.69	13	86	<.001	Predictors, Mediator, Controls

a: Significant at  $p < .05$

Table 3: Model Summary; Multiple Regression analysis with mediation

#### *Hypothesis 1:*

‘The level of individual ambidexterity of non-managerial employees is positively related to his/her innovative performance.’, which is grounded on the following result. The relationship,

and thus hypothesis 1, between ‘individual ambidexterity’ and ‘innovative performance’ has a positive effect of  $b=.07$ , a  $t$  score of 5.25, and with a significance level of  $p<.001$ . Therefore, the null hypothesis is rejected (meaning there is no difference), and thus we can accept the alternative hypothesis that proves hypothesis 1 to be supported. The unstandardized  $b$  coefficient indicates a positive but not a strong effect. This relationship between ‘individual ambidexterity’ and ‘innovative performance’ is also known as relationship b.

#### *Hypothesis 2:*

The hypothesis ‘Self-Efficacy’ positively influences ‘Individual Ambidexterity’ is tested in model 3. The direct effect of ‘Self-Efficacy’ on ‘Individual Ambidexterity’ is not supported. The relationship between these two variables is non-significant, with a negative unstandardized  $b$  coefficient ( $b=-1.21$ ,  $t = -.97$ ,  $p=.34$ ). Therefore we cannot assume that ‘Self-Efficacy’ effects ‘Individual Ambidexterity’, it is even negatively related but not interpretable due to no significance. This relationship is representing relationship a in figure 2.

#### *Hypothesis 3:*

As formulated in hypothesis 3: ‘Self-efficacy is positively related to the level of Innovative Performance of the non-managerial employee.’, which proved to be significant with an unstandardized coefficient of  $b = .39$ ,  $t = 2.43$ ,  $p <.05$ . Therefore, we may accept the hypothesized relationship between these two variables. This relationship is also known as relationship C (figure 2).

#### *Hypothesis 4:*

The hypothesis: ‘The positive relationship between Self-Efficacy and Innovative Performance is mediated by Individual Ambidexterity.’, is tested in model 3. Looking to the process output

(appendix Vc), it is concluded that the direct effect of 'self-efficacy is not mediated by 'individual ambidexterity'. The direct effect of 'self-efficacy' on 'innovative performance' under control of the mediator 'individual ambidexterity' (also known as C') is not significant ( $b = .31$ ,  $t = 1.66$ ,  $p = .10$ ). The indirect effect which is caused by 'individual ambidexterity' is checked via the 95-confidence interval (relationship ab, figure 2). The effect that is caused by 'individual ambidexterity' is,  $b = -.09$ , 95% CI  $[-.38, .20]$  and thus non-significant. This is concluded based on the general rule, when the zero is within the confidence interval the effect is non-significant, which is equal to an alpha level of  $>.05$  (Field, 2010).

#### *Hypothesis 5:*

'Cognitive flexibility positively influences Individual Ambidexterity.'. This hypothesis is found to be non-significant ( $b = .83$ ,  $t = .83$ ,  $p = .41$ ). Therefore, the null hypothesis is accepted and concluded that there is no relationship between these two variables which the researcher cannot interpret. This relationship shows relationship 'a' from figure 2.

#### *Hypothesis 6:*

'Cognitive Flexibility is positively related to the level of Innovative Performance of the non-managerial employee.'. The hypothesis (relationship C, figure 2), that is tested in model 3, is proved to be significant on an alpha level of  $.05$  and the direction of the relationship is positive ( $b = .44$ ,  $t = 3.42$ ,  $p < .01$ ), meaning that non-managerial employees that are more cognitive flexible than others are performing better regarding innovations. The relationship is found as expected and proposed in the hypothesis.

### *Hypothesis 7:*

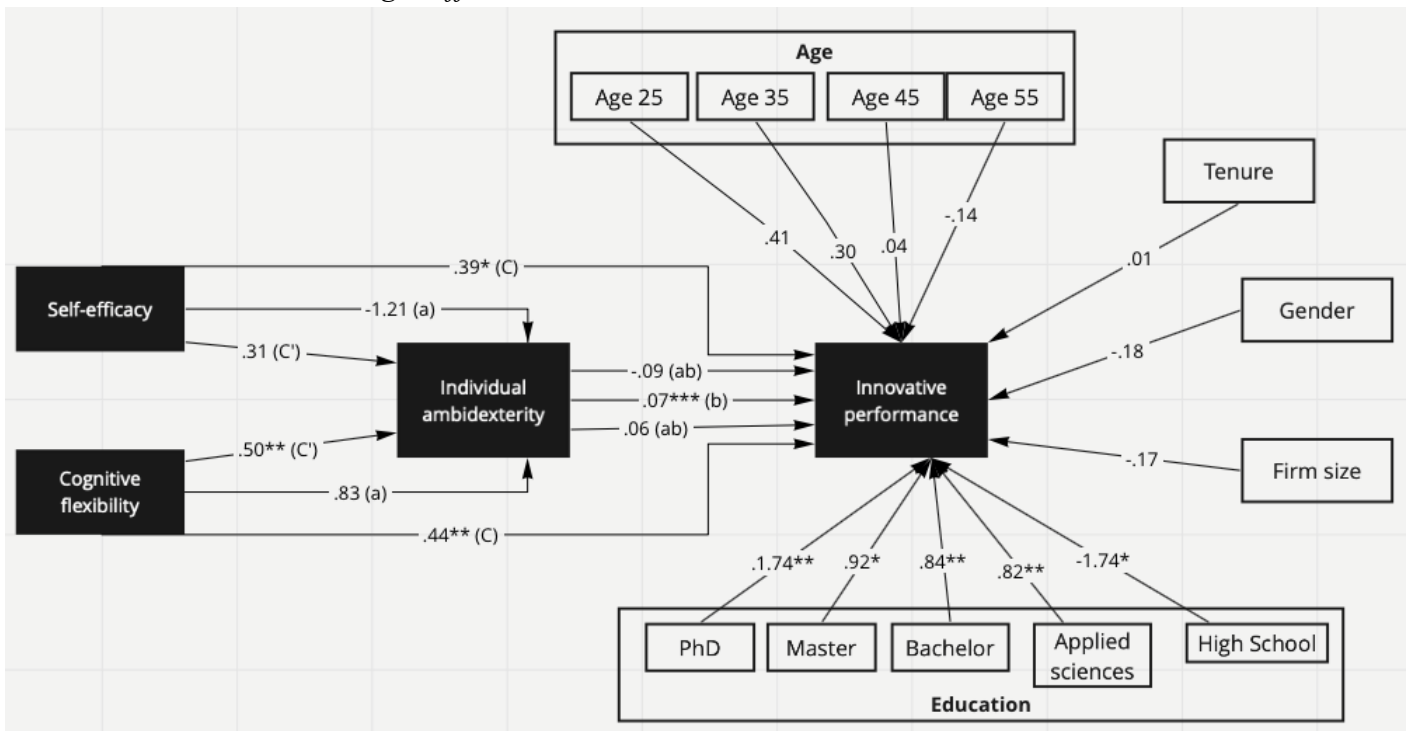
‘The positive relationship between Cognitive Flexibility and Innovative Performance is mediated by Individual Ambidexterity’. As seen in hypothesis 5 the direct effect of ‘cognitive flexibility’ on ‘innovative performance’ is significant ( $b = .44$ ,  $t = 3.42$ ,  $p < .01$ ), also known as relationship C. After including the mediator into the model. The direct effect of ‘cognitive flexibility’ on ‘innovative performance’ (also known as C’) is  $b = .50$ ,  $t = 3.41$ ,  $p < .01$ . This relationship shows an increase of the unstandardized b coefficient of .06. Moreover, this could indicate that the mediator is influencing the direct relationship (C’). However, the indirect effect (relationship ab) that is caused by the mediator ‘individual ambidexterity’ is proved to be non-significant ( $b = .06$ , 95% CI  $[-.10, .21]$ ) because the zero is within the 95-confidence interval.

### *Control variables*

For testing the control variables, each control variable including the dummy variables are included into the model for mediation in model 3. After analyzing the outcomes only one variable is proved to be significant. The relationship between the independent-, mediator-, and dependent variables is only significantly controlled for ‘education’. The reference categories are switched in order to find a possible relationship between the levels of ‘education’. The following relationships exists: the dummy variable ‘education’ with the category ‘High School’ is significant ( $b = -1.74$ ,  $t = -2.9$ ,  $p < .05$ ) and negatively related with the reference category ‘PhD’; category ‘Applied sciences’ is significant and positive related regarding the reference category ‘High School’ ( $b = .82$ ,  $t = 2.79$ ,  $p < .01$ ); category ‘Bachelor’ is positively and significant related relative to the reference category ‘High School’ ( $b = .84$ ,  $t = 2.68$ ,  $p < .01$ ); category ‘Master’ is positive and significant related to ‘High School’ ( $b = .92$ ,  $t = 2.60$ ,  $p < .05$ ); and lastly, category ‘PhD’ is significant and positively related to ‘High School’ ( $b = 1.74$ ,  $t =$

2.90,  $p < .01$ ). When the level of education increased (e.g. from high school to master) the coefficient increased and turned positive.

