KEEPING THE ‘OLDER’ ENGINEER ENGAGED AT WORK

Master thesis

Educational Science & Technology

D.M.J.S. ten Berg

17-06-2016

Supervising committee:

Dr. M.D. Endedijk

M. Wijga MSc.

UNIVERSITEIT TWENTE.

Title of final project
Keeping the 'Older' Engineer Engaged at Work

Researcher
Dieuwertje Maria Johanna Sabine ten Berg, d.m.j.s.tenberg@student.utwente.nl

Supervisors
M.D. Endedijk, m.d.endedijk@utwente.nl

M. Wijga, m.wijga@utwente.nl

Keywords
Professional identity, employee engagement, self-directed learning, career adaptability, organizational commitment, age cohorts, engineers, technical companies

Acknowledgement

These words are the last words of my master thesis, the last words of my study. For years graduating and writing a master thesis was something I saw other people do. It was something I could not imagine myself doing. It was something others did, something at the end of your studies. I never felt like the end of study was near, even now it is hard to imagine.

The choice for my project was quite conscious. I knew right away that I wanted something challenging, something that would take me out of my comfort zone. Therefore I made conscious choice for whom I wanted as my supervisors. And without them this would not have been possible without my supervisors. Firstly, Ruth, who supported me in the beginning of my project, who challenged me, let me swim for a bit until I found my direction. Secondly, Maaike, who has a special talent for making me cry, and who challenged me to look critically at my own work. And last but not least, Marijn, who read the whole thing at the end, which was really quite a lot. I want to thank you all for challenging me, for not telling me what to do, but for making me use my own brain. You ladies are truly inspiring, I always felt energized and enthusiastic after our meetings and TYF moments. Thank you.

Secondly I would like to thank my friends. They listened to me rambling and ranting about everything, even when it wasn't interesting. They understood the frustrations when the instrument was giving troubles. Without you guys this process would have been much more frustrating and less fun.

With my graduation I will finish my study Educational Science & Technology and I will no longer be a student. However, being a student was not just about gaining knowledge about educational science, it taught me much more than that. I taught me to challenge myself, to find opportunities and get them, to take on new adventures. And that's what I am going now, get on with my new adventure. The world is at my fingertips and I am ready to kick some ass.

Enschede, June 11th 2016
Dieuwertje ten Berg

Table of contents

Abstract

The Dutch technical sector is growing rapidly. Therefore, highly educated technical employees are needed. However, there are currently not enough young employees to fill all the vacancies. In order to fill the vacancies, companies started to actively recruit employees aged 50 years and older. Yet, keeping up-to-date with innovation is more difficult for older employees. Self-directed learning, organizational commitment and career adaptability could all help older technical employees to stay up-to-date with their sector. However, these aspects change when employees age. A concept that can explain the changing employee engagement of older employees is professional identity, which answers the question who a person is as a professional. An employee's professional identity consist of two elements: content and strength. The current research investigates the differentiation of self-directed learning, organizational commitment and career adaptability among highly educated technical employees. Furthermore the content and strength of professional identity are researched and differences between age cohorts are examined. Results show self-directed learning and career adaptability decrease with age while organizational commitment increases with age. Furthermore, six profiles of professional identity were identified (*nerd*, *socially oriented*, *all-rounder*, *comfort seeking*, *geek* and *status driven*). The distribution of the profile differs per age cohort, thus were employees younger than 35 more socially oriented and 60+ employees more comfort seeking. Furthermore, the strength of professional identity differed per age cohort, employees younger than 35 and 60+ identified more with their profession than employees aged 35-59. Self-directed learning, organizational commitment and career adaptability proved to be dependent on professional identity. Employees who were all-rounder were more self-directed and adaptive than comfort seekers. Professionals with a high identification were also more self-directed, adaptive and were affectively committed to their company. Lastly, a possible mediation effect of professional identity strength was tested. This effect turned out to be very small and non-significant. Thus the current research used professional identity to provide insight in the changing self-directed learning, career adaptability and organizational commitment of technical employees, to optimize the support of older technical employees so they can stay up-to-date with innovations in the technical sector.

Problem statement

The technical sector in the Netherlands is growing rapidly; in the past three years the number of vacancies grew with 28% (UWV, 2015). The technical sector is also highly dynamic, characterized by innovations and change (Volkerink, Berkhout, Bisschop, & Heyma, 2013). Unfortunately, there are not enough young employees to fill the open vacancies. Therefore Randstad Techniek, a Dutch recruitment company, started to actively recruit employees aged 50+ to fill the open vacancies (Trouw, 2010). However, in order for these older employees to be useful, they must stay up-to-date with innovations and developments in the technical sector.

Older employees have a harder time staying up-to-date, due to changing levels of employee engagement (Allen & Meyer, 1990), which is an important aspect to keep employees up-to-date with their field of work (Cataldo, 2011). Thus, supporting the employee engagement of the older employees is necessary to increase their usefulness, by keeping them up-to-date with innovations and developments. This is especially true for highly educated technical employees due to their fast changing work field. However, employee engagement is not yet researched among highly educated technical employees. Therefore, the current research will investigate the employee engagement of highly educated technical employee of different ages.

Additionally, not all employees with the same age are identical in who they are as a professional. In order to most effectively stimulate the employee engagement of older employees, their professional identity must be taken into consideration. Professional identity is the conscious awareness of the employee as a worker (Skorikov & Vondracek, 2011). Professional identity constructs the total picture of who a person is, as an employee. Therefore it can be used to highlight differences between the employees as a professional. To conclude, professional identity can be used to personalize the support given to increase employee engagement, making the stimulation of employee engagement more effective. However, professional identity is not a stable construct, but changes when an employee ages (Finegold, Mohrman, & Spreitzer, 2002). Thus, aspects of professional identity are different across age cohorts as, for example, employees will grow into different family responsibilities, such as raising children or taking care or elderly parents (Finegold et al., 2002).

Concluding, previous research has shown that age influences both employee engagement and professional identity. A changing professional identity will in turn influence employee engagement, due to the changing professional competencies. For this reason, we expect that professional identity will have a mediating effect on the relationship between age and employee engagement. This will be investigated in this research in the context of the technical sector. The goal of this research is twofold: (1) to investigate how employee engagement differs across different age cohorts of engineers in the technical sector, and (2) to investigate whether a potential decrease in employee engagement can be explained by changes in the professional identity across age cohorts.

In the next chapters a further explanation of the concepts age, professional identity, and employee engagement will be provided as derived from literature. Then the set-up of the empirical research will be discussed, leading to the presentation of the results closing with the conclusions and discussion in which the main findings will be presented.

Theoretical framework

Age

Employees age during their professional career and go through different stages in their lives and their career (Darcy, McCarthy, Hill, & Grady, 2012). When employees age they go through certain non-linear biological and mental changes, such as a different perspective of time (de Lange et al., 2009). For example, a starter will view time as open-ended since retirement is far away, a middle aged employee will view the future less open-ended creating a sense of urgency, pre-retirement employees will view time as limited, since retirement is near (de Lange et al., 2009). Different age groups have different experiences, which must be accounted for while measuring age. Age can be measured as a linear construct or in age cohorts (Settersten & Mayer, 1997). Whereas age as a linear construct simply measures someone's date of birth, age cohorts group individuals, who go through the same experiences within the same timeframe, together (Ryder, 1965). Therefore, the current research focuses on age cohorts, which is beneficial to investigate the specific influence of ageing on the engagement of employees.

The age of employees can be measured in three ways, either relatively or absolute (Cooke, 1994). The first relative method is *positional tenure*, which measures how long the person has been in the same type of function (Cooke, 1994). The second relative is *organisational tenure*, which measures how long an employee has been with the company (Cooke, 1994). The third is the absolute measure *chronological age*, which simply classifies people by their calendar age. Both positional and organizational tenure are subjected to change. When changes occur in an employee's career, either positional or organizational tenure or both will be reset. Chronological age is a more objective measure since it is not susceptible to career developments. For that reason, chronological age will be used in the current research. The next sections will further elaborate on age cohorts and explain the cohort system used in this research.

Research in social sciences from the past 40 years has revealed a large variation in the type of age cohorts used, see Table 1. Most remarkably the number of cohorts have increased over the years, which is likely due to changes in society such as an increased retirement age. Therefore, the age cohorts must be updated to represent the current technical context in the Netherlands. Currently, a technical study takes a minimum of four years, and the average study length is seven years (Van der Werf & Berkhout, 2015). The average technical student will enter the labour market around age 25. Furthermore, technical employees often transfer from field to office work at age 50. Lastly, technical employees retire at an age of 67. When merging the above mentioned specifications of the current labour market with the theory of Jonas (2003) and the frameworks of Bos, Donders, Bouwman-Brouwer, and Van der Gulden (2008) and Darcy, McCarthy, Hill, and Grady (2012), the following age cohorts were identified: <35 *early career*, 35-49 *developing career*, 50-59 *consolidating career*, and ≥60 *pre-retirement*. The next section will explain how in the current research age cohorts are defined more deeply.

The first age cohort is directly adapted from Darcy et al. (2012), namely <35, and is called *early career*. During the early career cohort employees will transfer to the labour market. Employees in this age cohort are focused, they push for achievement and want to establish themselves (Jonas, 2003; Darcy et al., 2012). The second age cohort, 35-49, is named *developing career;* during this phase employees

have reached corporate maturity and financial stability becomes more important (Jonas, 2003). The third age cohort, 50-59, is *consolidating career*; employees become less extrinsically motivated but start to seek more intrinsic gratification and relationships become more important (Jonas, 2003; de Lange et al., 2009). Finally, the fourth age cohort, ≥60, is pre-retirement. This is the moment that employees start to focus on their retirement, family becomes more important and employees often slowly disconnected from their work (Jonas, 2003). These age cohorts will be used in the next chapters.

Table 1

Overview age cohorts used in past 40 years

Hall & Mansfield (1975)	**Veiga (1983)**	**Jonas (2003)**	**Bos et al. (2008)**	**Darcy et al. (2012)**	**Current research**
20-34	29-37	22-25	<35	19-29	<35
35-49	38-55	25-38	35-44	30-39	35-49
50+	56-64	38-48	45-54	40-49	50-59
		48-58	55+	50+	60+
		58-65			

Employee engagement

The current research uses the term employee engagement as an umbrella term that captures three concepts namely: *organizational commitment*, *self-directed learning* and *career adaptability*. These three concepts will be defined and explained in the next sections.

Organizational commitment. Organisational commitment is defined as the psychological state that binds an employee to the organisation (Allen & Meyer, 1990). It is the acceptance, involvement, participation, and dedication of employees towards organisational goals. Employees put effort in making the organisation better and achieving organisational goals. One of the first scholars to focus on organisational commitment were Allen and Meyer (1990). They developed the Three-Component model of organisational commitment, constituting of three types of commitment, namely: affective, normative and continuance commitment. The current research only includes affective and continuance commitment. Normative commitment often develops very early during an employee's career and is mostly influenced by social experiences of the employee. Therefore, normative commitment will not distinguish differences between age cohorts and is left out of the current research. Affective and continuance commitment and their effect on work behaviour will be explained in the next sections.

The first is *affective commitment*, which can be defined as the desire of the employee to remain with the organisation (Allen & Meyer, 1990). An employee with a high affective commitment wants to stay with the organisation, because it provides positive work experiences and feelings of comfort and personal competence. Affective commitment is developed through work experiences that foster feelings of comfort and being challenged (Allen & Meyer, 1990). Affective commitment is related to positive effects such as experiencing more satisfaction, better results, less stress and illness, and more social behaviour (Meyer, Stanley, Herscovitch, & Topolnytsky, 2002).

The second is *continuance commitment*, or the recognition that the costs associated with leaving are higher than the costs associated with staying (Allen & Meyer, 1990). An employee with a high continuance commitment will stay with the organisation because of high investments in the company and their lack of other employment possibilities. Continuance commitment is developed through investments made by the employee in the organization and the employee's feelings about other possible career options (Allen & Meyer, 1990). A continuance committed employee will not easily leave the company, however they do experience more stress and less happiness (Meyer et al., 2002).

Affective commitment is supposedly the highest in the first year of employment (Allen & Meyer, 1990). New employees have high expectations in the beginning that are altered during their first year. The level of affective commitment stabilises after the first year. After stabilizing, affective

commitment is positively correlated with age, older employees show highest level of affective commitment. There was no effect found of age influencing continuance commitment (Allen & Meyer, 1990). Therefore, affective commitment is expected to increase with age, there are no expectations formulated for continuance commitment.

Hypothesis 1: Affective organizational commitment will increase with age, there are no expectations for the effect of age on continuance commitment.

Self-directed learning. Self-directed learning is defined by Knowles (1975, in Raemdonck, 2006, p.18) as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies and evaluating learning outcomes".

As a result of the fast changing workplace, employee engagement in development and learning is becoming increasingly important in companies (Raemdonck, van der Leeden, Valcke, Segers, & Thijssen, 2012). Due to the expectation that employees with high levels of self-directed learning take more responsibility and initiative for their development, self-directed learning is seen as an effective method of employee learning (Raemdonck et al., 2012), both for the employee and the company.

The founder of self-directed learning, Knowles, made four assumptions on self-directed learning that indicate change when employees age. The assumptions are: 1) when a person matures, their self-concept changes from being depended to increased self-direction; 2) a person obtains valuable experiences when the person matures, gaining important resources for learning; 3) adults learn the required knowledge necessary to perform the tasks in life; 4) the learning orientation of adults is problem-centred (Knowles, 1975). The assumptions imply that when employees age, they become more self-directed and gain more useful experiences, meaning that the older employees get, the higher their level of self-directed learning becomes.

Earlier research did however show an unclear effect of age on self-directed learning (Stockdale, 2003 in Raemdonck et al., 2012). The first result was that older employees scored higher on self-directed learning than younger employees (Stockdale, 2003). The second result show no difference between age groups (Stockdale, 2003). The research of Raemdonck et al. (2012) found no relationship between self-directed learning and age. However, the context of the research is different from the context of the current research, namely: low versus highly educated employees. Self-directed learning is influenced by occupational level and the amount of responsibility in the function (Raemdonck et al., 2012), which is supposedly higher among higher educated employees. This will make it likely that higher educated employees will show an increased level of self-directed learning compared to lower educated employees. So despite the results of the research of Raemdonck et al. (2012), we expect to find an increased level of self-directed learning when employees age. However, self-directed learning might be lower among the oldest employees, due to fewer career opportunities in their future. To conclude, the expectation is that the level of self-directed learning will increase with age with an optimum in age cohort 50-59 and a decrease in the pre-retirement age cohort.