### Visual model including coefficients



Note:  $* = p < .05$ ;  $** = p < .01$ ;  $*** = p < .001$

Figure 3: Visual representation of the model

## 5. Discussion

### *Interpretation of results*

By interpreting the results, the researcher works according to a chronological order, thus, starting off with the first hypothesis that proves the direct relationship between ‘individual ambidexterity’ and ‘innovative performance’. The relationship founds to be significant and positive, however very weak. The significant positive relationship is in agreement with other scholars (e.g. Jasmand, Blazevec & De Ruyter, 2012; Rosing & Zacher, 2016; Schnellbacher et al., 2019), which provided empirical evidence that explorative and exploitative activities improve the innovative performance of radical innovations and the refinement (i.e. incremental) of existing processes or products by handling both activities simultaneously, effectively, and flexibly. The difference between the strength of the relationship that other scholars found compared to this study can occur due to the investigation at different organizational levels that other scholars researched (i.e. organizational or managerial) (Mom, Van Den Bosch & Volberda, 2007; Birkinshaw & Gupta, 2013). Ambidexterity at the managerial level implies that managers are involved in more routine and radical tasks that require dealing with conflicting demands (i.e. delegating daily tasks and steering innovative teams) (Birkinshaw & gupta, 2013). In this study, only the non-managerial employees are investigated for whom balancing the contradictory demands might be new or absent within their job. Therefore, the significant but weak relationship can be grounded on the newness of the concept that is not often implemented or completely exploited within functions and organizations. On the contrary the relationship exists, thus, non-managerial employees who are purposely balancing their activities between radical and incremental tasks are able to perform better regarding innovations. The outcome shows the importance to stimulate and implement ambidexterity at the non-managerial level for organizations since this research and other scholars (e.g. Rosing

& Zacher, 2016) found significant relationships between these two factors, thus, organizations should stimulate contextual ambidexterity at the individual level within SMEs.

As mentioned above, individual ambidexterity is increased for individuals who can efficiently and flexibly deal with paradoxical demands (Schnellbacher et al., 2019; Good & Michel, 2013). This expected effect is that other scholars found is in agreement with the hypothesized relationships within this study which states that personal characteristics are positively related to individual ambidexterity (H2 & H5). However, both relationships are absent, meaning that both Self-Efficacy and Cognitive Flexibility are not stimulating one's ambidextrous behavior, which contradicts the results from other scholars. The reason why employees with high levels of Self-Efficacy and Cognitive Flexibility are encouraging their ambidextrous behavior could be due to solid managerial leadership (Kauppila & Tempelaar, 2016). According to Kauppila and Tempelaar (2016), strong paradoxical support and guidelines increases the non-managerial employee to behave ambidextrous by using their personal characteristics for handling conflicting demands that stimulate the learning orientation. Within this study the managerial leadership style is not included into the analysis, therefore, it is possible that the employees within this study are not experiencing paradoxical leadership that enables them to act upon both activities by using their cognition and efficiency. Nevertheless, the relationship is absent, for which, this study may not conclude that personal characteristics (e.g. self-efficacy and cognitive flexibility) are positively related to ambidextrous behavior at the individual level.

Meanwhile, the personal characteristics Self-Efficacy and Cognitive Flexibility posited a positive relationship between the innovative performance level of the non-managerial employee. When non-managerial employees are self-efficient, intrinsically motivated, cognitively able of switching between jobs, and are mentally creative, it allows the employee to put more effort and concentration into an innovation project that, subsequently, increases in

quality and performance (Wu et al., 2013; Chen et al., 1998). Hence, employees who are innately more self-efficient and more cognitively flexible outperform other colleagues or competitors regarding their innovations.

After clarifying the direct relationships, we interpret the mediation effect caused by individual ambidexterity that is expected between self-efficacy, cognitive flexibility and innovative performance. Self-efficacy is under the control of ambidexterity, not significantly related to innovative performance anymore. On the contrary Cognitive Flexibility tends to be stronger related to Innovative performance under the control of Individual Ambidexterity, even when the mediation effect is not significant. Hence, both mediation effects of Individual Ambidexterity are absent, meaning that self-efficient and cognitive flexible employees are not performing better regarding innovations when they are focusing on both tasks (i.e. radical and incremental). The non-significant relationship is not unexpected, since the former hypothesis between the direct relationships from Self-Efficacy and Cognitive Flexibility on Individual Ambidexterity is not significant as well. Therefore, this study substantiates the absent relationship that personal characteristics do not influence explorative or exploitative activities even more. However, other scholars found evidence between these three variables, which could be due to the absence of the managerial style these employees face as mentioned before. Another reason for turning a significant direct relationship into a non-significant relationship between Self-Efficacy and Innovative performance under the control of Individual Ambidexterity could be based upon the fact that employees are overwhelmed by dealing with conflicting demands. Employees can be confident and motivated (Self-Efficacy) to ‘come up with new ideas’ (Innovative Performance) but not by dealing with both radical and incremental activities that are uncertain and risky (Individual Ambidexterity). Therefore, the relationship turned absent. On the contrary, one’s cognitive flexibility is directly related to innovative performance and showed an increased effect when non-managerial employees are involved



with individual ambidexterity, even when individual ambidexterity is not significantly mediating the two factors. One way for interpreting this effect is that cognition is related to individual ambidexterity, and, thus, non-managerial employees are performing better regarding innovations when they are mentally able to switch between tasks and are capable of processing cognitive overload that is caused by balancing a conflicting agenda. Another reason for an increased effect of cognitive flexibility on innovative performance due to individual ambidexterity could be based on the fact that individual ambidexterity is not considered a mediator, but that ambidexterity functions as a moderator between the two. This would clarify the increased strength and therefore, it should be tested in future research.

Furthermore, the researcher finds evidence for the relationship between education and innovative performance. Thus, the higher a non-managerial employee is educated, the higher he or she performs innovations, comes up with new ideas or improves existing products and processes. The other control variables cannot meaningfully substantiate the expectations from other scholars. Age, Gender, Firm Size and Tenure are all non-significant within the total effect model. However, age showed a negative relationship as employees get older, which implicates that younger employees are more confident with suggesting new ideas or improving skills. This is in line with the research of Ambos et al. (2008). Second, Firm Size showed a negative relationship on Innovative Performance. This relationship is non-significant in the total effect model but is significant when looking to the bivariate analysis. This relationship is as expected following the study of Penrose (1959). According to the study of Penrose (1959), larger SMEs or firms with more resources are less urged to be creative and therefore are performing less on innovations. Gender showed a negative relationship between male, female and innovative performance. Hence, this relationship suggests that males are more innovative than females but non-significant within the total effect model but significant in table 2 (bivariate analysis). The underlying reason could be found in psychology that implies that males are more confident with

talking about their accomplishment, are more likely to brag or truly feeling more responsible for the committing to the job (Miller et al., 1992). Tenure relates marginal and non-significant, which is almost impossible to derive a conclusion out from it.

### *Theoretical contributions*

This study clarifies the relatively uninvestigated topic ambidexterity at the individual level, since ambidexterity at the individual level received a lot of interests from scholars to investigate in order to understand how employees can contribute to the ambidextrous behavior of the organization (Birkinshaw & Gupta, 2013; Bledow et al. 2009). Moreover, to our knowledge, this study explains as one of the first studies the interrelatedness of the variables self-efficacy, cognitive flexibility (e.g. one's personal characteristics), individual ambidexterity, and innovative performance at the individual level within high-tech SMEs.

The first contribution is that individual ambidexterity truly contributes to the level of innovative performance for individuals, and thereby it confirms the results of other scholars that individuals who are able to deal with paradoxical demands are better performing regarding their innovations (e.g. Rosing & Zacher, 2016; Kauppila & Tempelaar, 2016). Hence, ambidexterity is not considered as just an organizational or managerial construct, and thereby it is a multi-dimensional construct. The antecedents for behaving ambidextrous at the individual level is a suggestion for further research since this study was not able to find the true antecedents for behaving ambidextrous at the individual level.

Second, the individual ambidexterity scale is measured as a balancing factor regarding explorative and exploitative activities for individuals within SMEs, which is not yet investigated extensively. This relationship is proved to be significant. Therefore, this research contributes to the knowledge of academics that focuses their research on SMEs and innovation. The conclusion is that successfully balancing conflicting demands benefit the level of

innovative performance, which is particularly interesting since most firms are striving for ambidexterity in separated teams (e.g. structural ambidexterity). The omniscience that SMEs are facing difficulties regarding the human-, and financial resources to divide teams for achieving radical and incremental innovations, this study is able to show that SMEs are capable of competing without dividing project teams within the organization. Hence, SMEs can compete via employees that are able to balance their conflicting agenda in order to achieve both radical and incremental innovations.

Third, like many other scholars demonstrated there is an important gap that needs clarification regarding the antecedents of individual ambidexterity. The antecedents for managerial- or organizational ambidexterity are widely investigated, however, for individual ambidexterity it remains unclear what the antecedents for individual ambidexterity are (Schnellbacher et al., 2019; Zhang et al., 2019). Kauppila and Tempelaar (2016) are one of the few that found evidence for the relationship between social cognitive underpinnings and individual ambidexterity. However, this study shows that there is no relationship between personal characteristics and individual ambidexterity, but there is a relationship between personal characteristics and innovative performance. Therefore, this study suggests that other research should investigate what antecedents are truly benefitting individual ambidexterity.

Fourth, regarding the measurement scale is it unclear what the best operationalization for ambidexterity is because many different measures are used for ambidexterity, even after decades of research towards this topic (Rosing & Zacher, 2016). After conducting the EFA, this study contributes to the comprehensiveness of the operationalization for ambidexterity by deleting several items in order to achieve higher validity values. The improved scale that is used for this study contributes to other studies by providing a tested scale for measuring the construct in a balancing manner, which leads to more reliable and valid outcomes for similar studies.

### *Practical contributions*

Hereby, this section provides strategic and practical advice for managers that are working in high-tech SMEs. Based on these results, managers from these SMEs receive valuable insights for developing and managing a high-performing workforce.

First, managers must be aware that the workforce employed within their firm is highly valuable as the results showed that employees are able to balance conflicting demands within one function. Individuals who are capable of dealing with these tensions are performing higher regarding innovations which results in a more ambidextrous organization that is capable of outcompeting other organizations, which is extremely important within the high-tech industry. Individuals that behave ambidextrous are more time efficient and are capable to incorporate two jobs (tasks) into one. Therefore, the organization has no need of hiring designated teams with only one focus at the time. Managers should employ those employees that are ambidextrous on specific functions where innovation is required, by doing so, the manager will increase their innovation rate with projects that are more successful.

Second, managers must get to know their employees' social profile because self-efficient and cognitive flexible employees are performing better on innovations as well. Hence, employees that are intrinsically motivated, confident that they accomplish their tasks and are able to switch easily between jobs are the ones who innovate more and better. Learning about your employees can be done via quarterly performance reviews, whereby, the manager can find out what truly drives the employee to motivation. Moreover, managers should manage the employees in a passive or paradoxical management style focused on innovations in order to create more autonomy and commitment towards their job and innovations amongst the employees, by doing so the employees will have more motivation and responsibility, which results in more confidence for accomplishing the job.

Third, the educational background of employees is important for those functions that need to perform high regarding innovations. Whereas tenure and firm size was also expected to be a cause for better innovations, it was not. Hence, innovations can be learned but new knowledge via experience less easy, meaning the employee needs to possess a particular set of brains to increase their innovative performance rate.

Foremost, this study contributes to practitioners by clarifying the interrelatedness of the individuals' personal characteristics, being ambidextrous and achieving higher levels of innovative performance within SMEs in the high-tech industry.

#### *Limitations and future research*

Additionally to this study follows limitations. First, the most important limitation is the samples size, which are 100 respondents. This marginal number of respondents endangers the generalizability of the outcomes. The power of the analyzes, and thus, the conclusion will be improved by enlarging the data set and thereby the outcomes improve regarding its statistical power, which ultimately follows with more significant relationships. Future research is suggested to analyze the relationships with larger samples size in order to compare the results from this study. The second limitation is the sampling strategy. This research is built upon a data set that is gathered via non-probability sampling based on predefined definitions for non-managerial employees. The possibility of leaving out important respondents via non-probability sampling is present, which I noticed during the data collection period. The researcher often encountered the issue that startup entrepreneurs are not considered managers since they do have no or little employees to manage. However, these entrepreneurs face paradoxical tensions on a daily basis, which they have to solve alone by using their personal characteristics creatively. Hence, for future research it is recommended that the definition of non-managerial employees is broadened into non-managerial employees and entrepreneurs who manage their business

alone or is small teams. Third, the measurement scales for measuring the construct showed far from a simple structure, which means that the questions related to a certain construct were not exclusively measuring its belonging variable. After deleting several items, the items were all loading on the designated scale. However, with deleting items there is a lot of information loss which is sometimes circumstantial but needs to be avoided in order to remain more generalizable results. This limitation, and thus, the measurement scales need improvement, in order to measure the underlying construct more accurate. Therefore, future scholars are suggested to analyze the measurement scales repeatedly for discriminant- and convergent validity. As of now the measurement scales are valid and reliable, tested by the developers of the scales. However, the scales are tested in isolation, but not in context with related variables such as ambidexterity or the antecedents because the variables were so closely related that these caused the problem when measuring the factors together in one model. The fourth limitation which directly makes suggestions for future research is that the analysis is conducted via process. The model within this study is measuring two independent variables related to one dependent variable, additionally one mediator mediates the effect between the two independent variables. The limitation is related to the statistical program Hayes Process, which cannot analyze two independent variables within one analysis. Therefore, the researcher chose to conduct two separate analyses with each analyses including the other independent variable as covariate. According to Hayes (2018) this is the correct way of conducting the analysis with such a conceptual model. However, it is suggested to measure the conceptual model within one analysis since relationships can possibly change in direction, strength, or significance when measuring it all together. Therefore, future research should use a statistical program such as, Amos, Adanco or Smart-PLS which are structural equation modeling programs where causal effects can be measured. The last, and fifth, limitation and suggestion for future research is related to the control variables. This study has the purpose to find out how innovative non-

managerial employees are by using their personal characteristics in order to attain individual ambidexterity and high level of innovative performance. However, as proved by Kauppila and Tempelaar (2016) the managerial style is strongly influencing the performance and work ethic of the non-managerial employees. Therefore, future research should control for managerial style that is affecting the non-managerial employees, since it is expected that non-managerial employees that are managed via a paradoxical leadership style are performing better regarding individual ambidexterity and innovative performance with using their personal characteristics than employees that are managed via a passive style. Second, scholars found evidence for the size of the firm, resources and creativity regarding accomplishing innovations. Therefore, future research should conduct research towards the same variables, however, aimed at the difference between SMEs and corporates (e.g. smaller than 250 employees vs. larger than 250 employees) in order to find out if firm size is affecting innovative performance.

## 5. Conclusion

The main goal of this research is to explain the research gap, focused on the interrelatedness between non-managerial employees' personal characteristics (e.g., self-efficacy and cognitive flexibility), individual ambidexterity, and innovative performance within SMEs in the high-tech industry. Thereby, this research is clarifying and providing empirical evidence for the antecedents of ambidexterity at the individual level for non-managerial employees. This is done by answering the following research question:

*“What is the influence of personal characteristics (self-efficacy and cognitive flexibility) of non-managerial employees on attaining individual ambidexterity, and individual innovative performance within high-tech SMEs?”*

After reading the research question, it is expected that personal characteristics are related to individual ambidexterity, innovative performance and that the relationship between self-efficacy, cognitive flexibility, and innovative performance is mediated by individual ambidexterity. The study stated seven hypotheses that are tested, which are derived from literature. Each hypothesis is related to one effect between the independent-, and dependent variable, including the mediator. All hypotheses are expected to relate positive. Only hypothesis 1, 3, and 6 are found to be significant, meaning individual ambidexterity, and the personal characteristics of a non-managerial employee (e.g., self-efficacy and cognitive flexibility) are directly and positively related to innovative performance. However, the expectation that personal characteristics influence individual ambidexterity is not evident (H2 and 5). Hence, self-efficacy and cognitive flexibility are not supportive to balancing explorative and exploitative activities and dealing with conflicting demands. Looking to the mediation effect (H4 and H7), the direct effect between self-efficacy and innovative performance turned absent and the direct effect between cognitive flexibility and innovative performance increased, even with a non-significant mediator.



In order to give answer on the research question and, thus, the goal of this research, the interrelatedness between the variables does not exist within an overarching relationship as proposed in the conceptual model, however, each variable within the model stimulates the dependent variable in a separate manner. Second, the relationships that are significant are all positively directed, as expected from literature. In extension to answering the research question, education proved to relate positively with innovative performance, hence, higher educated employees are performing better on innovations relative to lower educated employees.

Concluding, this research adds new knowledge to the relatively unexplored relationship for non-managerial employees and the influence of their personal characteristics on attaining ambidextrous behavior and innovative performance within high-tech SMEs. The importance for clarification within this field of research for SMEs is due to the highly competitive industry and quick innovative successors, called creative destruction. Moreover, the need for an efficient and high-performing workforce is present to outcompete large well-funded organizations. Hence, with this research it is concluded that successfully balancing explorative and exploitative tasks leads to higher innovative performance. Next to this, by employing self-efficient, cognitive flexible, and higher educated employees on meaningful and important positions where innovation is required, causes the SME to perform better regarding innovations.

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## Appendices

### Appendix I: Overview of measurements

<i>Variable</i>	<i>Research used</i>	<i>Items</i>
<i>Innovative Performance</i>	Welbourne, Johnson, Erez, 1998	I come up with new ideas I work towards implementing new ideas. I find improved ways to do things. I create better processes and routines.
<i>Individual Ambidexterity</i>	Mom et al., 2009	<i>To what extent did you, last year, engage in work related activities that can be characterized as follows:</i> <b>Exploration activities</b> Searching for new possibilities with respect to products/services, processes, or markets Evaluating diverse options with respect to products/services, processes, or markets Focusing on strong renewal of products/services or processes Activities of which the associated yields or costs are currently unclear Activities requiring quite some adaptability of you Activities requiring you to learn new skills or knowledge Activities that are not (yet) clearly existing company policy <b>Exploitation activities</b> Activities of which a lot of experience has been accumulated by yourself Activities which you carry out as if it were routine Activities which serve existing (internal) customers with existing services/products Activities of which it is clear to you how to conduct them

		<p>Activities primarily focused on achieving short-term goals</p> <p>Activities which you can properly conduct by using your present knowledge</p> <p>Activities which clearly fit into existing company policy</p>
<i>Self-efficacy</i>	Chen et al., 2001	<p>I will be able to achieve most of the goals that I have set for myself.</p> <p>When facing difficult tasks, I am certain that I will accomplish them.</p> <p>In general, I think that I can obtain outcomes that are important to me.</p> <p>I believe I can succeed at most any endeavor to which I set my mind.</p> <p>I will be able to successfully overcome many challenges.</p> <p>I am confident that I can perform effectively on many different tasks.</p> <p>Compared to other people, I can do most tasks very well.</p> <p>Even when things are tough, I can perform quite well.</p>
<i>Cognitive Flexibility</i>	Martin & Rubin, 1995	<p>I can communicate an idea in many different ways.</p> <p>I avoid new and unusual situations. (R)</p> <p>I feel like I never get to make decisions. (R)</p> <p>I can find workable solutions to seemingly unsolvable problems.</p> <p>I seldom have choices when deciding how to behave. (R)</p> <p>I am willing to work at creative solutions to problems.</p> <p>In any given situation, I am able to act appropriately.</p> <p>My behavior is a result of conscious decisions that I make.</p> <p>I have many possible ways of behaving in any given situation.</p> <p>I have difficulty using my knowledge on a given topic in real life situations. (R)</p> <p>I am willing to listen and consider alternatives for handling a problem.</p> <p>I have the self-confidence necessary to try different ways of behaving.</p>