Hypothesis 2: Self-directed learning will increase with age with an optimum at age cohort 50-59, the level of self-directed learning is expected to have lowered at age 60+.

Career adaptability. Career adaptability is the psychosocial construct that indicates the resources of an individual to cope with tasks, transitions and traumas in their occupational role (Savickas & Porfeli, 2012). Career adaptability will help an employee adjust to rapid changes and new conditions in their work (van der Horst, Klehe, & Van der Heijden, 2016)

The current labour market is fast changing, with new innovations forcing both companies and employees do develop themselves. Traditional career paths are less common and employees switch more between companies during their career. These changes make career adaptability increasingly important for both companies and employees (van de Horst et al., 2016). Career adaptability enables companies and employees to keep up with the changes in the labour market. At the moment, career

adaptability has mainly been researched among young adults during their transition from school to work (van der Horst et al., 2016). However, with the ageing workforce, the needs of the older employees have become more important. It might be more difficult for older employees to successfully adjust to the rapid changes in their work (van de Horst et al., 2016). This assumption was confirmed by the research by van der Horst et al. (2016), which demonstrated that the impact of age on career adaptability was negative, meaning that older employees scored lower on career adaptability than younger employees. Older employees tend to be less flexible than younger employees, leading to more problems with adjusting to changes. This lead to the expectation in this research that a linear decrease in career adaptability will be visible when age increases.

Hypothesis 3: Career adaptability will decrease with age, being the highest at age <35 and lowest at 60+.

Professional identity

The concept of identity. In order to understand professional identity one must first understand the concept of identity. The concept of identity will, in the broadest sense, give an answer to the question "who am I?" (Ashfort, Harrison, & Corley, 2008; Crocetti, Avanzi, Hwak, Fraccaroli, & Meeuws, 2014). When looking more precisely into the literature on identity it becomes clear that there are two major research traditions concerning identity namely, social psychology and developmental psychology. Both traditions have their own perspective on identity. Social psychology views identity as a social construct, whereas the developmental psychology views identity as a personal construct. Both perspectives will be further explained in the next sections.

On the one hand there is the social perspective which derives it views from social identity theory (Tajfel & Turner, 1979). A social identity is the part of an individual's identity that is derived from group belongingness and the person's emotional attachment towards this membership (Tajfel & Turner, 1979). Social identities are shared by the members of the group, and also distinguish between groups (Tajfel & Turner, 1979). Belonging to a group ensures that a person can relate to other people in a meaningful way (Abrams & Hogg, 1988). To conclude, from a social identity theory perspective, identity can be understood as a situationally formed social entity in which individuals define themselves based on the prototypical norms, values and behaviours of a group (I am an engineer, thus I perceive myself to be nerdy, pragmatic, lacking in social skills, interested in computer games), and compare it to relevant outgroups (I am NOT a psychologist, emotional, talkative, having coaching skills).

On the other hand there is the personal perspective derives it ideas from the ego identity by Erikson (1950 in Kroger & Marcia, 2011). Erikson defined eight stages of identity development in childhood each with its own phase-specific psychosocial crisis (Erikson, 1950 in Kroger & Marcia, 2011). Originally it focussed on children, however later research expanded the theory to adults and Erikson's ideas about exploration and commitment are widely accepted among vocational psychologist (Skorikov & Vondracek, 2011). According to this perspective, identity changes due to the integration of older identities with newly explored identities to which a person committed. For example, an engineer whose work role changes to being a project leader will have to develop management skills such as communication and coaching, which will impact their personality. To conclude, according to personal identity the identity of a person will change when their role in life changes (Erikson, 1950 in Kroger & Marcia, 2011).

The two traditions described above are clearly divided in how they view identity. Despite these contrasting viewpoints, recently the two perspectives have been used together to understand professional identity development. Both perspectives offer insight in how professionals develop a professional identity, yet both perspectives separately do not give a complete overview of identity. The difference lays within the reference scope (personal vs. group), however changes in identity are both intertwined with changes in the person and changes in the group (Pratt, Rockmann, & Kaufmann, 2006). To this end, in this research identity will be viewed as both a social and a personal concept, defining a person by their groups and roles and the prototypical characteristics of the group members.

Professional identity. One environment that provides scope to build an identity based on both social aspects as well as personal roles is the professional identity. Professional identity gives an answer to the question "Who am I as a professional?". The division in identity literature is also clearly visible in the literature concerning professional identity. On the one hand scholars focussing on the social psychology perspective of professional identity give the following definition: "*Professional identity denotes the degree to which employees identify themselves with the profession that they practice and its typical characteristics"* (Bartels, Peters, de Jong, Pruyn, & van der Molen, 2010, p.211). On the other hand, scholars using the developmental psychology perspective define professional identity as: "*The unique traits and characteristics that differentiate someone from others in a work domain"* (Miscenko & Day, 2015, p.3). The current research combines both perspectives, following scholars who integrated both perspectives in their work such as Pratt et al. (2006), Crocetti et al. (2014) and Molleman and Rink (2015). Professional identity is defined as a *person's identity concerning their profession and career, being able to change over time when the person develops his career, being shaped by the social environment of the person both during education and occupation* (Crocetti et al., 2014).

In addition to the divergence of theoretical traditions, there are also different ways to conceptualize professional identity, namely qualitative and quantitative. On the one hand, the qualitative conceptualization measures the content of professional identity. Professional identity content captures who a person is, what one values and how one feels about their professional environment (Ashfort et al. 2008). For example, I am an engineer, I believe in logic, I like solving problems, I can do math. The content of professional identity will help explain how a person thinks about their professional environment and why one makes certain career decisions (Ashfort et al., 2008). To conclude, the content of professional identity is the basis behind the why people join a company, are willing to leave a company or why they approach their work the way they do, because it is the intrinsic drive on which employees build their choices (Ashfort et al., 2008).

On the other hand, the quantitative conceptualization measures the strength of professional identity. Professional identity strength is the degree to which the person is committed to these identity elements (Ellemers, Kortekaar, & Ouwekerk, 1999). Identity strength focusses on the degree to which, for example, being an engineer, or being able to solve problems is important to a person's self-concept. In order for employees to identify with a profession, they must have a sense of membership, the evaluative awareness that the membership is valuable and they must have an emotional investment in the awareness and evaluation (Ashfort et al., 2008). When there is a strong professional identity, being a member of the profession will influence the self-concept of the employee.

Earlier research focusses on either the content or the strength of professional identity, not both. However, recent research did show that content and strength are related to each other and both influence career choices of students (Möwes, 2016). In order to design a framework that combines both the content and strength of professional identity, the frameworks of Ashfort et al. (2008) and Schwartz et al. (2011) were combined. According to Schwartz et al. (2011) the content of professional identity consists of the interest, goals, values, and abilities in the employees' profession. Ashfort et al. (2008) also measured beliefs and stereotypical traits. The new framework includes values (I care about freedom), goals (I want to have a prestigious job), interests (I like camping), competences (I am good at negotiation), and personality (I am optimistic). The strength of professional identity is argued to exist of a self-definition, the importance of the self-definition and the affective value (Ashfort et al., 2008). Combining the two frameworks leads to the following model of professional identity, see Figure 1.

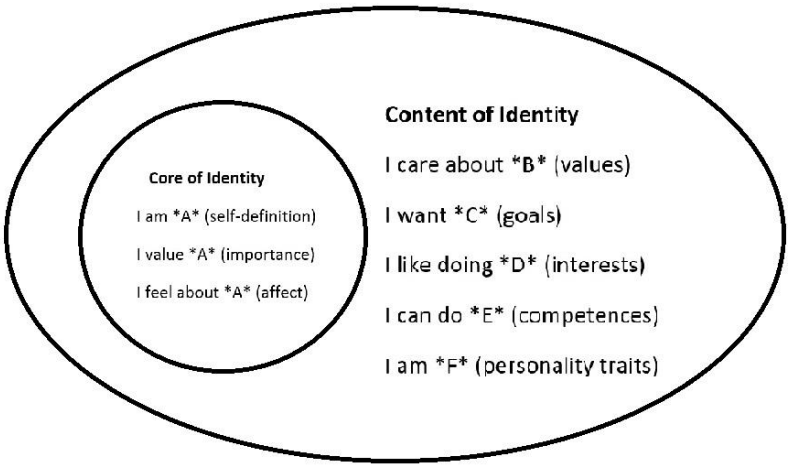

Figure 1. Model of professional identity (adapted from Ashfort et al., 2008)

Age influencing professional identity

With the passing of time employees gain more life and work experiences, change jobs or organisations. Therefore, an employee's career is subject to change. Consequently, employees will revise, adjust or renew their professional identity (Crocetti et al., 2014). The adjustments and renewals of the professional identity of an employee can be found in both the content and the strength of the professional identity (Ashfort et al, 2008). First the potential changes in professional identity content will be discussed, later the changes in strength.

Firstly, due to having more life experiences older employees have different values and goals than younger employees (Van der Horst et al., 2016). For example, when ageing employees will grow into different family responsibilities, such as raising children or taking care of ageing parents, which affects their needs and priorities in life and at work (Finegold et al., 2002). Secondly, the economic and social environment in which an employee grew up, will influence the content of professional identity (Finegold et al., 2002). Employees of different age cohorts were born in different economic and social environments, shaping their generational values and preferences (Finegold et al., 2002). For example, a working mother is nowadays seen as normal, whereas this was quite unique 30 years ago. Therefore, we expect that employees in distinct age cohorts, will differ in the content of their professional identity.

Lastly, the strength of professional identity is developed through exploration and commitment. Younger and older employees differ in the degree to which they are still exploring or already committed to their professional identity (Whitbourne & VanManen, 1996). Older employees are more often highly committed after deeply exploring their options and they are satisfied by their choices (Whitbourne & VanManen, 1996) Younger employees often lack strong identity commitment and are often not actively exploring their professional identity options (Whitbourne & VanManen, 1996; Crocetti et al., 2014). Therefore, we expect that the strength of professional identity will increase with age. This led to the following hypotheses:

Hypothesis 4: The content of professional identity will differ per age cohort.

Hypothesis 5: The strength of professional identity will be stronger with older employees.

Professional identity influencing employee engagement

Currently little is known about the influence of professional identity on employee engagement. Previous research is very fragmented or lacking empirical evidence and conducted in a different context. Nevertheless, there are research results indicating that professional identity will influence employee engagement. The results will be covered shortly, with an explanation of the expected effect in the current research.

Self-directed learning. No studies were found investigating the relation between identity strength and self-directed learning. However, there are certain competencies that can predict the level

of self-directed learning. Employees who are self-assessing, evaluative, reflective, critical and who manage incoming information, show higher level of self-directed learning (Patterson, Crooks, & Lunyk-Child, 2002). Therefor we expect that employees with a professional identity profile showing reflective, critical and evaluative competencies will have a higher degree of self-directed learning than other profiles.

Hypothesis 6: A PI profile showing reflective, critical and evaluative competencies will score higher on self-directed learning than profiles that do not possess these competences.

Organizational commitment. The strength of professional identity and organizational commitment are theorized to influence each other (Baruch & Cohen, 2007). If professional identity strength is connected to being a member of the organization, it will increase organizational commitment (Baruch & Cohen, 2007). However, no proof has been found that a strong professional identity resembles a strong organizational commitment or vice versa.

Research did show that personality can predict organizational commitment (Kumar & Bakhshi, 2010). Firstly, affective commitment is positively related to extraversion. Employees who are extraverted and social, will be more attached to the company. Secondly, continuance commitment is positively related with conscientiousness and extraversion. People who are conscientiousness are hard workers, they value formal and informal rewards and are dutiful, making them more aware of the costs of leaving the company. People who are extraverted value the social environment and associate that with the costs of leaving (Kumar & Bakhshi, 2010). Therefore, we formulated the following hypotheses:

Hypothesis 7: PI profiles with extraverted personalities, or valuing social behaviour will show higher levels of affective commitment than profiles that do not have those traits.

Hypothesis 8: PI profiles containing personality traits of conscientiousness, extraversion will show higher levels of continuance commitment than profiles that do not have these personality traits.

Career adaptability. No studies investigating the relationship between identity strength and career adaptability were found. However, there is an indication that professional identity content will influence career adaptability. The values and interests of an employee provide the information needed for the career exploration and adaptation of the employee (Klehe, Zikic, van Vianen, & de Pater, 2011), implicating that the content of the professional identity guides the employees in the process of exploration and adaptation. To conclude, when the values and interests of the employee change due to age, the career exploration and adaptation of the employee change. There are however no indicators of precise characteristics influencing career adaptability. Since the effect of changing values and interests could only be measured longitudinal, no hypotheses can be formulated.

Research questions and research model

Figure 2 shows the research model was designed based on the literature:

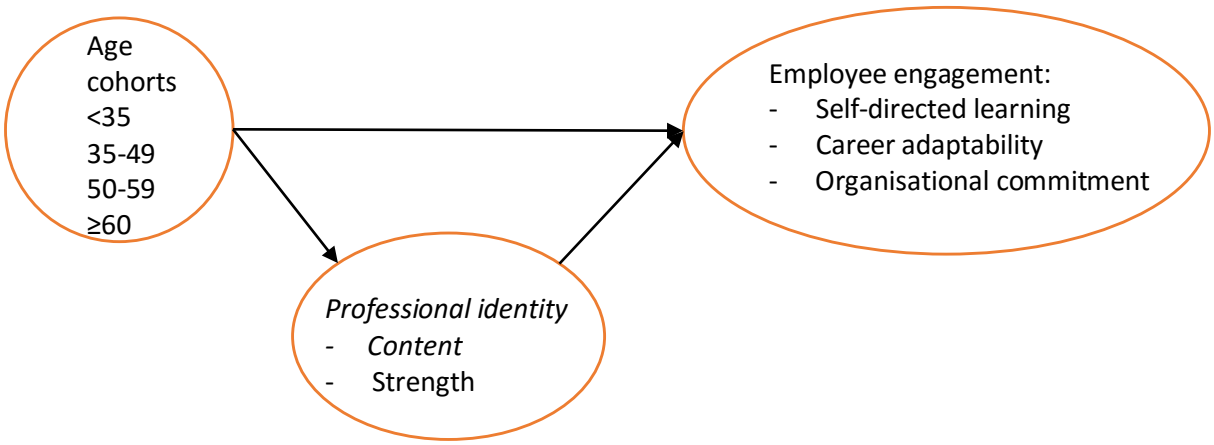

Figure 2. Research model

In order to confirm the hypothesis, the following research questions must be answered. The main research question is:

- How does employee engagement of technical employees change across different age cohorts, and can this be explained by a change in their professional identity?

There are several sub questions that need to be answer in order to answer the main research question:

- (1) What profiles are distinguishable in the content of professional identity?
- (2) What is the difference in technical employees' level of employee engagement (i.e., organisational commitment, self-directed learning and career adaptation) between age cohorts?
- (3) What is the difference in technical employees' content and strength of professional identity across age cohorts?
- (4) What is the relationship between the content and strength of technical employees' professional identity?
- (5) What is the relationship between the professional identity (i.e., content and strength) of engineers and employee engagement?

Research design

Respondents

The population of interest is the population of technical employees working in technical companies located in the east of the Netherlands. The characteristics of the employees, companies and the company's motivation to participate will be discussed in the next sections.

Companies. Four high-tech companies from the region Twente in the east of the Netherlands participated in the research. The high-tech companies are active in diverse fields namely: development of manufacturing solutions, power and process industry, energy technology and electronics. Not all companies produce end products, making them less known with the general public. All companies are international and provide together around 1200 jobs in the region of Twente.

Company's motivation. The companies elected to participate in the study are all a part of Techniekpact Twente. Participation was free of charge. The companies participated for several reasons, (1) to gain more knowledge about the types engineers working in their organisation, (2) to improve their

recruitment system and (3) to stimulate the development of their employees. The companies received an overview of the results, however, the results could not be traced back to individual employees.

Employees. The sample of technical employees had functions that typically require at least a bachelor's degree. Not all employees were college graduates, however, due to experience they do function on such a level. The total sample consisted of 501 participants of whom 254 completed the Career Compass, which was a response rate of 50.7%. The engineers included in the study come from a diverse background. 93.2% of the population was male, 6.8% was female. The average age of the engineer was 45, oldest was 66 and the youngest 22. 18.6% was in the early career stage; 46,8% in the developing career stage; 25.3% in the consolidating career stage and 9.3% was in the pre-retirement stage.

Procedure

The participants received two emails, the first was an announcement, explaining the research and that they would receive a link in a few days. The second email that the participants received contained a link to an online survey, the Career Compass. Online surveys are a suitable measure to reach a large population (Babbie, 2010). The emails were sent by their own HR-manager. This was done for several reasons namely: (1) to show the support of the company of the participation in the research, (2) to increase the response rate (3) to prevent leaking of personal information, such as email addresses, to third parties. In line with the ethical guidelines of the University of Twente the participants were informed of the voluntary participation, the possibility to stop at any moment and the anonymous processing of their data. Participants were offered the possibility to receive an overview of the results of their professional identity. In order to receive this report, participants had to enter personal contact information. The contact information was stored separately from the dataset to ensure anonymity. Participants were asked 234 questions which took them around 23 minutes to answer. Participants received the Career Compass at their work email, however they were free to fill out the Career Compass anywhere they wanted at any time. However, they were asked to take the time and to find an environment that was not distractive, allowing them to concentrate on the Career Compass.

Instrumentation

During this research the professional identity, employee engagement and age of the employees of the companies was measured. The instrument used to do so was the Career Compass (CC), which was developed by Möwes (2016) at the University of Twente. The CC was developed to measure the content and strength of professional identity and was piloted on STEM-students. The CC is based on a literature review of professional identity across different social sciences disciplines. Multiple scales, validated in literature, were selected and combined to represent the five domains of professional identity (interests, competences, values, personality and goals). The CC has a total amount of 177 items, see Table 2 for the overview of the items.

Table 2.

Overview of scales originally used in the Career Compass to measure professional identity.

Domain	Reference	Factors	n items	Example item
Interests	Hansen and Scullard's (2002)	athletic (1) artistic and intellectual (2) social (3) outdoor (4)	28	I am interested in… " dancing"
Competences	Male, Bush, & Chapman, 2011 Passow, 2007	cognitive skills (1), communication (2), life-long learning (3), teams (4), STEM skills (5), management and business (6) and social skills (7)	38	I am good at… "social networking"
Values	Lyons, Higgins, & Duxbury, 2010 Ros, Schwartz, & Surkiss, 1999	achievement (1), benevolence (2), hedonism (3), power (4), security (5), self-direction (6), stimulation (7), tradition (8), universalism (9) and socialism (10)	40	I find…. important "politeness"
Personality	Ashton et al., 2004 Ashton, & Lee, 2009	honesty-humility (1), emotionality (2), extraversion (3), agreeableness (4), conscientiousness (5) and openness to experience (6)	43	I am… "responsible"
Goals	Roberts & Robins, 2000 Sheldon, Elliot, Kim, & Kasser, 2001	economy and status (1), family (2), influence (3), universalism (4), physical well-being (5), comfort (6) autonomy (7) and security (8)	28	In the future I want to be… "who I really am"

In order to measure employee engagement items on self-directed learning, career adaptability and organizational commitment were added, see Table 3 for an overview. Self-directed learning was measured with four items that are derived from Raemdonck (2006). The original instrument developed by Raemdonck (2006) contained more items, however in order to keep the length of the Career Compass at a maximum of 25 minutes only four items were chosen. Career adaptability was measured with 12 items which were selected from Savicak & Porfelli (2011), Crocetti, Robini, & Meeuws (2008) and Gupta et al (2014). Keeping in mind the time of the instrument, a selection was made, however the four aspects of career adaptability were all included in the instrument. Lastly organisational commitment was measured with eight items that were selected from Ellemers (1999). We ensured that both affective and continuance commitment were included. Furthermore, 13 items measuring professional background were added to the CC. Previous research showed that answering an item in the career

compass took an average time of 4 seconds. Considering this, employees were expected to need 20-25 minutes to answer the complete CC.

Table 3.

Overview of scales added to the Career Compass to measure employee engagement

Domain	Reference	Factors	n items	Example item
Self-directed learning	Raemdonk (2006)	Self-directed learning (1)	4	I find learning an important aspect of my working life
Career adaptability	Savicak & Porfelli (2011)	Career exploration (1) Career confidence (1)	12	I have a plan for my career
	Crocetti, Robini, & Meeuw (2008)	Career clarity/control (1)		
	Gupta, Chong, & Leong (2014)	Career concern (1)		
Organizational commitment	Ellemers (1999)	Affective (1) Continuance (1)	8	I feel a strong sense of belonging to this organisation

Instrument validation. As the instrument was not yet tested for the use among technical employees, validation of the instrument was necessary.

Data analysis instrument. The career compass was during its development validated among STEM students. However the reliability and validity of the career compass had not yet been tested on technical employees. In order to test the reliability and validity of the career compass the factor structure of professional identity was tested following the procedure suggested by Schmitt (2011). As a first step, a series of confirmatory factor analyses (CFAs) was conducted to identify whether the expected factor structure as found among the STEM students would fit the data. In case of a poor model fit a series of exploratory factor analyses (EFAs) were performed to the individual domains to establish a statistically sound concept of professional identity. CFAs were used to test the new factor structure. When a reliable factor structure was established, the items were used to form a scale. The scale was formed by adding up the items scores and dividing it by the number of items. This was done to establish a set of clusters of the technical employees based on their professional identity.

Confirmatory factor analyses. First order CFAs were performed on the individual scales to test the quality of the scales of professional identity and employee engagement. The CFAs were performed using the statistics program R with the *lavaan* package. For the first order CFAs, the weighted least square means and variance adjusted (WLSMV) estimator was used. The WLSMV estimator is useful for simple models and also for smaller sample sizes (Beauducel & Herzberger, 2006). To identify whether the model fit was sufficient, the five most commonly used fit indicators were inspected (Kyndt & Onghena, 2014). First of all the ratio between chi-square and the freedom degrees was inspected. When the ratio was smaller or equal to three, a sufficient fit was indicated. Second the comparative fit index (CFI) and the Tucker-Lewis index (TLI) were inspected. For both measures a value close to or higher than .95 was optimal, but values above .90 were viewed as acceptable. Lastly, the root mean square error of approximation (RMSEA) and the standardized root mean residual (SRMR) were inspected. For both, a value below 0.08 was sufficient to indicate a good model fit. The model fits of the initial CFA and later CFAs (if necessary) conducted were compared to see if the model fit had improved over the first one.

Exploratory factor analyses. The EFAs were conducted using the 23rd version of IBM's statistics program SPSS. In order to select an EFA that would optimally fit the data, decisions on (1) rotation method (2) sample size (3) number of factors (4), and criteria for item removal were made.

- (1) The variables within the five factors of professional identity are interconnected to one another and not orthogonal. For this reason an oblique rotation method was chosen, namely direct oblimin (Field, 2013).
- (2) There are numerous rules of thumb concerning the minimum sample size necessary for factor analysis (Schmitt, 2011). The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) was used for each individual EFA to confirm whether the sample size was large enough or not. KMO values higher than .60 were seen as acceptable (Field, 2013).
- (3) To ensure that the appropriate number of factors were determined, the eigenvalues were analysed (>1) and the scree plots were taken into consideration. The factors were interpreted based on their connection to the theoretical content. Lastly, Cronbach alphas were calculated for each individual, newly develop factor to ensure the reliability. Values higher than .70 were seen as acceptable, values between .61 and .69 as mediocre and lower than .60 as poor.
- (4) Items reduction took place according to the recommendations of Worthington & Whittaker's (2006). An item was removed when the highest factor loading was lower than .3; when an item loaded more than .3 with several factors in the pattern matrix; or when the two highest factors loadings were smaller than .15.

Initial CFA. The initial CFA performed using the factor structure as suggested in the literature showed poor model fit for almost every model (Table 4). None of the models showed good model fit. Personality showed the least sufficient model fit. The fit of the factor structure found in literature was so poor that R was not capable of returning results. This was due to the poor correlation of items within the same factors and high correlation between items in different factors. Competences, values and goals showed the most sufficient model fit, only the CFI and TLI indicators showed insufficient model fit. However since the model fit of personality was very poor and none of the models showed an overall sufficient model fit, it was decided to further investigate the concept of professional identity.

Table 4.

Output from the CFAs with factor structure suggested in literature on PI

Fit indices	Critical values indicating model fit	Interests	Competences	Values	Personality	Goals	Self-directed learning	Organizational commitment	Career adaptability
Ratio X^2/df	<3	1.94	1.82	1.44	**NA**	1.69	1.89	**12.18**	**10.45**
CFI	≥.90	**.57**	**.46**	**.32**	**NA**	**.78**	.97	**.56**	**.83**
TLI	≥.90	**.53**	**.41**	**.25**	**NA**	**.74**	.90	**.29**	**.76**
RMSEA	<.08	.06	.06	.04	**NA**	.05	.06	**.19**	**.10**
SRMR	<.08	**.09**	.08	.08	**NA**	.08	.02	**.14**	.08

Note. Insufficient model fit is indicated bold. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean residual.

Initial CFA STEM student structure. The initial CFA performed using the factor structure as found in research among STEM students showed poor model fit for almost every model (Table 5). The fit of goals is most sufficient, only the TLI indicator is not sufficient. For interests, competencies and values both the CFI and TLI are insufficient. For personality only the chi-square/degree of freedom ratio is sufficient, all other indicators are not. Due to the poor model fit, it was decided to further investigate the concepts of professional identity in order to define a fitting factor structure.

Table 5.

Output form the CFAs with the factor structure found in research among STEM students

Fit indices	Critical values indicating model fit	Interests	Competences	Values	Personality	Goals
Ratio X^2/df	<3	2.32	2.16	1.60	2.75	1.58
CFI	≥.90	**.77**	**.63**	**.66**	**.11**	.92
TLI	≥.90	**.70**	**.55**	**.60**	**.13**	**.88**
RMSEA	<.08	.07	.07	.05	**.08**	.05
SRMR	<.08	.07	.06	.07	**.10**	.05

Note. Insufficient model fit is indicated bold. CFI = comparative fit index; TLI = Tucker-Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean residual.

Exploratory factor analyses. In order to establish a stable internal factor structure of professional identity, EFAs were conducted for each domain of professional identity. The EFAs were conducted using principal axis factor analyses (PAFs) using an oblique rotation (direct oblimin). In order to know if the sample size was large enough, the Kaiser-Meyer Olkin (KMO) was checked. The KMO values indicated that the sample size were large enough (KMO > .6) for all EFAs (Table 6). Each of the newly developed factor structures will be discussed subsequently.

Table 6.

Overview of the Kaiser-Meyer-Olkin values for the domains of professional identity

Domain	KMO
Interests	.75
Competences	.91
Values	.89
Personality	.80
Goals	.76
Self-directed learning	.78
Organizational commitment	.74
Career adaptability	.83

Interests. In order to build a fitting factor structure for the technical employee's interests, an EFA was performed on all 28 items measuring interests. This resulted initially in a nine-factor structure. The items and factors were analysed whether or not the before mentioned criteria were met. Items that did not meet the criteria were stepwise deleted. After the deletion of (an) item(s) an EFA was performed again. After nine rounds of item deletion, a six-factor structure remained including 15 items (see Appendix A). The factors had a poor (α= .53 - .60), to mediocre (α= .61 - .67) and acceptable (α=.72) reliability and explained a total of 62.41% of total variance. The original scale was a four factor structure, the factors were named social, outdoors, artistic & intellectual and athletic. One of the newly develop factors was given the same name as the original factor structure (social) the other four factors got new names. The new factors exist of combinations of items in the original factor structure, differing from the original structure.