*Note: Items marked “R” are reversed scored.*

## Appendix II: Data preparation

### *Frequencies table per variable*

Statistics												
		I will be able to achieve most of the goals that I have set for myself.	When facing difficult tasks, I am certain that I will accomplish them.	In general, I think that I can obtain outcomes that are important to me.	I believe I can succeed at most any endeavor to which I set my mind.	I will be able to successfully overcome many challenges.	I am confident that I can perform effectively on many different tasks.	Compared to other people, I can do most tasks very well.	Even when things are tough, I can perform quite well.	I can communicate an idea in many different ways.	I avoid new and unusual situations.	I feel like I never get to make decisions.
N	Valid	100	100	100	100	100	100	100	100	100	100	100
	Missing	8	8	8	8	8	8	8	8	8	8	8
Mean		5.82	5.59	5.61	5.72	5.71	5.58	5.20	5.45	5.87	2.29	2.14
Sum		582	559	561	572	571	558	520	545	587	229	214

I can find workable solutions to seemingly unsolvable problems.	I seldom have choices when deciding how to behave.	I am willing to work at creative solutions to problems.	In any given situation, I am able to act appropriately.	My behavior is a result of conscious decisions that I make.	I have many possible ways of behaving in any given situation.	I have difficulty using my knowledge on a given topic in real life situations.	I am willing to listen and consider alternatives for handling a problem.	I have the self-confidence necessary to try different ways of behaving.	Searching for new possibilities with respect to products/services, processes, or markets	Evaluating diverse options with respect to products/services, processes, or markets	Focusing on strong renewal of products/services or processes
100	100	100	100	100	100	100	100	100	100	100	100
8	8	8	8	8	8	8	8	8	8	8	8
5.30	2.29	5.99	5.57	5.46	5.41	2.64	6.01	5.80	5.73	5.74	5.06
530	229	599	557	546	541	264	601	580	573	574	506

Activities of which the associated yields or costs are currently unclear	Activities requiring quite some adaptability of you	Activities requiring you to learn new skills or knowledge	Activities that are not (yet) clearly existing company policy	Activities of which a lot of experience has been accumulated by yourself	Activities which you carry out as if it were routine	Activities which serve existing (internal) customers with existing services/products	Activities of which it is clear to you how to conduct them	Activities primarily focused on achieving short-term goals	Activities which you can properly conduct by using your present knowledge	Activities which clearly fit into existing company policy	I come up with new ideas
100	100	100	100	100	100	100	100	100	100	100	100
8	8	8	8	8	8	8	8	8	8	8	8
4.94	5.71	5.74	4.88	5.59	5.43	5.19	5.56	5.31	5.67	5.31	5.82
494	571	574	488	559	543	519	556	531	567	531	582

I work towards implementing new ideas.	I find improved ways to do things.	I create better processes and routines.	Age	Gender	Education	Tenure within profession (in years)	Firm size
100	100	100	100	100	100	108	100
8	8	8	8	8	8	0	8
5.43	5.70	5.41	2.99	1.35	2.69		1.48
543	570	541	299	135	269		148

### Appendix III: Exploratory Factor Analysis

Items deleted before final iteration: SE\_3, CF\_8, EXPLR\_2, EXPLT\_1, IP\_1, CF\_4, EXPLR\_6, SE\_4, EXPLR\_5, SE\_6, CF\_12 deleted (final iteration)

#### **KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.756
Bartlett's Test of Sphericity	Approx. Chi-Square	1316.270
	df	351
	Sig.	.000

All communalities are above .2. The lowest communality scores .205 which is larger than the critical value.

The initial eigen value of the 5 extracted factors has the lowest factor an eigen value of 1.671 with a cumulative percentage of 60.9%.

#### **Rotated Factor Matrix<sup>a</sup>**

	Factor				
	1	2	3	4	5
SE_1 I will be able to achieve most of the goals that I have set for myself.				.463	
SE_2 When facing difficult tasks, I am certain that I will accomplish them.				.669	
SE_5 I will be able to successfully overcome many challenges.				.438	
SE_7 Compared to other people, I can do most tasks very well.				.653	

SE_8 Even when things are tough, I can perform quite well.				.700	
CF_1 I can communicate an idea in many different ways.					.618
CF_6 I am willing to work at creative solutions to problems.	.730				
CF_7 In any given situation, I am able to act appropriately.	.329				.558
CF_9 I have many possible ways of behaving in any given situation.					.617
CF_11 I am willing to listen and consider alternatives for handling a problem.	.726				
EXPLR_1 Searching for new possibilities with respect to products/services, processes, or markets		.637			
EXPLR_3 Focusing on strong renewal of products/services or processes		.745			
EXPLR_4 Activities of which the associated yields or costs are currently unclear		.797			

EXPLR_7 Activities that are not (yet) clearly existing company policy		.691	-.330		
EXPLT_2 Activities which you carry out as if it were routine			.619		.388
EXPLT_3 Activities which serve existing (internal) customers with existing services/products			.597		
EXPLT_4 Activities of which it is clear to you how to conduct them			.690		
EXPLT_5 Activities primarily focused on achieving short-term goals			.665		
EXPLT_6 Activities which you can properly conduct by using your present knowledge			.668		
EXPLT_7 Activities which clearly fit into existing company policy			.747		
IP_2 I work towards implementing new ideas.		.709		.314	
IP_4 I create better processes and routines.		.742			
IP_3 I find improved ways to do things.	.535	.471		.329	



R_CF_2 I look for new and unusual situations	.698				
R_CF_3 I feel like I get to make decisions	.692				
R_CF_5 I often have choices when deciding how to behave	.662				
R_CF_10 I find it easy to use my knowledge on a given topic in real life situations.	.498				

Extraction Method: Principal Axis Factoring.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

## Appendix IV: Reliability Analysis

*New computed variables (including items and reliability test).*

Factor	Items	Cronbach's Alpha
Self-Efficacy	SE_1 SE_2 SE_5 SE_7 SE_8	.730
Cognitive Flexibility	CF_1 R_CF_2 R_CF_3 R_CF_5 CF_6 CF_7 R_CF_10 CF_11	.822
Exploration	EXPR_1 EXPR_3 EXPR_4 EXPR_7	.811
Exploitation	EXPL_2 EXPL_3 EXPL_4 EXPL_5 EXPL_6 EXPL_7	.830
Innovative Performance	IP_2 IP_3 IP_4	.794

***Self-Efficacy scale***

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.730	.729	5

### Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SE_1 I will be able to achieve most of the goals that I have set for myself.	21.95	5.078	.412	.212	.714
SE_2 When facing difficult tasks, I am certain that I will accomplish them.	22.18	4.715	.583	.386	.647
SE_5 I will be able to successfully overcome many challenges.	22.06	5.734	.356	.161	.728
SE_7 Compared to other people, I can do most tasks very well.	22.57	4.369	.524	.310	.673
SE_8 Even when things are tough, I can perform quite well.	22.32	4.664	.597	.371	.642

### *Cognitive Flexibility scale*

#### Reliability Statistics

Cronbach's Alpha	N of Items
.813	9

### Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
CF_1 I can communicate an idea in many different ways.	45.62	24.278	.424	.805
CF_6 I am willing to work at creative solutions to problems.	45.50	22.030	.663	.779
CF_7 In any given situation, I am able to act appropriately.	45.92	23.610	.462	.801
CF_9 I have many possible ways of behaving in any given situation.	46.08	25.004	.251	.822
CF_11 I am willing to listen and consider alternatives for handling a problem.	45.48	22.050	.563	.788
R_CF_2 I look for new and unusual situations	45.78	21.345	.637	.779
R_CF_3 I feel like I get to make decisions	45.63	21.367	.690	.773
R_CF_5 I often have choices when deciding how to behave	45.78	21.608	.530	.793

R_CF_10 I find it easy to use my knowledge on a given topic in real life situations.	46.13	20.478	.469	.810
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Choice: delete CF\_9.

Argumentation: Cronbach's alpha increases .09 and the item is loading on construct 5 which is an undefined construct and represented by other items as well.

### *Exploration scale*

#### **Reliability Statistics**

Cronbach's Alpha	N of Items
.811	4

#### **Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
EXPLR_1 Searching for new possibilities with respect to products/services, processes, or markets	14.88	9.945	.578	.793
EXPLR_3 Focusing on strong renewal of products/services or processes	15.55	8.896	.572	.788

EXPLR_4 Activities of which the associated yields or costs are currently unclear	15.67	6.829	.714	.724
EXPLR_7 Activities that are not (yet) clearly existing company policy	15.73	7.714	.697	.728

### ***Exploitation scale***

#### **Reliability Statistics**

<i>Cronbach's Alpha</i>	<i>N of Items</i>
.830	6

#### **Item-Total Statistics**

	<i>Scale Mean if Item Deleted</i>	<i>Scale Variance if Item Deleted</i>	<i>Corrected Item-Total Correlation</i>	<i>Cronbach's Alpha if Item Deleted</i>
EXPLT_2 Activities which you carry out as if it were routine	27.04	14.524	.581	.806
EXPLT_3 Activities which serve existing (internal) customers with existing services/products	27.28	14.264	.575	.807
EXPLT_4 Activities of which it is clear to you how to conduct them	26.91	14.850	.606	.802

<i>EXPLT_5 Activities primarily focused on achieving short-term goals</i>	<i>27.16</i>	<i>13.934</i>	<i>.600</i>	<i>.802</i>
<i>EXPLT_6 Activities which you can properly conduct by using your present knowledge</i>	<i>26.80</i>	<i>14.747</i>	<i>.549</i>	<i>.812</i>
<i>EXPLT_7 Activities which clearly fit into existing company policy</i>	<i>27.16</i>	<i>13.025</i>	<i>.695</i>	<i>.781</i>



### *Innovative Performance scale*

#### **Reliability Statistics**

Cronbach's	
Alpha	N of Items
.794	3

#### **Item-Total Statistics**

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
IP_2 I work towards implementing new ideas.	11.11	3.978	.689	.663
IP_3 I find improved ways to do things.	10.84	5.570	.554	.808
IP_4 I create better processes and routines.	11.13	3.892	.698	.653