Competences. The competences of the technical employees were measured with 38 items that were derived from two scales. The combined scales formed a total of seven factors namely: cognitive, communication, life-long learning, teams, STEM, management & business, and social skills. The initial EFA showed a factor structure of eight factors. The items were analysed and tested according to the criteria and follow-up EFAs were performed. After nine rounds of EFAs a six-factor structure was

established including 27 items (see Appendix B). Some of the original factors showed to be separated factors (communication split up into public speaking and communication skills). Other factors were established out of multiple factors, managerial skills is a combination of management, communication and social skills. The reliability of the new scales varied from mediocre (α= .66) to acceptable (α= .78 - .90). Together the scales explained 66.1% of total variance.

Values. The initial factor structure contained ten factors including achievement, benevolence, hedonism, power, security, self-direction, stimulation, tradition, universalism, and sociality, with a total of 40 items. After multiple EFAs reducing the items using the before mentioned criteria, a six-factor structure with 20 items was developed (see Appendix C). All six new factors were combinations of items from multiple initial factors. One of the new factors had poor reliability (α= .52), two mediocre (α= .67 - .68) and three had acceptable reliability (α= .76 - .80). Combined, the factors explained 63.96% of the total variance.

Personality. The initial factor structure of personality contained six factors over 43 items to measure the personality of technical employees. Originally the factors were extraversion, honesty, emotionality, agreeableness, conscientiousness and open-mindedness. After multiple rounds of item reduction a seven-factor structure containing 23 items was established (see Appendix D). The new factors emotionality and openness remained from the original factor structure. The other factors were combinations of multiple original factors, or renamed to better fit the content of the factor. The reliability was poor for one factor (α= .60), mediocre for two (α= .66 - .67) and acceptable for the rest (α= .70 - .75). The total variance explained by the factors was 64.6%.

Goals. The goals of technical employees was measured with 28 items that originally formed eight factors. The original factors were: economic & status, family, influence, universalism, physical thrive, comfort, autonomy, and security. After each step of item reduction a new EFA was performed, in total ten EFAs were executed. A six factor structure containing 16 items was established (see Appendix E). Five of the original factors were retained, only the new factor family is a combination of the original factors family and economic & status. Reliability analysed showed that one factor was poor (α= .57) four were mediocre (α= .63 - .69) and one was acceptable (α= .73). The factors combined explained 65.66% of total variance.

Self-directed learning. Self-directed learning was measured with one factor containing four items (see Appendix F). All the items formed one factor with an α of .78 which is acceptable, explaining 61.77% of total variance.

Organizational commitment. Organizational commitment was measured with two factors, affective and continuance commitment (see Appendix G). One item got removed after the EFA. Both original factors remained. The reliability of the scales is mediocre (α= .60) and acceptable (α= .87). The two factors together explained 70.14% of total variance.

Career adaptability. Career adaptability was measured with twelve items in four factors namely: exploration & curiosity, clarity & control, concern, and confidence. After multiple EFAs five items remained in one factor. The other items were removed due to the item formulation. The items that correlated together were all formulated in the same tone. This implicated that the insecurely formulated items correlated together and the actively formulated items correlated together. In order to measure how engaged employees are in the process of career adaptability only the active formulated items remained (see Appendix H). The new scale has good reliability (α= .93). The total amount of variance explained by the scales is 45.11%.

Final confirmatory factor analyses. Based on the EFAs of each domain of professional identity and employee engagement, the new factor structure consisted of 36 factors. CFAs were performed to confirm the improved fit of the newly established domains. The fit of the new factors did improve, however not all values are conform to the critical values that indicate good model fit. Especially organizational commitment did not show a very good model fit. Self-directed learning showed a very

good model fit. The scales of professional identity were decent. The chi-square ratios of personality and goals were above 3, and all the CFI and TLI values (except goals) were too low. The SRMR value of personality was slightly higher than .08. See Table 7 for more details.

Table 7.

Model fit indices for final CFAs covering all domain of professional identity and employee engagement

Fit indices	Critical values indicating model fit	Interests	Competences	Values	Personality	Goals	Self-directed learning	Organizational commitment	Career adaptability
Ratio X^2/df	<3	1.62	1.74	1.58	**3.06**	**4.44**	1.89	**4.50**	**3.36**
CFI	≥.90	**.89**	**.72**	**.65**	**.67**	.94	.97	**.84**	.97
TLI	≥.90	**.85**	**.67**	**.57**	**.60**	.92	.90	**.71**	.93
RMSEA	<.08	.05	.05	.05	.06	.03	.06	**.12**	**.10**
SRMR	<.08	.06	.06	.06	**.08**	.05	.02	.08	**.**03

Data analysis

RQ1. The goal of the first research question was to examine if different profiles of professional identity content can be found. In order to do so, a *k*-means cluster analysis was performed. A *k*-means cluster analysis will cluster participants who have a similar answer pattern. A *k*-means cluster analysis uses a fixed number of clusters. In order to establish the right amount of clusters the following steps were undertaken. First, an estimate of clusters was made by investigating the scree plot. Using that number as an estimate, multiple *k*-means with different clusters were run. To establish the clustering that fit the data best, ANOVA's were analysed. Furthermore, the clusters were analysed with literature to come to a statistically sound and logic clustering.

RQ2 The goal of the second research question was to establish the relationship between age and employee engagement. In order to do so, multiple ANOVA's were conducted. Each component of employee engagement was analysed separately, because each component had specific hypotheses. Post-hoc analysis were executed using Bonferroni, which limits the type I errors made (Field, 2009).

RQ3 The third research question investigated the relationship between age and professional identity. The relation between age and content was investigated using a Chi-square analysis. This test was chosen because it is free of assumptions (Field, 2009). To test whether particular cells in the crosstabs showed a significant deviation, post hoc adjusted residuals were conducted. A difference of at least two standard deviations indicated by residuals <-1.96 or >1.96, was considered statistically significantly different (Field, 2009).

The relationship between professional identity strength and age was researched using a correlation analysis. Spearman's rho was reported since this is the most robust measure when only two items are analysed (Eisinga, te Grotenhuis, & Pelzer, 2012).

RQ4. The fourth question established whether or not there is a relation between the content and strength of professional identity, which was conducted using an ANOVA with Bonferroni post-hoc analysis.

RQ5. The fifth question discussed the relationship between employee engagement and professional identity. The relation between the content of professional identity and employee engagement was analysed via a MANOVA. This choice was made because a MANOVA allows for multiple dependent variables to be entered into the analysis (Field, 2009). The relation between the strength of professional identity and employee engagement was analysed using a linear regression analysis, which allows a scale variable to be an independent variable (Field, 2009).

RQ6. The last research question tested the complete research model. This was done with a mediation model in SPSS using the PROCESS macro. The PROCESS macro does not allow categorical variables as mediation variables. Therefore, the mediation analysis was only conducted using professional identity strength as a mediator. Since age is also a categorical variable, dummy variables were created to further investigate the effect of the mediation model (Field, 2013).

Results

RQ 1: What profiles are distinguishable in the content of professional identity?

The results of the exploratory and confirmatory factor analyses were used to form profiles of the different types of technical employees working at the involved companies. This was done by conducting a correlation analyses called *k*-means. The 30 factors were all included in the correlation analyses which resulted in five profiles. One participant was excluded from the analysis. This decision was made because the answer pattern of this person was so extreme that he, on his own, was a unique profile. The *k*-means analysis forces the research to choose a certain number of clusters in which the data is fitted. This number was estimated by looking at the scree plot which showed that the first 5 factors would contain the largest variance. Furthermore, correlation analyses were conducted with 4, 5 and 6 clusters. The formed clusters were reviewed with literature. The six cluster structure was deemed the most logical, therefore it was chosen. All items proved to be of significant influence on determining the cluster.

The six profiles were nerd, socially oriented, all-rounder, comfort seeking, geek and status driven (see Figure 3). The nerd was self-centred, good at engineering, collaboration, and research skills, the nerd values learning. The nerd was not girly, did not value power and status and physical wellbeing. The profile that was socially oriented values hedonism, family, traveling, security, and benevolence. The person fitting the socially oriented profile was not relaxed and was less interested in research, public speaking, and doing research. The all-rounder was interested in politics, good at management, research, and public speaking skills. The all-rounder was open and self-centred, values tradition and power. The all-rounder was not conscientious, introverted, relaxed and open or ambitious. The fourth profile was comfort seeking, this profile was introverted, values security and physical activities. This person was not a manager, not good in communication, public speaking, and engineering and did not value learning or power. The Geek was conscientious, introverted and good in engineering and research skills. The geek had no family or physical goals, did not value hedonism, was not interested in social activities and was not good in collaboration. The status driven profile was ambitious and relaxed, interested in social activities, status and power. The status driven profile was not introverted, did not value security, tradition and nature and was not good at research. How the profiles were distributed and further characteristics, will be discussed in the upcoming sections.

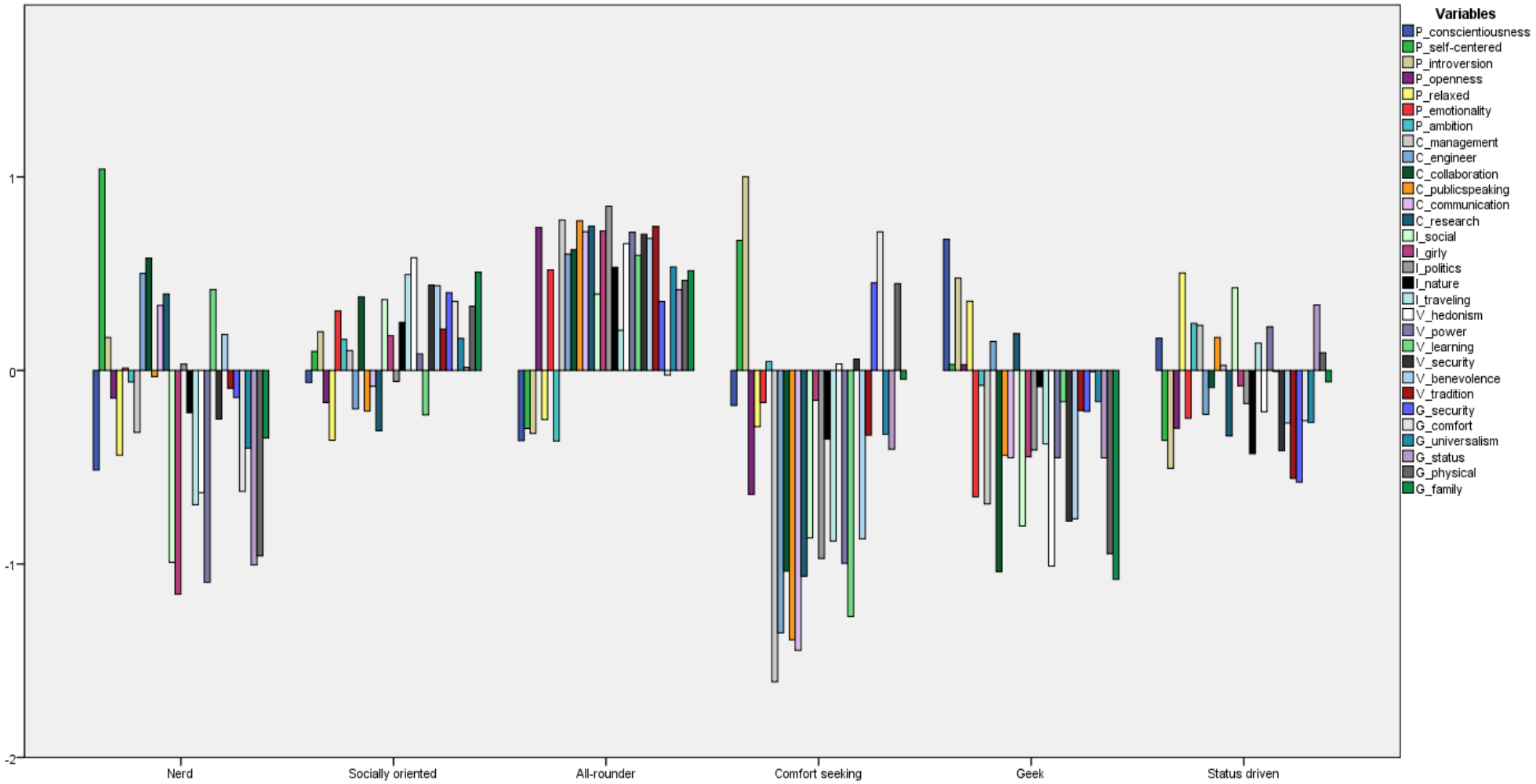

Figure 3. Overview of the six clusters, with the standardized score of each factor

Distribution of profiles. Three of the profiles were most common, namely status driven (26.0%), all-rounder (22.4%), and socially oriented (20.1%). Geek (15.7%), nerd (8.3%), and comfort seeking (7.5%) were less common among technical employees (see Figure 4). Pearson Chi-square (p=.050) showed that there was a significant difference of profile distribution between females and males (see Table 8). Post-hoc analysis showed that only the comfort seeking profile differed significantly between men and women.

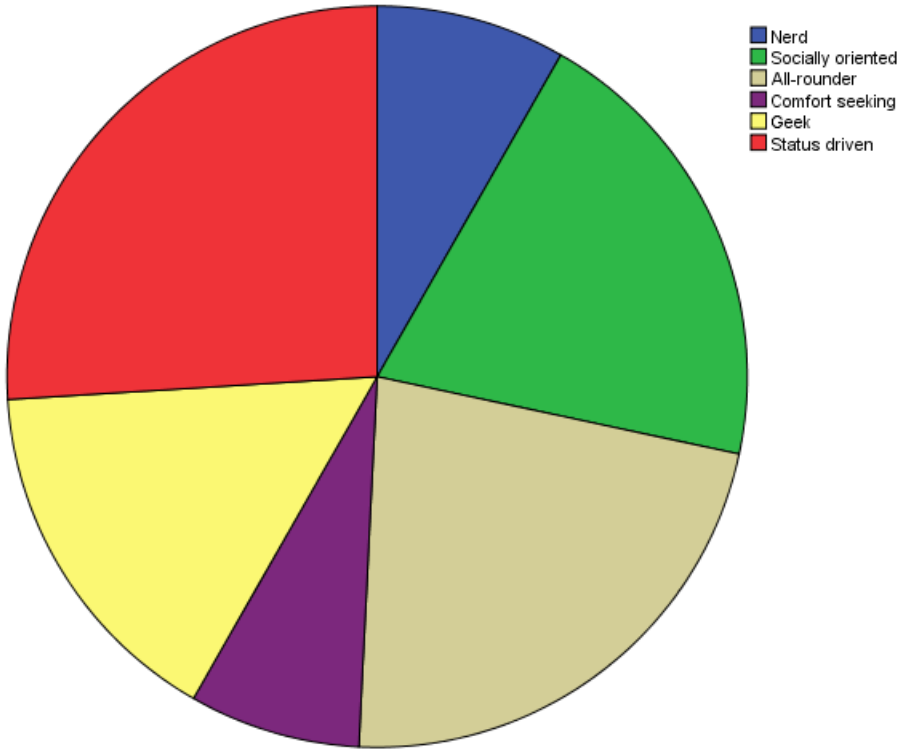

Figure 4. Distribution of profiles

Table 8.