## Appendix V: Descriptive statistics

### *Descriptive statistics control variables: Univariate*

#### Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	10	10.0	10.0	10.0
	25-34	28	28.0	28.0	38.0
	35-44	26	26.0	26.0	64.0
	45-54	25	25.0	25.0	89.0
	55-64	11	11.0	11.0	100.0
	Total	100	100.0	100.0	

#### Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	65	65.0	65.0	65.0
	Female	35	35.0	35.0	100.0
	Total	100	100.0	100.0	

## Education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Graduated from high school	13	13.0	13.0	13.0
	Graduated from university of applied sciences (HBO)	32	32.0	32.0	45.0
	Graduated from bachelor's degree (WO)	31	31.0	31.0	76.0
	Graduated from master's degree	21	21.0	21.0	97.0
	Doctoral degree (PhD)	3	3.0	3.0	100.0
	Total	100	100.0	100.0	

## Firm size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-49 employees (small sized firm)	52	52.0	52.0	52.0
	50-250 employees (medium sized firm)	48	48.0	48.0	100.0
	Total	100	100.0	100.0	

**Tenure within profession (in years)**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	2	2.0	2.0	2.0
	2	6	6.0	6.0	8.0
	3	5	5.0	5.0	13.0
	4	5	5.0	5.0	18.0
	5	6	6.0	6.0	24.0
	6	5	5.0	5.0	29.0
	7	7	7.0	7.0	36.0
	8	7	7.0	7.0	43.0
	9	3	3.0	3.0	46.0
	10	3	3.0	3.0	49.0
	11	5	5.0	5.0	54.0
	12	3	3.0	3.0	57.0
	13	5	5.0	5.0	62.0
	14	5	5.0	5.0	67.0
	15	2	2.0	2.0	69.0
	16	3	3.0	3.0	72.0
	17	1	1.0	1.0	73.0
	18	5	5.0	5.0	78.0
	19	4	4.0	4.0	82.0
	20	3	3.0	3.0	85.0
	22	2	2.0	2.0	87.0
	23	2	2.0	2.0	89.0
	24	3	3.0	3.0	92.0
	27	1	1.0	1.0	93.0
	28	3	3.0	3.0	96.0
	30	2	2.0	2.0	98.0
	34	1	1.0	1.0	99.0
	39	1	1.0	1.0	100.0
	Total	100	100.0	100.0	

### Descriptive Statistics control variables

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Age	100	1	5	2.99	1.176	.058	.241	-.911	.478
Gender	100	1	2	1.35	.479	.639	.241	-1.625	.478
Education	100	1	5	2.69	1.042	.108	.241	-.714	.478
Tenure within profession (in years)	100	1	39	12.24	8.274	.866	.241	.310	.478
Firm size	100	1	2	1.48	.502	.081	.241	-2.034	.478
Valid N (listwise)	100								

### *Descriptive statistics independent-, mediating-, and dependent variable (univariate)*

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
SeEf	100	3.40	6.80	5.5540	.53625	-.679	.241	2.129	.478
CogFl	100	3.38	6.88	5.7600	.62505	-.465	.241	.698	.478
IndAmb	100	8.50	45.50	27.6842	5.57048	-.588	.241	1.836	.478
IP	100	2.33	7.00	5.5133	1.00774	-.976	.241	1.279	.478
Valid N (listwise)	100								

## Descriptive statistics: Bivariate

### Correlations

		SeEf	CogFl	IP	IndAmb	Age	Gender	Education	Tenure within profession (in years)	Firm size
SeEf	Pearson Correlation	1	.132	.417**	.059	-.033	-.212*	.455**	-.001	-.097
	Sig. (2-tailed)		.189	.000	.560	.746	.034	.000	.995	.336
	N	100	100	100	100	100	100	100	100	100
CogFl	Pearson Correlation	.132	1	.344**	.031	.055	.056	.111	-.080	-.293**
	Sig. (2-tailed)	.189		.000	.761	.586	.583	.269	.430	.003
	N	100	100	100	100	100	100	100	100	100
IP	Pearson Correlation	.417**	.344**	1	.464**	-.112	-.208*	.445**	-.143	-.259**
	Sig. (2-tailed)	.000	.000		.000	.267	.037	.000	.156	.009
	N	100	100	100	100	100	100	100	100	100
IndAmb	Pearson Correlation	.059	.031	.464**	1	.070	-.155	.161	.137	.006
	Sig. (2-tailed)	.560	.761	.000		.490	.123	.109	.175	.955
	N	100	100	100	100	100	100	100	100	100
Age	Pearson Correlation	-.033	.055	-.112	.070	1	.167	.055	.823**	.248*
	Sig. (2-tailed)	.746	.586	.267	.490		.096	.586	.000	.013
	N	100	100	100	100	100	100	100	100	100
Gender	Pearson Correlation	-.212*	.056	-.208*	-.155	.167	1	-.266**	.080	.092

	Sig. (2-tailed)	.034	.583	.037	.123	.096		.007	.426	.361
	N	100	100	100	100	100	100	100	100	100
Education	Pearson Correlation	.455**	.111	.445**	.161	.055	-.266**	1	-.019	-.253*
	Sig. (2-tailed)	.000	.269	.000	.109	.586	.007		.848	.011
	N	100	100	100	100	100	100	100	100	100
Tenure within profession (in years)	Pearson Correlation	-.001	-.080	-.143	.137	.823**	.080	-.019	1	.300**
	Sig. (2-tailed)	.995	.430	.156	.175	.000	.426	.848		.002
	N	100	100	100	100	100	100	100	100	100
Firm size	Pearson Correlation	-.097	-.293**	-.259**	.006	.248*	.092	-.253*	.300**	1
	Sig. (2-tailed)	.336	.003	.009	.955	.013	.361	.011	.002	
	N	100	100	100	100	100	100	100	100	100

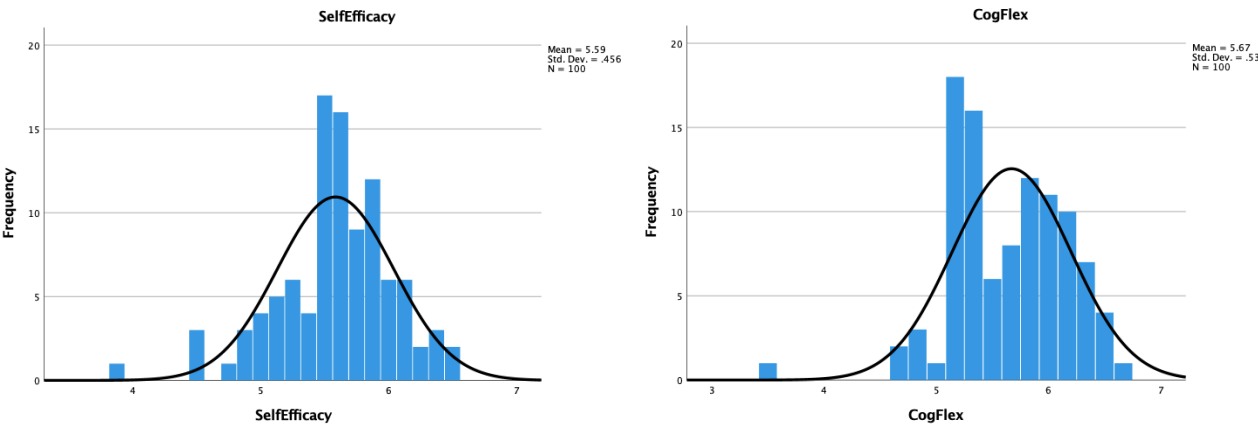
\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

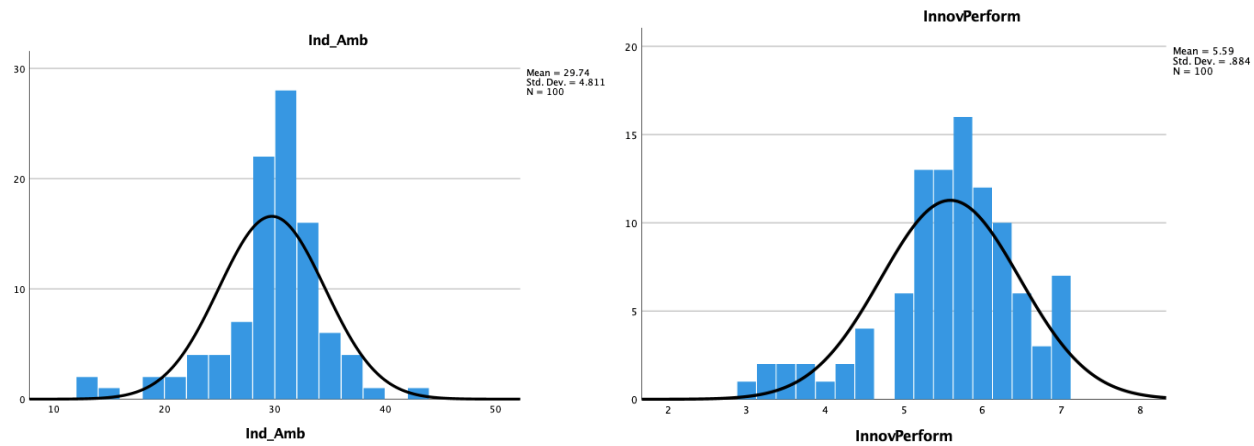
Appendix VI: Assumptions for Mediation.