Gender distribution of the profiles

	Frequency	Percent	Female %	Male %
Nerd	21	8.3%	-	9.6%
Socially oriented	51	20.1%	31.3%	18.3%
All-rounder	57	22.4%	18.8%	22.8%
Comfort	19	7.5%	**25.0%**	**6.4%**
Geek	40	15.7%	6.3%	17.4%
Status	66	26.0%	18.8%	25.6%
Total	254	100%	6.8%	93.2

Note: Significant deviations of the observed frequency are indicated **Bold**

Distribution among highest attained educational level. The employees who obtained a University degree (WO) fit mostly in the status driven and geek profile. Employees who finished the University of Applied Sciences (HBO) were mostly status driven and all-rounders. Employees who finished vocational education (MBO) fitted mostly in the socially oriented profile (see Table 9). The chi-square score showed that there was a significant difference in the distribution of the profiles between the three educational levels (X^2=26.094, p=.004). Post-hoc analysis showed that the profiles differed only regarding vocational education. Employees who finished vocational education had more often a socially oriented or comfort seeking profile and less often a status driven profile.

Table 9.

Distribution of profiles per educational level

	Educational level							
	WO		HBO		MBO		Total	
Nerd	6	16.2%	15	10.3%	-	-	21	9.1%
Socially oriented	4	10.8%	26	17.9%	**16**	**32.0%**	46	19.8%
All-rounder	7	18.9%	31	21.4%	12	24.0%	50	21.6%
Comfort seeking	1	2.7%	8	5.5%	**9**	**18.0%**	18	7.8%
Geek	8	21.6%	24	16.6%	6	12.0%	38	16.4%
Status driven	11	29.7%	41	28.3%	**7**	**14.0%**	59	25.4%
Total	37	100%	145	100%	50	100%	232	100%

Note: Significant deviations of the observed frequency are indicated in **bold**

RQ2: What is the difference in technical employees' level of employee engagement (i.e. self-directed learning, organisational commitment and career adaptation) between age cohorts?
To investigate whether the employee engagement of technical employees would differ per age cohort, ANOVA's were performed. Each component of employee engagement was analysed separately. The results showed a significant effect for each component of employee engagement, which will discussed more in depth shortly. Figure 5 shows the effect for each component per age cohort. Table 10 shows an overview of the means and standard deviations for each component per age cohort.

Firstly, affective organizational commitment was significantly influenced by age, F(3, 223) = 3.259, $p < .05$, ω= .042, indicating that affective organizational commitment did increase with age, confirming hypotheses 1. Post-hoc test showed that there was only a significant difference between the developing career cohort and the consolidating career cohort (α<.05). Interesting was that the affective organizational commitment was lowest during the developing career cohort, shoot up in the consolidating career cohort and lowered slightly in the pre-retirement cohort.

Secondly, continuance commitment proved to be significantly affected by age, F(3, 223) = 10.993, p<.05, ω=.116. Continuance commitment grew when ageing. Post-hoc tests showed that there was no significant difference between early career and developing career and also not between consolidating career and pre-retirement. The two groups did differ significantly from each other (α<.05).

Thirdly, the results showed that there was a significant effect of age on self-directed learning F(3, 229) = 3.178, p <.05, ω = .04, indicating that self-directed learning did decrease with ageing. Therefore, hypothesis 2 was not confirmed. Interestingly however, the pre-retirement age cohort does showed a slightly higher level of self-directed learning than the consolidating age cohort. Post-hoc tests show that there was a significant difference between early career and consolidating career (α<.05) and a moderately significant difference between developing career and consolidating career (α<.10).

Lastly, results showed that there was a significant effect of age on career adaptability F(3,225) = 5.114, p<.05, ω=.071. Hypothesis 3 was confirmed because career adaptability lowered with age. Post-hoc tests showed that employees in the early career cohort scored significantly higher at career adaptability than employees in the consolidating or pre-retirement phase.

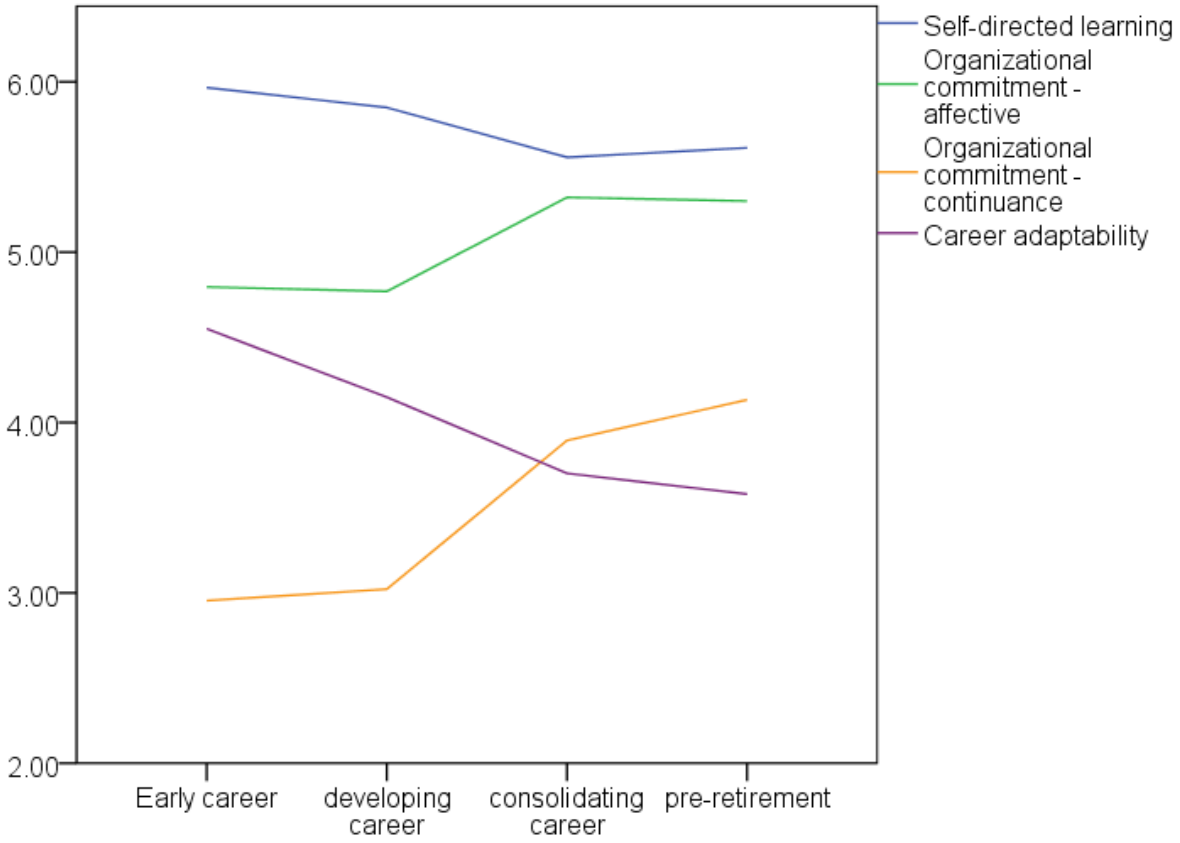

Figure 5. Mean scores for self-directed learning, organizational commitment and career adaptability, for each age cohort

Table 10.

Means and standard deviation of self-directed learning, organizational commitment and career adaptability for each age cohort

Scale	Age cohort	Mean	Std. deviation
Self-directed learning	Early career	5.97	.76
	Developing career	5.85	.73
	Consolidating career	5.55	.79
	Pre-retirement	5.64	.79
Organizational commitment - Affective	Early career	4.80	1.32
	Developing career	4.77	1.24
	Consolidating career	5.32	.98
	Pre-retirement	5.30	1.57
Organizational commitment - Continuance	Early career	2.9	1.02
	Developing career	3.02	1.26
	Consolidating career	3.90	1.18
	Pre-retirement	4.13	1.25
Career adaptability	Early career	4.55	1.12
	Developing career	4.13	1.34
	Consolidating career	3.70	.99
	Pre-retirement	3.58	1.35

RQ 3: What is the difference in technical employees' content and strength of PI across age cohorts?

Age and content of professional identity. The age cohorts had a significantly different distribution of profiles (X^2= 27.329, p=0.026), confirming hypothesis 4. The early career cohort had the most socially oriented profiles and the least all-rounder profiles (see Table 11). The developing career cohort had the least socially oriented profiles. The consolidating career had statistically the least status driven profiles. Finally, the pre-retirement phase had the most comfort seeking profiles.

Table 11.

Profile distribution within the age cohorts

	Age cohort									
Profile	Early career		Developing career		Consolidating career		Pre-retirement		Total	
Nerd	1	2.3%	11	9.9%	7	11.7%	2	9.5%	21	8.9%
Socially oriented	**15**	**34.1%**	**13**	**11.7 %**	13	21.7%	5	23.8%	46	19.5%
All-rounder	**3**	**6.8%**	29	26.1%	16	26.7%	5	23.8%	53	22.5%
Comfort seeking	3	6.8%	7	6.3%	4	6.7%	**4**	**19.0%**	18	7.6%
Geek	8	18.2%	18	16.2%	11	18.3%	2	9.5%	39	16.5%
Status driven	14	31.8%	33	29.7%	**9**	**15.0%**	3	14.3%	59	25.0%
total	44	18.6%	111	47.0%	60	25.4%	21	8.9%	236	100%

Note: Significant deviations of the observed frequency are indicated **Bold**

Age and strength of professional identity. Spearman's rho showed that there was a significant relation between age and the strength of professional identity (r=-.146, n=237, p=.025). The strength of professional identity was quite high during the early career cohort, lowered during the developing career cohort and was the lowest during the consolidating career cohort. The strength of professional identity was the highest during the pre-retirement phase (see Figure 6). Therefore, hypothesis 5 was partly confirmed, the strength of professional identity was the highest in the oldest age cohort, but did not increase with age.

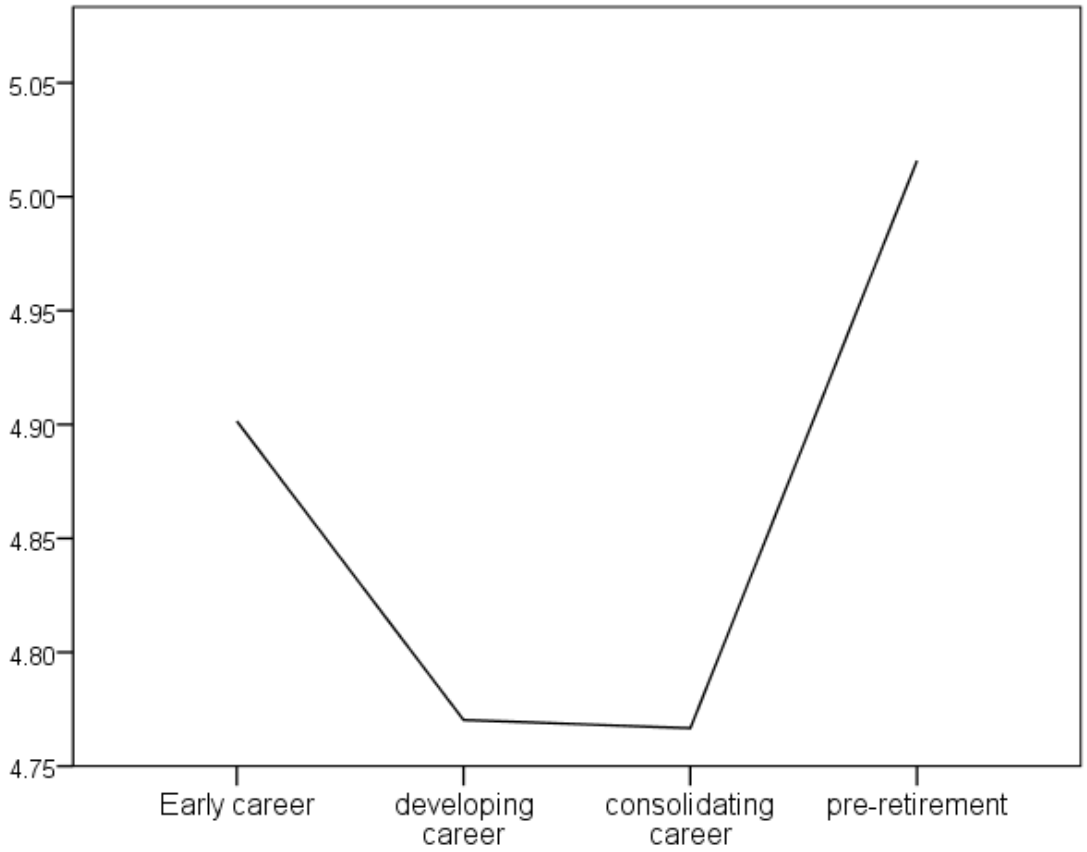

Figure 6. Strength of professional identity per age cohort

RQ 4: What is the relationship between the content and strength of a technical employees' professional identity?

There was a significant difference between the strength of professional identity of the five profiles $F(5,231) = 3.175$ p=.009 ω=.064. The all-rounder had the highest mean of professional identity strength and the comfort seeking profile had the lowest (see Table 12 and Figure 7). The post-hoc test showed that the strength of PI of the all-rounder was significantly higher than the strength of professional identity of the geek and the status driven profiles. 6.4% of the variance among professional identity strength was explained by the content of professional identity.