Appendix VIa: Normality of the error term distribution

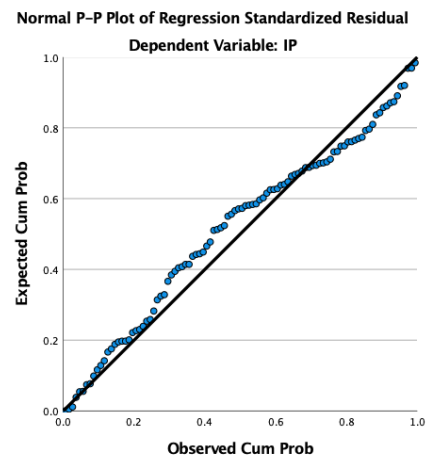
*Univariate testing*

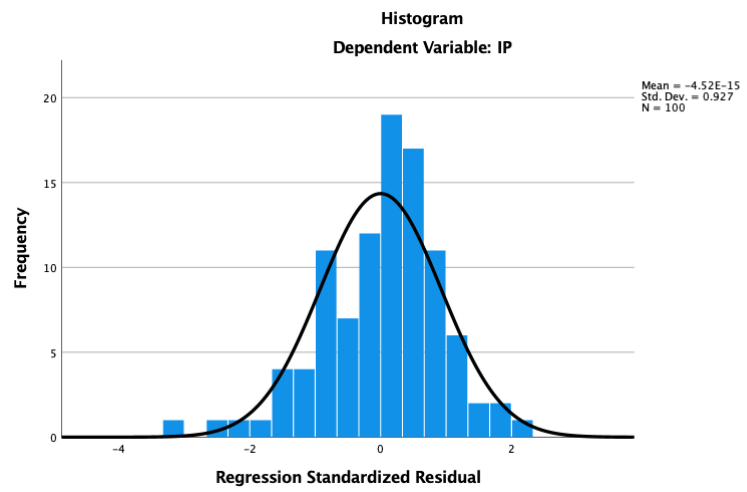




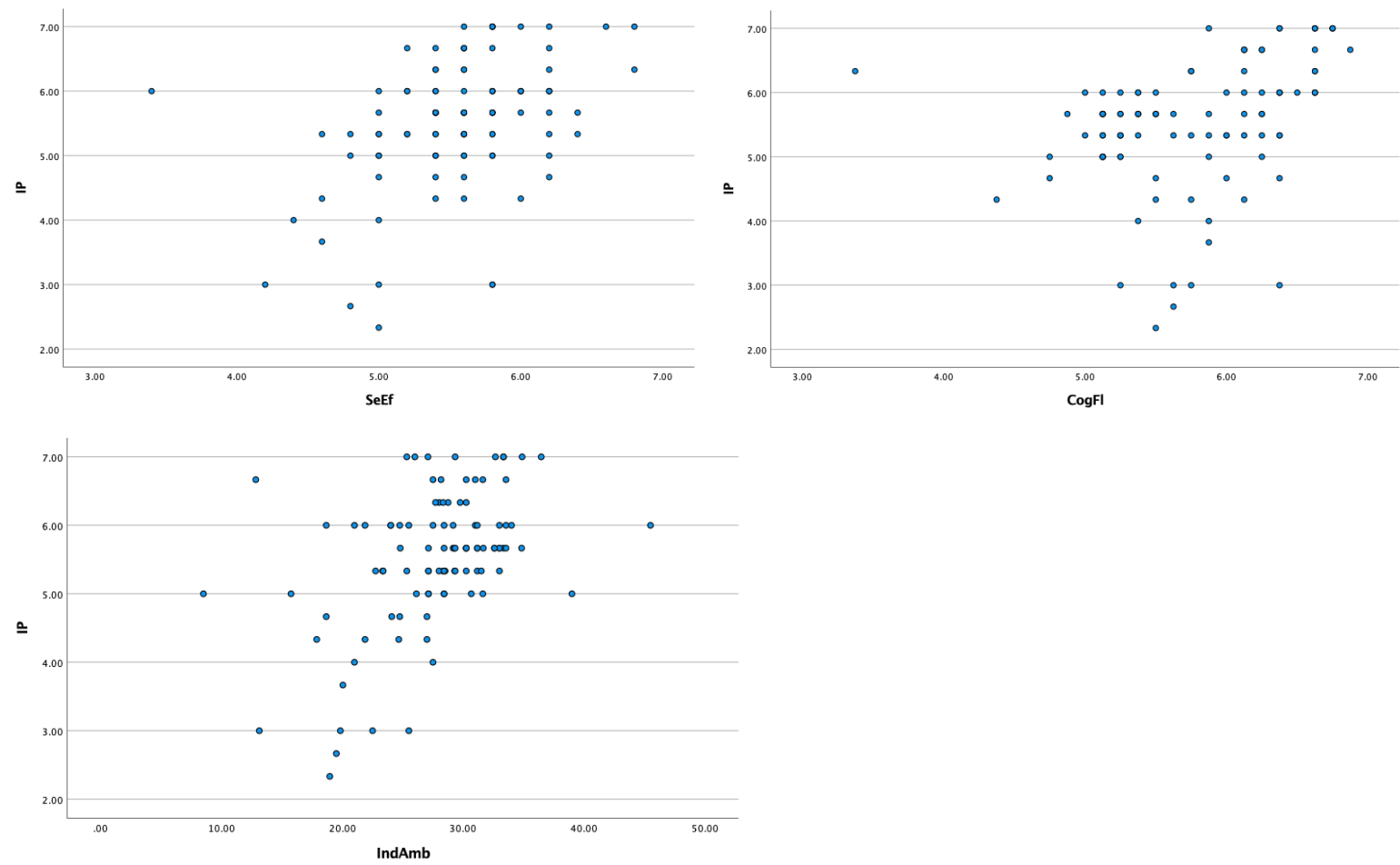


### *Bivariate testing*





Appendix VIb: Linearity of the phenomenon measured



## Appendix VIc: Independence or the error terms

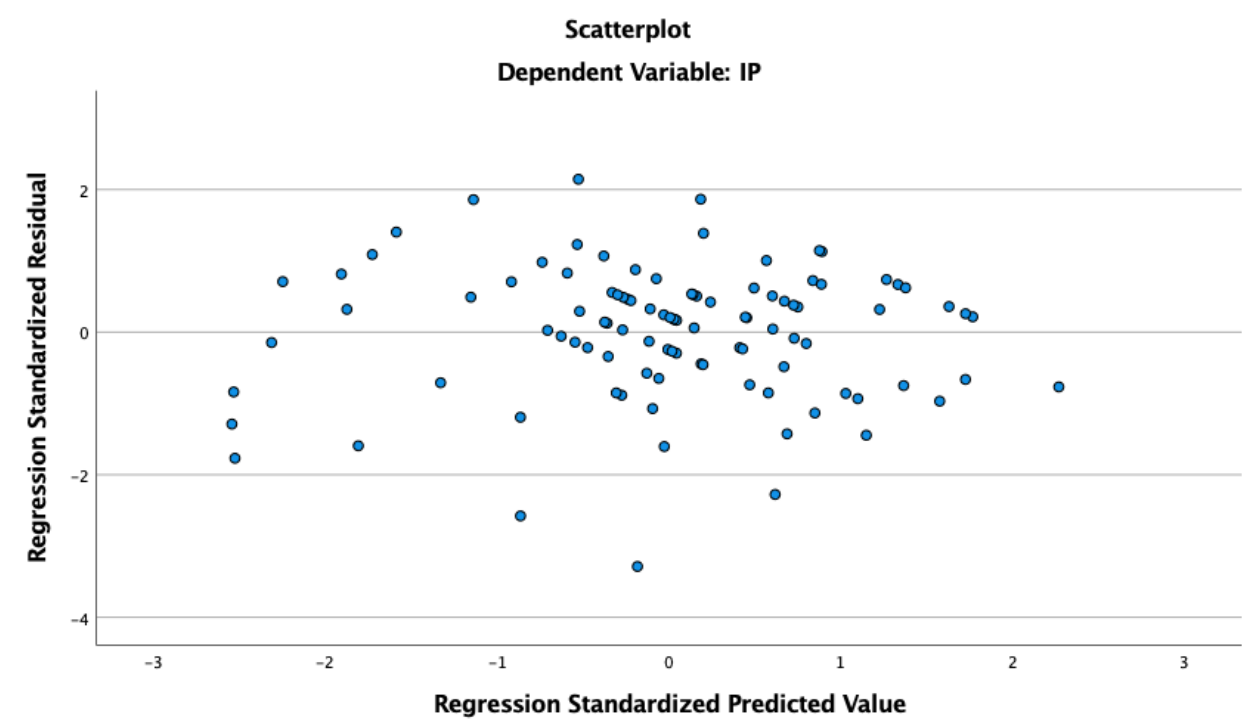
### Coefficients<sup>a</sup>

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	-.483	1.242		-.389	.698					
SeEf	.393	.162	.209	2.431	.017	.417	.255	.175	.701	1.426
CogFl	.440	.129	.273	3.418	.001	.344	.348	.246	.813	1.230
IndAmb	.073	.014	.404	5.248	.000	.464	.495	.378	.875	1.143
Gender	-.098	.175	-.047	-.559	.577	-.208	-.061	-.040	.750	1.333
Tenure within profession (in years)	-.011	.017	-.094	-.666	.507	-.143	-.072	-.048	.262	3.817
Firm size	-.168	.167	-.083	-1.002	.319	-.259	-.108	-.072	.749	1.336
Dummy Age 18-24	-.362	.287	-.108	-1.261	.211	-.148	-.136	-.091	.703	1.422

Dummy Age 35-44	-.173	.225	-.076	-.769	.444	.151	-.083	-.055	.535	1.869
Dummy Age 45-54	-.217	.297	-.094	-.730	.467	-.234	-.079	-.053	.316	3.161
Dummy Age 55-64	-.244	.440	-.076	-.555	.580	-.042	-.060	-.040	.275	3.636
Dummy Education High School	-.644	.259	-.216	-2.483	.015	-.405	-.260	-.179	.687	1.456
Dummy Education WO	-.053	.203	-.024	-.260	.796	.081	-.028	-.019	.590	1.694
Dummy Education Master	.049	.238	.020	.204	.839	.226	.022	.015	.555	1.801
Dummy Education PhD	.730	.480	.124	1.520	.132	.202	.163	.110	.778	1.285

a. Dependent Variable: IP

Appendix VIId: Constant variance of the error term



## Appendix VII: Mediation Analysis

### *Model 1: Multiple regression without control variables and mediator variable*

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.508 <sup>a</sup>	.258	.243	.87667	.258	16.908	2	97	.000

a. Predictors: (Constant), CogFl, SeEf

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	25.989	2	12.994	16.908	.000 <sup>b</sup>
	Residual	74.549	97	.769		
	Total	100.538	99			

a. Dependent Variable: IP

b. Predictors: (Constant), CogFl, SeEf

# **Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.159	1.152		-1.006	.317
	SeEf	.710	.166	.378	4.283	.000
	CogFl	.474	.142	.294	3.331	.001

a. Dependent Variable: IP

## ***Model 2: Mediation analysis without control variables***

### ***Model 2.1: Cognitive Flexibility as X variable***

Model : 4

Y : IP

X : CogFl

M : IndAmb

Covariates:

SeEf

Sample

Size: 100



\*\*\*\*\*

OUTCOME VARIABLE:

IndAmb

Model Summary

R	R-sq	MSE	F	df1	df2	p
.0634	.0040	31.5426	.1958	2.0000	97.0000	.8225

Model

	coeff	se	t	p	LLCI	ULCI
constant	23.2566	7.3786	3.1519	.0022	8.6121	37.9011
CogFl	.2085	.9111	.2288	.8195	-1.5998	2.0168
SeEf	.5810	1.0620	.5471	.5856	-1.5268	2.6887

Standardized coefficients

	coeff
CogFl	.0234
SeEf	.0559

\*\*\*\*\*

OUTCOME VARIABLE:

IP

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6681	.4464	.5798	25.8051	3.0000	96.0000	.0000

#### Model

	coeff	se	t	p	LLCI	ULCI
constant	-2.9863	1.0503	-2.8432	.0055	-5.0711	-.9014
CogFl	.4574	.1236	3.7019	.0004	.2121	.7026
IndAmb	.0786	.0138	5.7086	.0000	.0513	.1059
SeEf	.6643	.1442	4.6071	.0000	.3781	.9506

#### Standardized coefficients

	coeff
CogFl	.2837
IndAmb	.4344
SeEf	.3535

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

#### OUTCOME VARIABLE:

IP

#### Model Summary

R	R-sq	MSE	F	df1	df2	p
.5084	.2585	.7685	16.9076	2.0000	97.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-1.1588	1.1518	-1.0061	.3169	-3.4447	1.1271
CogFl	.4738	.1422	3.3313	.0012	.1915	.7560
SeEf	.7100	.1658	4.2830	.0000	.3810	1.0390

Standardized coefficients

	coeff
CogFl	.2938
SeEf	.3778

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y \*\*\*\*\*

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps	c_cs
.4738	.1422	3.3313	.0012	.1915	.7560	.4701	.2938

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c'_ps	c'_cs
.4574	.1236	3.7019	.0004	.2121	.7026	.4539	.2837

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0164	.0732	-.1463	.1523

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0163	.0720	-.1438	.1484

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0102	.0437	-.0840	.0934

\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

----- END MATRIX -----

### ***Model 2.2: Self-Efficacy as X variable***

Model : 4

Y : IP

X : SeEf  
M : IndAmb

Covariates:

CogFl

Sample

Size: 100

\*\*\*\*\*

OUTCOME VARIABLE:

IndAmb

Model Summary

R	R-sq	MSE	F	df1	df2	p
.0634	.0040	31.5426	.1958	2.0000	97.0000	.8225

Model

	coeff	se	t	p	LLCI	ULCI
constant	23.2566	7.3786	3.1519	.0022	8.6121	37.9011
SeEf	.5810	1.0620	.5471	.5856	-1.5268	2.6887
CogFl	.2085	.9111	.2288	.8195	-1.5998	2.0168

Standardized coefficients

	coeff
SeEf	.0559
CogFl	.0234

\*\*\*\*\*

OUTCOME VARIABLE:

IP

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6681	.4464	.5798	25.8051	3.0000	96.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-2.9863	1.0503	-2.8432	.0055	-5.0711	-.9014
SeEf	.6643	.1442	4.6071	.0000	.3781	.9506
IndAmb	.0786	.0138	5.7086	.0000	.0513	.1059
CogFl	.4574	.1236	3.7019	.0004	.2121	.7026

Standardized coefficients

	coeff
SeEf	.3535
IndAmb	.4344
CogFl	.2837

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

OUTCOME VARIABLE:

IP

Model Summary

R	R-sq	MSE	F	df1	df2	p
.5084	.2585	.7685	16.9076	2.0000	97.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-1.1588	1.1518	-1.0061	.3169	-3.4447	1.1271
SeEf	.7100	.1658	4.2830	.0000	.3810	1.0390
CogFl	.4738	.1422	3.3313	.0012	.1915	.7560

Standardized coefficients

	coeff
SeEf	.3778
CogFl	.2938

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y \*\*\*\*\*

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps	c_cs
--------	----	---	---	------	------	------	------

.7100	.1658	4.2830	.0000	.3810	1.0390	.7045	.3778
-------	-------	--------	-------	-------	--------	-------	-------

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c' _ps	c' _cs
.6643	.1442	4.6071	.0000	.3781	.9506	.6592	.3535

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0457	.1439	-.2065	.3582

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0453	.1417	-.2096	.3441

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0243	.0741	-.1248	.1671

\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:



5000

----- END MATRIX -----

***Model 3: Mediation Analysis including control variables***

***Model 3.1: Cognitive Flexibility as X variable***

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Version 3.5.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.      [www.afhayes.com](http://www.afhayes.com)

Documentation available in Hayes (2018). [www.guilford.com/p/hayes3](http://www.guilford.com/p/hayes3)

\*\*\*\*\*

Model : 4

Y : IP

X : CogFl

M : IndAmb

Covariates:

SeEf      D\_Ed\_HS   D\_Ed\_HBO   D\_Ed\_WO   D\_Ed\_Ma   D\_Age\_18   D\_Age\_35   D\_Age\_45   D\_Age\_55   Gender   Tenure  
 FirmSize

Sample

Size: 100

\*\*\*\*\*

OUTCOME VARIABLE:

IndAmb

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3541	.1254	31.2428	.9482	13.0000	86.0000	.5083

Model

	coeff	se	t	p	LLCI	ULCI
constant	31.4380	9.7017	3.2405	.0017	12.1516	50.7244
CogFl	.8257	.9927	.8317	.4079	-1.1478	2.7992
SeEf	-1.2056	1.2441	-.9690	.3352	-3.6787	1.2676
D_Ed_HS	-4.9748	4.0508	-1.2281	.2228	-13.0276	3.0780
D_Ed_HBO	-2.5738	3.7044	-.6948	.4891	-9.9379	4.7903
D_Ed_WO	-1.5345	3.5741	-.4293	.6687	-8.6396	5.5706
D_Ed_Ma	-1.8668	3.5847	-.5208	.6039	-8.9930	5.2594
D_Age_18	-.6313	2.2210	-.2843	.7769	-5.0465	3.7838

D_Age_35	.8488	1.7397	.4879	.6269	-2.6097	4.3072
D_Age_45	-2.0129	2.2847	-.8810	.3808	-6.5547	2.5289
D_Age_55	-4.1884	3.3763	-1.2405	.2182	-10.9003	2.5235
Gender	-1.1086	1.3477	-.8226	.4130	-3.7878	1.5706
Tenure	.2275	.1304	1.7451	.0845	-.0316	.4866
Firmsize	.0288	1.2931	.0223	.9823	-2.5418	2.5994

# Standardized coefficients

	coeff
CogFl	.0926
SeEf	-.1161
D_Ed_HS	-.3019
D_Ed_HBO	-.2166
D_Ed_WO	-.1280
D_Ed_Ma	-.1372
D_Age_18	-.0342
D_Age_35	.0672
D_Age_45	-.1573
D_Age_55	-.2364
Gender	-.0954
Tenure	.3379
Firmsize	.0026

\*\*\*\*\*

OUTCOME VARIABLE:

IP

# Model Summary

R	R-sq	MSE	F	df1	df2	p
.7473	.5584	.5223	7.6777	14.0000	85.0000	.0000

# Model

	coeff	se	t	p	LLCI	ULCI
constant	.2471	1.3288	.1860	.8529	-2.3949	2.8891
CogFl	.4404	.1289	3.4176	.0010	.1842	.6967
IndAmb	.0732	.0139	5.2481	.0000	.0454	.1009
SeEf	.3932	.1617	2.4311	.0172	.0716	.7148
D_Ed_HS	-1.3738	.5283	-2.6002	.0110	-2.4242	-.3233
D_Ed_HBO	-.7300	.4803	-1.5199	.1323	-1.6850	.2250
D_Ed_WO	-.7829	.4626	-1.6923	.0943	-1.7027	.1369
D_Ed_Ma	-.6814	.4642	-1.4679	.1458	-1.6044	.2416
D_Age_18	-.3623	.2873	-1.2610	.2108	-.9335	.2090
D_Age_35	-.1733	.2253	-.7693	.4438	-.6212	.2746
D_Age_45	-.2167	.2967	-.7302	.4672	-.8067	.3733
D_Age_55	-.2444	.4404	-.5549	.5804	-1.1201	.6313
Gender	-.0979	.1749	-.5595	.5773	-.4457	.2500
Tenure	-.0114	.0172	-.6660	.5072	-.0455	.0227
Firmsize	-.1675	.1672	-1.0019	.3192	-.4999	.1649

# Standardized coefficients

	coeff
CogFl	.2732
IndAmb	.4045
SeEf	.2092
D_Ed_HS	-.4608
D_Ed_HBO	-.3396
D_Ed_WO	-.3611
D_Ed_Ma	-.2768
D_Age_18	-.1084
D_Age_35	-.0758
D_Age_45	-.0936
D_Age_55	-.0763
Gender	-.0466
Tenure	-.0938
Firmsize	-.0835