Table 12.

Mean and standard deviation of professional identity strength for each profile

Profile	Mean	Std. deviation
Nerd	4.71	.75
Socially oriented	4.86	.78
All-rounder	5.17	.86
Comfort seeking	4.65	.88
Geek	4.66	.64
Status driven	4.65	.84

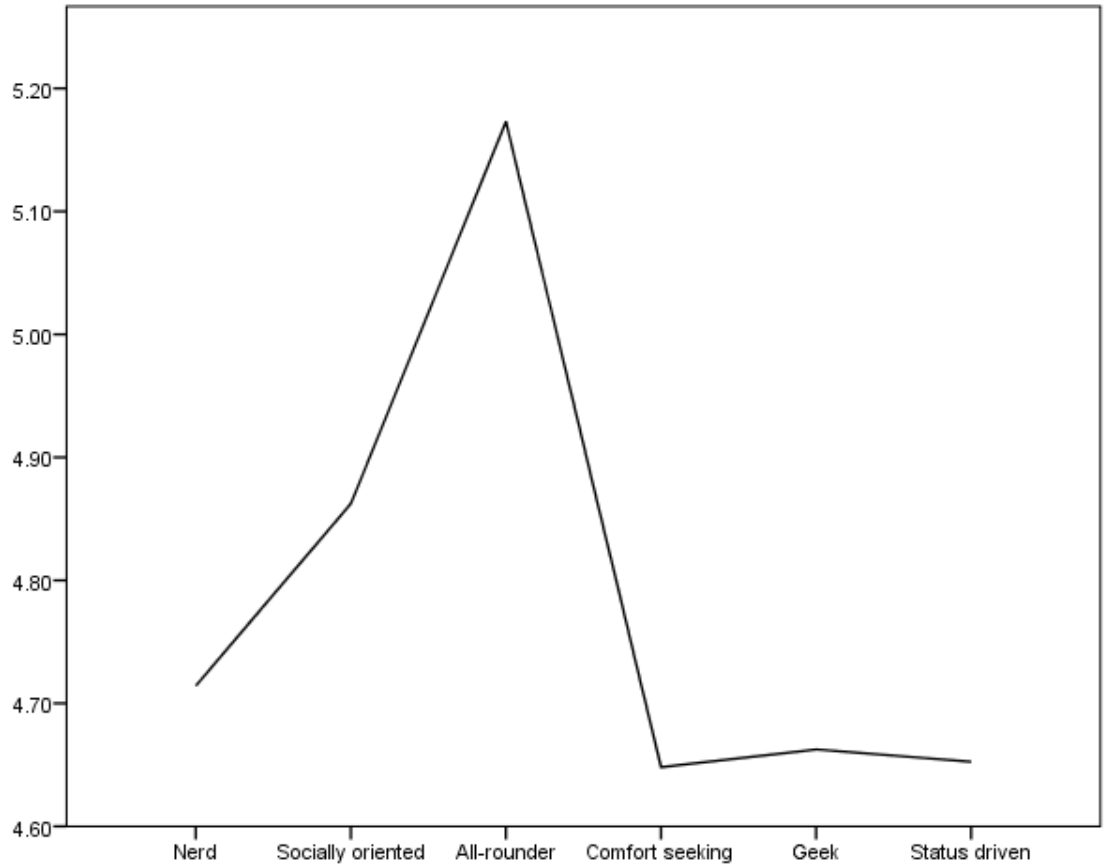

Figure 7. Means per age cohort

RQ 5: What is the relationship between the professional identity (i.e. content and strength) of engineers and employee engagement?

Professional identity content and employee engagement. The results showed that the level of employee engagement did differ depended on the content of professional identity (see Table 13).

Table 13.

MANOVA results of employee engagement and the profiles

Profile	Mean square	F	DF	P
SDL	6.84	14.92	5	.00
Affective OC	4.44	2.97	5	.01
Continuance OC	4.22	2.71	5	.02
Career adaptability	8.96	6.44	5	.00

The post-hoc tests showed for self-directed learning that the nerd and the all-rounder scored the highest and the comfort seeking profile scored significantly lower than all other profiles ($p<.005$). Hypothesis 6 was confirmed because these profiles scored the highest and lowest on the factor learning.

The profile of all-rounder also scored highest on affective commitment, on which the comfort seeking and geek profiles scored the lowest (see Figure 8). The only significant difference was between the all-rounder and the geek ($p=.015$). The all-rounder values social behaviour, the comfort seeking and geek profiles score highest on introversion. Therefore hypothesis 7 was confirmed, because extraverted, social profiles showed more affective commitment.

The comfort seeking profile did have the highest level of continuance commitment, while the status driven and all-rounder profiles had the lowest level of continuance commitment. Status driven scored significantly lower than comfort seeking (p=.019) and the all-rounder scored moderately significantly lower (p=.078). The results did not follow the hypothesis that extraversion or conscientiousness would increase continuance commitment, therefore, hypothesis 8 was rejected.

Lastly, with regards to career adaptability the all-rounder profile showed the highest scores and the comfort seeking profile the least. The comfort seeking profile scored significantly lower than the socially oriented, all-rounder and status driven profiles (p<.05). The geek scored also lower than the all-rounder (p<.05)

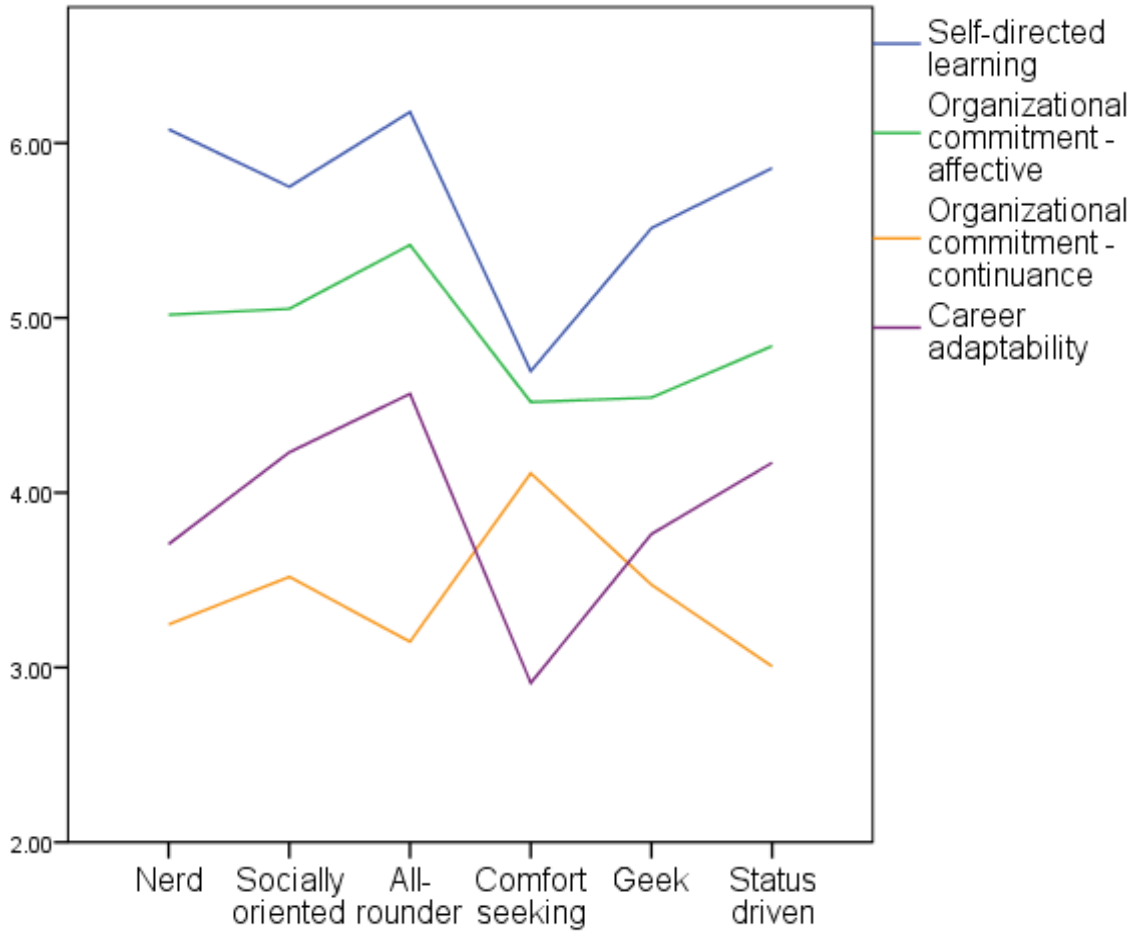

Figure 8. Means of self-directed learning, organizational commitment and career adaptability for each profile

Employee engagement and professional identity strength. A multiple regression analyses was run to predict the level of professional identity strength from employee engagement. Self-directed learning and affective organizational commitment did predict the level of professional identity strength $F(4,223)=11.585$, $p=.000$, $R^2=.172$. Continuance organizational commitment and career adaptability did not significantly predict the strength of professional identity. An overview of professional identity strength categorized by employee engagement can be found in Figure 9.

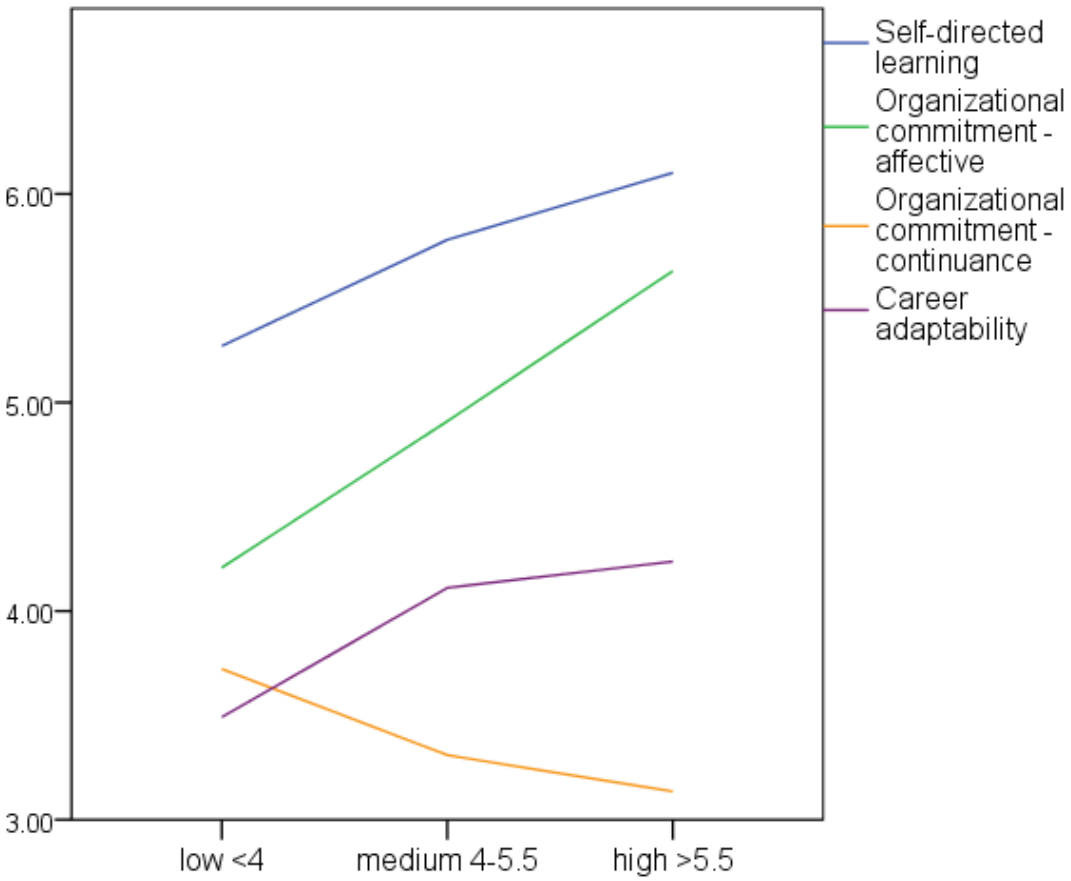

Figure 9. Means of self-directed learning, organizational commitment and career adaptability per professional identity strength

Main RQ: How does employee engagement of technical employees change across different age cohorts, and can this be explained by a change in their professional identity?
In order to establish if the change of employee engagement across age cohorts could be explained by professional identity, a mediation analysis was run, containing professional identity strength as mediator. Self-directed learning and affective organizational commitment were analysed, since only these who concepts showed to be directly affected by professional identity strength.

Self-directed learning. The results showed no significant indirect effect of professional identity strength on self-directed learning through age (see Figure 10), b = .003, BCa CI [-.033 - .043]. The effect was extremely small, κ^2 = .0044, 95% BCa CI [.0000 - .0161]. Only the direct effect of professional identity strength on self-directed learning proved to be significant, b = .202, p<.0001. Since age cohorts was a categorical variable, dummy variables were made to investigate if the different age cohorts differed significantly from each other. Consolidating career showed significant difference from the other age cohorts, p = .006. The mediating effect of professional identity strength on the relation between age and self-directed learning was strongest with employees in the consolidating career stage.