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

OUTCOME VARIABLE:

IP

## Model Summary

R	R-sq	MSE	F	df1	df2	p
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.6445 .4153 .6835 4.6993 13.0000 86.0000 .0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	2.5474	1.4350	1.7753	.0794	-.3052	5.4001
CogFl	.5009	.1468	3.4110	.0010	.2090	.7928
SeEf	.3050	.1840	1.6574	.1011	-.0608	.6708
D_Ed_HS	-1.7378	.5992	-2.9004	.0047	-2.9289	-.5467
D_Ed_HBO	-.9183	.5479	-1.6760	.0974	-2.0075	.1709
D_Ed_WO	-.8951	.5286	-1.6933	.0940	-1.9460	.1558
D_Ed_Ma	-.8180	.5302	-1.5428	.1265	-1.8721	.2360
D_Age_18	-.4085	.3285	-1.2434	.2171	-1.0615	.2446
D_Age_35	-.1112	.2573	-.4321	.6667	-.6227	.4003
D_Age_45	-.3640	.3379	-1.0771	.2845	-1.0357	.3078
D_Age_55	-.5509	.4994	-1.1031	.2731	-1.5436	.4419
Gender	-.1790	.1993	-.8979	.3717	-.5753	.2173
Tenure	.0052	.0193	.2709	.7871	-.0331	.0436
Firmsize	-.1654	.1913	-.8648	.3895	-.5456	.2148

Standardized coefficients

	coeff
CogFl	.3107
SeEf	.1623
D_Ed_HS	-.5829

D_Ed_HBO	-.4272
D_Ed_WO	-.4129
D_Ed_Ma	-.3323
D_Age_18	-.1222
D_Age_35	-.0486
D_Age_45	-.1572
D_Age_55	-.1719
Gender	-.0851
Tenure	.0429
Firmsize	-.0824

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y \*\*\*\*\*

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps	c_cs
.5009	.1468	3.4110	.0010	.2090	.7928	.4970	.3107

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c'_ps	c'_cs
.4404	.1289	3.4176	.0010	.1842	.6967	.4371	.2732

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0604	.0766	-.0975	.2087

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0600	.0761	-.0932	.2130

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	.0375	.0469	-.0564	.1314

\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

NOTE: Due to estimation problems, some bootstrap samples had to be replaced.

The number of times this happened was:

244

----- END MATRIX -----



### ***Model 3.2 Self-Efficacy as X variable***

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Version 3.5.3 \*\*\*\*\*

Written by Andrew F. Hayes, Ph.D.      [www.afhayes.com](http://www.afhayes.com)

Documentation available in Hayes (2018). [www.guilford.com/p/hayes3](http://www.guilford.com/p/hayes3)

\*\*\*\*\*

Model    : 4

Y        : IP

X        : SeEf

M        : IndAmb

Covariates:

D\_Ed\_HS   D\_Ed\_HBO   D\_Ed\_WO   D\_Ed\_Ma   D\_Age\_18   D\_Age\_35   D\_Age\_45   D\_Age\_55   Gender   Tenure   Firmsize   CogFl

Sample

Size:   100

\*\*\*\*\*

OUTCOME VARIABLE:

IndAmb

Model Summary

R	R-sq	MSE	F	df1	df2	p
.3541	.1254	31.2428	.9482	13.0000	86.0000	.5083

Model

	coeff	se	t	p	LLCI	ULCI
constant	31.4380	9.7017	3.2405	.0017	12.1516	50.7244
SeEf	-1.2056	1.2441	-.9690	.3352	-3.6787	1.2676
D_Ed_HS	-4.9748	4.0508	-1.2281	.2228	-13.0276	3.0780
D_Ed_HBO	-2.5738	3.7044	-.6948	.4891	-9.9379	4.7903
D_Ed_WO	-1.5345	3.5741	-.4293	.6687	-8.6396	5.5706
D_Ed_Ma	-1.8668	3.5847	-.5208	.6039	-8.9930	5.2594
D_Age_18	-.6313	2.2210	-.2843	.7769	-5.0465	3.7838
D_Age_35	.8488	1.7397	.4879	.6269	-2.6097	4.3072
D_Age_45	-2.0129	2.2847	-.8810	.3808	-6.5547	2.5289
D_Age_55	-4.1884	3.3763	-1.2405	.2182	-10.9003	2.5235
Gender	-1.1086	1.3477	-.8226	.4130	-3.7878	1.5706
Tenure	.2275	.1304	1.7451	.0845	-.0316	.4866
FirmSize	.0288	1.2931	.0223	.9823	-2.5418	2.5994
CogFl	.8257	.9927	.8317	.4079	-1.1478	2.7992

Standardized coefficients

	coeff
SeEf	-.1161
D_Ed_HS	-.3019
D_Ed_HBO	-.2166
D_Ed_WO	-.1280
D_Ed_Ma	-.1372
D_Age_18	-.0342
D_Age_35	.0672
D_Age_45	-.1573
D_Age_55	-.2364
Gender	-.0954
Tenure	.3379
Firmsize	.0026
CogFl	.0926

\*\*\*\*\*

OUTCOME VARIABLE:

IP

Model Summary

R	R-sq	MSE	F	df1	df2	p
.7473	.5584	.5223	7.6777	14.0000	85.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	.2471	1.3288	.1860	.8529	-2.3949	2.8891
SeEf	.3932	.1617	2.4311	.0172	.0716	.7148
IndAmb	.0732	.0139	5.2481	.0000	.0454	.1009
D_Ed_HS	-1.3738	.5283	-2.6002	.0110	-2.4242	-.3233
D_Ed_HBO	-.7300	.4803	-1.5199	.1323	-1.6850	.2250
D_Ed_WO	-.7829	.4626	-1.6923	.0943	-1.7027	.1369
D_Ed_Ma	-.6814	.4642	-1.4679	.1458	-1.6044	.2416
D_Age_18	-.3623	.2873	-1.2610	.2108	-.9335	.2090
D_Age_35	-.1733	.2253	-.7693	.4438	-.6212	.2746
D_Age_45	-.2167	.2967	-.7302	.4672	-.8067	.3733
D_Age_55	-.2444	.4404	-.5549	.5804	-1.1201	.6313
Gender	-.0979	.1749	-.5595	.5773	-.4457	.2500
Tenure	-.0114	.0172	-.6660	.5072	-.0455	.0227
Firmsize	-.1675	.1672	-1.0019	.3192	-.4999	.1649
CogFl	.4404	.1289	3.4176	.0010	.1842	.6967

#### Standardized coefficients

	coeff
SeEf	.2092
IndAmb	.4045
D_Ed_HS	-.4608
D_Ed_HBO	-.3396
D_Ed_WO	-.3611

D_Ed_Ma	-.2768
D_Age_18	-.1084
D_Age_35	-.0758
D_Age_45	-.0936
D_Age_55	-.0763
Gender	-.0466
Tenure	-.0938
FirmSize	-.0835
CogFl	.2732

\*\*\*\*\* TOTAL EFFECT MODEL \*\*\*\*\*

OUTCOME VARIABLE:

IP

Model Summary

R	R-sq	MSE	F	df1	df2	p
.6445	.4153	.6835	4.6993	13.0000	86.0000	.0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	2.5474	1.4350	1.7753	.0794	-.3052	5.4001
SeEf	.3050	.1840	1.6574	.1011	-.0608	.6708
D_Ed_HS	-1.7378	.5992	-2.9004	.0047	-2.9289	-.5467
D_Ed_HBO	-.9183	.5479	-1.6760	.0974	-2.0075	.1709

D_Ed_WO	-.8951	.5286	-1.6933	.0940	-1.9460	.1558
D_Ed_Ma	-.8180	.5302	-1.5428	.1265	-1.8721	.2360
D_Age_18	-.4085	.3285	-1.2434	.2171	-1.0615	.2446
D_Age_35	-.1112	.2573	-.4321	.6667	-.6227	.4003
D_Age_45	-.3640	.3379	-1.0771	.2845	-1.0357	.3078
D_Age_55	-.5509	.4994	-1.1031	.2731	-1.5436	.4419
Gender	-.1790	.1993	-.8979	.3717	-.5753	.2173
Tenure	.0052	.0193	.2709	.7871	-.0331	.0436
Firmsize	-.1654	.1913	-.8648	.3895	-.5456	.2148
CogFl	.5009	.1468	3.4110	.0010	.2090	.7928

Standardized coefficients

	coeff
SeEf	.1623
D_Ed_HS	-.5829
D_Ed_HBO	-.4272
D_Ed_WO	-.4129
D_Ed_Ma	-.3323
D_Age_18	-.1222
D_Age_35	-.0486
D_Age_45	-.1572
D_Age_55	-.1719
Gender	-.0851
Tenure	.0429

FirmSize	-.0824
CogFl	.3107

\*\*\*\*\* TOTAL, DIRECT, AND INDIRECT EFFECTS OF X ON Y \*\*\*\*\*

Total effect of X on Y

Effect	se	t	p	LLCI	ULCI	c_ps	c_cs
.3050	.1840	1.6574	.1011	-.0608	.6708	.3026	.1623

Direct effect of X on Y

Effect	se	t	p	LLCI	ULCI	c'_ps	c'_cs
.3932	.1617	2.4311	.0172	.0716	.7148	.3902	.2092

Indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	-.0882	.1516	-.3799	.2008

Partially standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	-.0875	.1501	-.3757	.1961

Completely standardized indirect effect(s) of X on Y:

	Effect	BootSE	BootLLCI	BootULCI
IndAmb	-.0469	.0827	-.2195	.0953

\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*

Level of confidence for all confidence intervals in output:

95.0000

Number of bootstrap samples for percentile bootstrap confidence intervals:

5000

NOTE: Due to estimation problems, some bootstrap samples had to be replaced.

The number of times this happened was:

253

----- END MATRIX -----