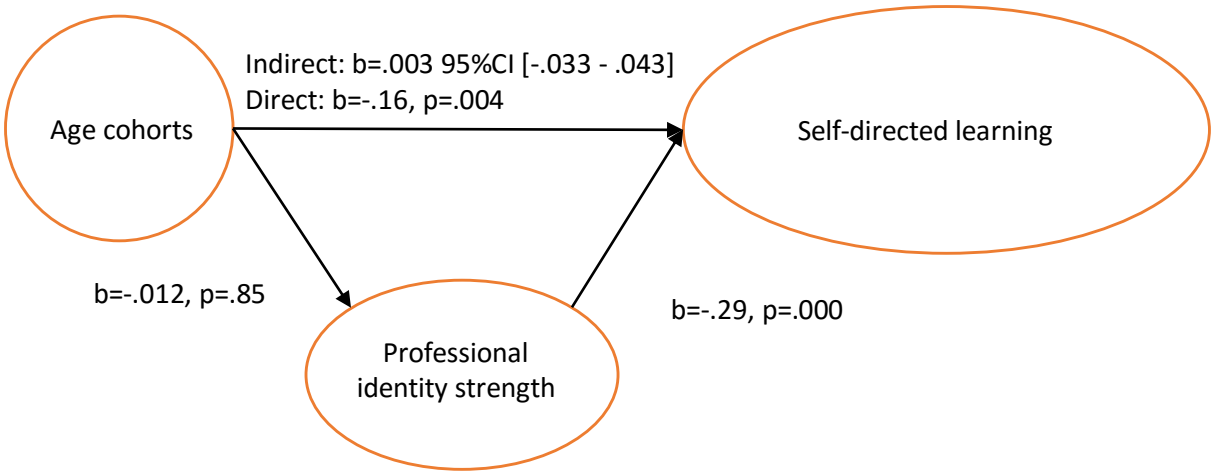

Figure 10. Mediation model with professional identity strength as mediation variable, and self-directed learning as outcome variable

Affective organizational commitment. The results showed no significant indirect effect of PI strength on affective organizational commitment through age (see figure 11), *b* = .004, BCa CI [-.065 - .063]. The effect was extremely small, κ^2 = .0029, 95% BCa CI [.0000 - .0082]. Only the direct effect of professional identity strength on affective organizational commitment proved to be significant, *b* = .48, p<.0001. Since age cohorts was a categorical variable, dummy variables were made to investigate if the different age cohorts differed significantly from each other. The developing career cohort showed significant difference from the other age cohorts, p = .034. The mediating effect of professional identity strength on the relation between age and affective commitment was strongest with employees in the developing career stage.

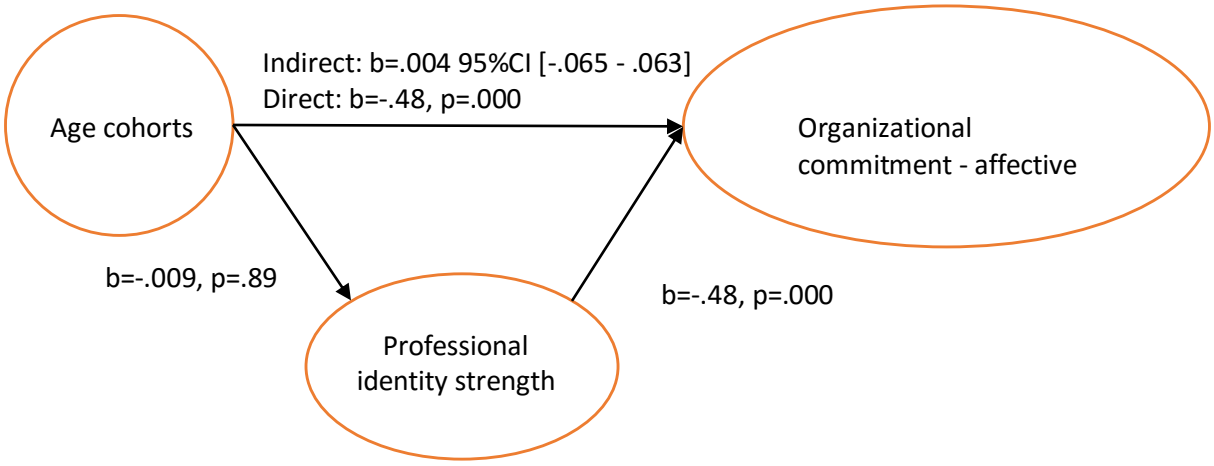

Figure 11. Mediation model with professional identity strength as mediation variable and affective commitment as outcome variable

Conclusions

The early career employee

The employee younger than 35 years old takes control of their own learning process. They have a flexible view of their career, seeing multiple possibilities for their career. The youngest employees are not as committed to their organization as their older colleagues. They have the lowest level of continuance commitment and the second lowest affective commitment. Early career employees are often socially oriented or status driven. Early career employees are less often in the all-rounder profile than the other age cohorts. They have a strong professional identity, meaning that young employees do identify with their profession.

The developing career

Employees aged 35 to 49 are classified in the developing career age cohort. They are quite self-direct in their learning process, see possibilities in their careers and can cope with change in their career, although their score is a bit lower than their younger colleagues. The developing career employee is not highly committed to the company. They show the lowest affective commitment and the second lowest continuance commitment. They are often in the all-rounder profile or in the status driven profile. They are the least socially oriented of all profiles. They identify relatively little with their profession; their score on professional identity strength is the second lowest score. However, the absolute score shows that they do identify with their profession.

The consolidating career

The employee in the consolidating career age cohort is aged between 50 and 59. The consolidating career employees are the least self-directed in their learning of all employees, finding it difficult to give direction to their own learning. They show the highest level of affective commitment, meaning that consolidating career employees do enjoy being a part of their company most of all employees. They also show the second highest level of continuance commitment. Concluding, employees aged 50 to 59 are highly committed to their company. Additionally, their score on career adaptability was lower. They see fewer possibilities for their career and find it more difficult to cope with change. Employees aged 50 to 59 are most often in the all-rounder or socially oriented profile and the least in the status driven profile. Of all employees, they identify the least with their profession.

Pre-retirement

For the pre-retirement employee, who is 60 years or older, retirement is within reach. They score second lowest on self-directed learning, just a little bit higher than their colleagues in the consolidating career cohort. They are very committed to the company. They score second highest on affective commitment, so pre-retirement employees do still enjoy being a part of the company. Furthermore they score highest on continuance commitment, meaning that they also feel the need to stay with the company. Additionally, they score lowest on career adaptability. Pre-retirement employees see the least possibilities for their career and find it difficult to adhere to changes in their careers. However, they do identify the most with their profession of all employees.

Discussion

The goal of this research was twofold; first to investigate how employee engagement of technical employees changes across age cohorts and second to find out whether or not the change in employee engagement across age cohorts could be explained by a changing professional identity. Both research goals will be discussed, following the research questions. Additionally, recommendations for literature, practical implications and methodological limitations will be presented. Lastly, the final conclusion will be given.

Research findings

RQ1 Profiles of professional identity. The first research question focused on the possibility to distinguish profiles of professional identity. The profiles were established with a cluster analysis. Since there was only one previous research building professional identity profiles, which used a different method, no expectations were established on forehand. The profiles were judged on their logic and labelled by their most outstanding qualities. Six profiles were found namely: nerd, socially oriented, all-rounder, comfort seeking, geek, and status driven. The new profiles were compared to the profiles of Möwes (2016), who found seven profiles among STEM students namely; status driven, hip, geeky, outdoorsy, uncertainty avoidant, nerdy and creative. Möwes' (2016) profiles were established using factor analysis which led to a different content of the profiles. Despite these differences, some profiles did overlap. Three profiles were found in both studies: status driven, nerd and geek. Möwes' profile hip is comparable to the socially oriented profile, both valuing social behaviour. Also the profiles uncertainty avoidant (Möwes, 2016) and the comfort seeking profiles are comparable as both profiles find comfort and security most important. The all-rounder profile is unique, which could be explained

by the fact that employees have gained more experience than students. The creative profile from Möwes was not found among technical employees in technical organizations, these students also did not want to work within the technical sector (Möwes, 2016) which explains why they were not found.

RQ2 Effect of age on employee engagement. The second research question investigated if there were differences in employee engagement between the age cohorts. Previous research enabled the forming of hypothesises, each one will be discussed more deeply. Firstly, affective commitment was supposedly higher among new employees, before stabilizing and gradually increasing with age (Allen & Meyer, 1990). The affective commitment was indeed a bit higher in the early career cohort than in the developing cohort, it also did increase from consolidation career to developing career. However there was a slight, non-significant, decrease in the pre-retirement phase. Affective commitment is also fostered by personal competences and by feeling challenged (Allen & Meyer, 1990). The decrease could come from the decreased feelings of competency, because older employees had more difficulty keeping up-to-date (Brouwer et al., 2012), or were perceived as less competent and thus less challenged (Desmette & Gaillard, 2008). Another explanation could be that the current older generation could not yet anticipate on the new retirement age (Brouwer et al., 2012), therefore there was a discrepancy between current retirement age and the age the employee thought they could retire, influencing their motivation.

Secondly, continuance commitment, for which no expectations were formed. The current research showed that continuance commitment did increase with age. The increasing continuance commitment could be explained by the fact that employees had more responsibilities when they get older, for example, children who cost money. It could also be explained by the fact that older employees felt like they cannot find another job so easily, because they were more expensive to hire.

Thirdly, self-directed learning, for which earlier research had found an increase (Stockdale, 2003), or no effect (Raemdonck et al, 2012) among older employees. We did find a significant difference between age cohorts, however it was a decrease with age, instead of an increase. We expected the age cohort of consolidating career to have the highest level of self-directed learning, however they had the lowest level of self-directed learning. Note however that the level of self-directed learning was overall very high. The high level of self-directed learning among young employees could be explained by the amount of attention self-directed learning has gotten the past few years. For example by the problem-based education that was given to students. The problem-based education gave younger employees more experience in guiding their own learning process, making them better at it than older employees.

Lastly, career adaptability for which we expected a decrease with age, which it did. It was the highest in the early career age cohort and the lowest in the pre-retirement age cohort. When compared with continuance commitment, a decrease of career adaptability seem very logical. The harder employees find it to change their careers, the more likely they feel like they have no other options. When an employee sees multiple career options, adjusting their career will feel easier.

RQ3 Professional identity in relation with age. The content of professional identity did change with age. In the early career age cohort has the most socially oriented engineers. These employees were younger than 35, friends were still very important and they were starting a family. The early career age cohort had the least all-rounders of all profiles. An early career employee was still starting and did not yet have the possibilities to develop themselves more broadly. Furthermore the early career employee would work with more experienced colleagues showing the young employees possibilities for professional development.

The developing career cohort had the least socially oriented profiles. Their children have gotten a bit older and the focus was more on their career. They are often in the all-rounder or status driven profile. They had the chance to develop themselves and their career was their main focus.

The consolidating career cohort had the least status driven profiles, it was possible that they either reached their ambitious goals, or stood them aside. They were more often an all-rounder or socially oriented. The focus was again more on family and social activities and less on career.

The pre-retirement age cohort had the highest percentage of comfort seeking engineers. They reached retirement and started to disengage from their work. Family became more important, and they

were often in the socially oriented profile. Staying up-to-date with the latest developments had become more difficult; in the pre-retirement cohort were the least geeky profiles.

The strength of professional identity was also differed between the age cohorts. The early career and pre-retirement age cohorts had high levels of professional identity strength and the developing and consolidating career had lower levels. This was not completely in line with the expectation. However, this could be explained by psychological crisis such as mid-life crisis, which would make employees question the identification with their profession. Employees who just entered from university made their career choice recently, had high expectations and were still fully committed (Allen & Meyer, 1990), this made them more convinced of their profession. Pre-retirement employees had either been in their profession for a long time, or made a conscious choice to change their career, making them more committed to their choice of profession.

RQ4 Relation content and strength. The content and strength were significantly related with each other. This implicated that your profile did say something about your level of identification. The all-rounder identified most with his profession. Comfort seeking had the lowest identification closely followed by the geek and status driven profiles. There were no expectations, only one research had investigated the balance between content and strength before, which showed that they did relate (Möwes, 2016). The current research confirmed that professional identity content and strength of technical employees were related to each other.

RQ5 Relationship professional identity and employee engagement. Self-directed learning proved to be increased by the competency learning. Both the nerd and the all-rounder were competent learners and showed high levels of self-directed learning. The value factor learning consisted of lifelong learning and intellectual stimulation. Reflective and evaluative competencies were both a part of learning, which explained the high level of self-directed learning in these profiles. The all-rounder was also critical, which was a part of personality factor openness. Which explained why the all-rounder had the highest score on self-directed learning. The profile comfort seeking scored low on self-directed learning. The comfort seeking profile scored lowest on learning and openness, which explained the low score on self-directed learning.

Affective commitment was increased by extraversion or social behaviour. The all-rounder scored low on introversion and high on social behaviour. Therefore the high score could be explained. However, the profile socially oriented, which values social behaviour and family, scored only second highest on affective commitment. This could be explained by the factor introversion. The social oriented profile was introverted instead of extraverted. This could have minimized the effect of valuing social behaviour on affective commitment. The comfort seeking profile scored low on social behaviour and very high on introversion, explaining why the comfort seeking profile had the lowest score of affective commitment.

Continuance commitment should have been increase by extraversion or conscientiousness. However, the comfort seeking profile had the highest score on continuance commitment while it scored high on introversion and low on conscientiousness. The profiles of all-rounder and status driven, who scored both low on introversion (thus high on extraversion) had the lowest scores of continuance commitment. The hypothesis was rejected. The effect of goals of employees on continuance commitment was not yet researched. Perhaps the goals as comfort or security had more influence on continuance commitment than personality traits had.

Career adaptability was free of assumptions. The comfort seeking profile scored lowest on career adaptability, the all-rounder, status driven and socially oriented profiles score highest. The value social behaviour was highly valued by the all-rounder, status driven and socially oriented profile, but valued low by the comfort seeking profile. Perhaps career adaptability was influenced by social behaviour. This could be researched further in the future.

The strength of professional identity only influenced self-directed learning and affective commitment significantly. Continuance commitment decreased with increased identification, career adaptability increased. So when an engineer was more convinced that he was an engineer, he would show more self-directed learning, would like his company better and did see more options for its career. Earlier research found that an increased identification could influence organizational commitment (Baruch, & Cohen, 2007). This only proved to be true in the case of affective commitment. Which could

be explain by the affective value that was a part of professional identity strength (Ashfort et al., 2008). The increased level of self-directed learning and career adaptability could be explained by the high level of self-definition. Knowing who you are as a professional would make it more likely that they would know what they want in their career.

Main RQ Mediation model. The mediation effect of professional identity strength on self-directed learning and affective commitment was very small and was not significant. For self-directed learning the effect was strongest for the consolidating career. Which could be explained because self-directed learning was lowest among professional with a low identification with their profession. Furthermore, employees in the consolidating career cohort scored both lowest at self-directed learning and at professional identity strength. For affective commitment was the effect the strongest in the developing career. The employees developing career have a low identification and the lowest score of affective commitment, which explained why the mediation effect was the strongest.

Implications for theory

After conducting the literature research a problem in the currently available literature became clear namely; there was a lack of unity within these topics age and employee engagement. This will be further discussed per research topic.

Age. As mentioned during the establishment of the age cohorts, there was allot of diffusion in the age cohorts used in previous research. Firstly, the age cohorts used differed per research. This would affect the comparability of the researches. Secondly, the age cohorts were often limiting, especially when it came to including older employees. Four out of the five researches used, started the pre-retirement phase more than eleven years before retirement. The new retirement age of 67 was a recent development explaining why the change was not yet visible in the literature. However, this was concerning because the adjustment of the retirement age can influence employees (Brouwer et al, 2012). Furthermore, wide age cohorts or lack of inclusion of 60+ years old employees could give a distorted or limited results on the effect of ageing. Thirdly, the evidence supporting the age cohorts was either theoretical or empirical. The research of Jonas (2003) for example presented a theoretical underpinning for a division of age cohorts. However, there was no empirical evidence of the validity and reliability of the classification. The research of Bos et al. (2008) and Darcy et al. (2012) had the opposite problem. They classify and use age cohorts, however it was completely unclear why these age cohorts were chosen.

The diffusion would influence the validity, reliability and comparability of research. Therefore, we recommended that future research would establish a theoretical and empirical sound categorization of age cohorts, which was validated and reliable in a diverse context, which could be widely used in research investigating the effect of age. This way all future research would be more valid and reliable, making it be possible to compare research.

Employee engagement. The term employee engagement was often used as an umbrella term, which was also done by the current research. However, this resulted in incoherent definitions and results of employee engagement. Different definitions of employee engagement could give different results, however all under the name of employee engagement. This would imply that the same variables are researched even when not. Including or excluding elements could also influence the results due to elements affecting each other. For example, self-directed learning and career adaptability influenced each other (Brown, Bimrose, Barnes, & Hughes, 2012). Therefore, a research investigating career adaptability and organizational citizenship behaviour that excluded self-directed learning would be influenced by the indirect effect between the elements. Scholars defined the concept as they seem fitting for their research, however this made the overall research field diffuse and difficult to interpret.

Implications for human resource management policy and practice

Results of this research had practical implications for technical companies. The research showed that there were multiple profiles of technical employees, which were differently distributed among the age cohorts. It gave the companies who participated in the research an overview of the profiles of their engineers. These profiles could be used by companies in various ways. First was to use the profiles

during the selection procedure and development of the employees. If certain profiles would be missing, underrepresented or overrepresented, the selection procedure could be used to ensure that all profiles would be represented. Furthermore, the profiles could be used to personalise the professional development of technical employees. For example, employees with the status driven profile who want to develop leadership skills could be supported with possible trainings. A profile such as geek or nerd could develop themselves towards fields of their interests such as research and development. Matching the career wishes of the technical employee with the needs of the company would be beneficial to both parties. It would result in happier employees and a more effective company, which was positive for both parties.

Secondly, the results could be used to fit strategy to the needs of the age cohorts, supporting the employee engagement of their employees. The organizational commitment of the early career employees could be supported to keep employees in the company. Employees in the development career cohort could use support in both their organizational commitment and commitment to their profession. The consolidating career cohort could use more support to take charge of their own learning process and to adjust to changes. Furthermore, they could use support to enhance their commitment to their profession. Pre-retirement employees could be given more support with their learning, and how to take charge of their own career. By doing this, the older employees would feel like they still matter to the company, making them more motivated. For the company it would be beneficial to have older employees who could keep up-to-date with developments and were motivated to do so.

Lastly, STEM students and career counsellors could use the profiles to guide students in their career choice. It showed students that there were multiple profiles within a company. This would take away prejudices students or society might have regarding the company or profession. The students would realize whether or not the profiles within the company were fitting with their own professional identity. By taking away prejudices more technical students would remain in the technical sector, or would find a job in a sector that fits with their professional identity.

Limitations and future directions

Some limitations of the current study need to be considered. A first limitation was the model estimation used during the exploratory factor analysis. The current research used principal component analysis (PC), which was a frequently used method for EFAs (Schmitt, 2011). However, PC did not assume measurement error, which made it less likely to generalize to a CFA. This might have lowered the model fit estimated with the CFAs. A method such as principal axis factoring might have given better overall model fit measures, since it generalized better to CFAs (Schmitt, 2011).

The EFA of personality was the second limitation, since the new factor structure was so different from the structure found in literature. In the current research we did establish six factors, but seven. Five of the original factors were found, the other two contain factors from multiple original factors. Multiple EFAs paths were explored, however in order to establish a six factor structure meant excluding many items, lowering the overall reliability of the construct personality. For future research we do recommend to see if a six factor structure would be possible, to enhance comparability with other measures and to enhance clarity for researchers and users.

The third limitation regarded reliability. In general the CFA scores of the scales were quite low. However, research on personality using CFAs revealed that it was unlikely to gain sufficient model fit for complex concepts such as personality (Ashton, Lee, Goldberg, & de Vries, 2009). Arguing that the domain of professional identity was as complex as personality, the since the model fit was barely insufficient, the reliability of the CFAs was deemed acceptable. Furthermore, the Cronbach alphas were also quite low. However, removing items would not have increased the alpha. A method that could have increased the overall reliability would be to use a second critic. Now, a second critic was only used in a situation of doubt. Consistent use of a second critic would lead to a more sound solution and is recommended for future research.

The fourth limitation concerned the sample used in the research. The participating companies were all based in the region Twente in the east of the Netherlands. Therefore, the respondents were all based in the same region. This could biased the results because some types of engineers may not wanted to work with the region of Twente. Furthermore, the age cohorts were not evenly distributed over the sample. The pre-retirement age cohort was for example, much smaller. This could be explained by a smaller interest in their professional development, since retirement is near. The uneven distribution

could have influenced the results, for example because only the more active older employees participated in the research. For future research we recommend to enlarge the region in which the respondents are based and to aim for a more even distribution of age cohorts.

The last limitation was the lack of content in the mediation analysis. Due to difficulty with implementing a categorical variable as a mediating variable into a mediation model, professional identity content was left out of the model. The PROCESS macro used was not capable of using categorical variables as mediator variables, however, Valeri and VanderWeele (2013) described a SPSS macro that was capable to implement a categorical mediator variable. Therefore it is recommended that future research would explore the option further, to establish if the content of professional identity would mediate the effect of age on employee engagement.

Final conclusion

The Dutch economy currently has little experience with the sustainable employment of older technical employees. However, the technical sector is growing rapidly. In order to satisfy the need for technical employees, older employees must stay motivated and up to date. This research successfully showed the differences in employee engagement between age cohorts, including technical employees of all ages. Furthermore, the research showed that the employee engagement also depends on the professional identity of the employee. To conclude, the changing professional identity is related to the changes in employee engagement among employees in a different age cohort. The results enable companies to directly target the employees who need support with aspects of employee engagement. Furthermore it will visualize the development wishes of the employees, allowing the company and employee to grow it the desired direction. Being able to cater to the needs of the employees will increase the employee engagement, creating employees who believe in the company, who are motivated and feel the desire to making things better. This will prolong the sustainable employability of older technical employees, satisfying the need for technical employees within technical companies.

References

Abrams, D., and Hogg, M.A. (1988). Comments on the motivational status of self-esteem in social identity and intergroup discrimination. *European Journal of Social Psychology*, 18, 3 17-334. doi: 10.1002/ejsp.2420180403

Allen, N.J., & Meyer, J.P. (1990). Organizational commitment: evidence of career stage effects? *Journal of Business Research, 26,* 49-61. doi:10.1016/0148-2963(93)90042-N

Ashfort, B.E., Harrison, S.H., & Corley, K.G. (2008). Identification in organizations: An examination of four fundamental questions. *Journal of management, 34*(3), 325-374. doi: 10.1177/0149206308316059

Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of personality. *Journal of personality assessment, 91*(4), 340-345. doi 10.1080/00223890902935878

Ashton, M.C., Lee, K., Perugini, M., Szarota, P., De Vries, R.E., Di Blas, L., … & De Raad, B. (2004). A six-factor structure of personality-descriptive adjectives: solutions from psycholexical studies in seven languages. *Journal of personality and social psychology, 86*(2), 356-366. doi: 10.1037/0022-3514.86.2.356

Babbie, E. (2010). *The practice of Social Research*. Belmont, CA: Wadsworth.

Bartels, J., Peters, O., de Jong, M., Pruyn, A., & van der Molen, M. (2010). Horizontal and vertical commuication as determinants of professional and organisational identification. *Personnel Review, 39*(2), 210-226. doi:10.1108/00483481011017426

Baruch, Y., & Cohen, A. (2007). The Dynamics between Organizational Commitment and Professional Identity Formation at Work. In A. Brown, S. Kirpal, & F. Rauner (Eds.). *Identities at Work* (pp. 241-260). Dordrecht: Springer.

Beauducel, A., & Herzberger, P.Y. (2006). On the performance of maximum likelihood versus means and variance adjusted weighted least squares estimation in CFA. *Structural Equation Modeling, 13*(2), 186-203. doi: 10.1207/ s15328007sem1302_2

Bos, J.T., Donders, N.C.G.M., Bouwman-Brouwer, K.M., & Van der Gulden, J.W.J. (2009). Work characteristics and determinants of job satisfaction in four age groups: university employees' point of view. *International Archives of Occupational and Environmental Health, 82,* 1249-1259. doi: 10.1007/s00420-009-0451-4

Brouwer, S., de Lange, A., van der Mei, S., Wessels, M., Koolhaas, W., Bültmann, U., … van der Klink, J. (2012). *Duurzame inzetbaarheid van de oudere werknemers: stand van zaken* [Sustainable use of older employees, updated situation].Groningen: Rijksuniversiteit.

Brown, A., Brimrose, J., Barnes, S., Hughes, D. (2012). The role of career adaptabilities for mid-career changers. *Journal of Vocational Behaviour, 80*(3), 754-761. doi:10.1016/j.jvb.2012.01.003

Cataldo, P. (2011). Focusing on employee engagement: how to measure it and improve it. Retrieved from: http://facultystaffpartnership.web.unc.edu/files/2014/11/UNC-focusing-on-employee-engagement.pdf

Cooke, D.K. (1994). Measuring career stage. *Human Resource Management Review, 4*(4), 383-398. doi:10.1016/1053-4822(94)90020-5

Crocetti, E., Avanzi, L., Hawk, S.T., Fraccaroli, F., & Meeus, W. (2014). Personal and social facets of job identity: a person-cantered approach. *Journal of Business and Psychology, 2,* 281-300. doi: 1007/s10869-013-9313-x

Crocetti, E., Rubini, M., & Meeuws, W. (2008). Capturing the dynamics of identity formation in various ethnic groups: Development and validation of a three-dimensional model. *Journal of Adolescence, 31*(2), 207-222. doi:10.1016/j.adolescence.2007.09.002

Darcy, C., McCarthy, A., Hill, J., & Grady, G. (2012) Work–life balance: One size fits all? An exploratory analysis of the differential effects of career stage. *European Management Journal, 2,* 111-120. doi:10.1016/j.emj.2011.11.001

de Lange, A.H., Taris, T.W., Janse, P., Kompier, M.A., Houtman, I.L.D., & Bongers, P.M. (2009). On the relationship among work characteristics and learning-related behavior: Does age matter? *Journal of Organizational Behavior, 31*(7), 925-950. doi: 10.1002/job.649

Desmette, D., & Gaillard, M. (2008). When a 'worker' becomes an 'older worker'. *Career Development International, 2,* 168-185. doi: 10.1108/13620430810860567

Eisinga, R., Te Grotenhuis, M., & Pelzer, B. (2012). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown?. *International journal of public health, 58*(4), 637-642. doi: 10.1007/s00038-012-0416-3

Ellemers, N., Kortekaas, P., & Ouwerkerk, J.W. (1999). Self-categorisation, commitment to the group and group self-esteem as related but distinct aspects of social identity. *European journal of social psychology, 29*(23), 371-389. doi: 10.1002/(SICI)1099-0992(199903/05)29:2/33.3.CO;2-L

Field, A. (2009). *Discovering statistics using SPSS*. London: Sage publications.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics.* London: Sage publications.

Finegold, D., Mohrman, S., & Spreitzer, G.M. (2002). Age effect on the predictors of technical workers' commitment and willingness to turnover. *Journal of Organizational Behavior, 23,* 655-674. doi: 10.1002/job.159

Gupta, A., Chong, S., & Leong, F.T.L. (2014). Development and Validation of the Vocational Identity Measure. *Journal of Career Assessment,* 1-12. doi: 10.1177/1069072714523088

Hall, D., & Mansfield, R. (1975). Relationships of age and seniority with career variables of engineers and scientists. *Journal of applied psychology, 2,* 201-210. doi: 10.1037/h0076549

Hansen, J.L., & Scullard, M.G. (2002). Psychometric evidence for the Leisure Interest Questionnaire and analyses of the structure of leisure interests. *Journal of Counseling Psychology, 49*(3), 331-341. doi: 10.1037/0022-0167.49.3.331

Jonas, R.M. (2003). Working with Career Stages. In G.R. Walz, & R.L. Richard (Eds.), *Global Realities: Celebrating Our Differences, Honoring Our Connections* (pp. 281-289). Greensboro, NC: CAPS Press.

Klehe, U.C., Zikic, J., Van Vianen, A.E.M, & De Pater, I.E. (2011). Career adaptability, turnover and loyalty during organizaitonal downsizing. *Journal of vocational Behavior, 79,* 217-229. doi:10.1016/j.jvb.2011.01.004

Kroger, J., & Marcia, J.E. (2011). The identity statuses: Origins, meanings, and interpretations. In S. J. Schwartz, K. Luyckx & V. L. Vignoles (Eds.), *Handbook of identity theory and research.* New York: Springer New York.

Kumar, K., & Bakhshi A. (2010). The five-factor model of personality and organizational commitment: is there any relationship? *Humanity & Social Sciences Journal, 5*(1), 25-34. Retrieved from: http://www.idosi.org/hssj/hssj5(1)10/4.pdf

Kyndt, E., & Onghena, P. (2014). The integration of work and learning: tackling the complexity with structural equation modelling. In *Discourses on Professional Learning* (pp. 255-291). Springer Netherlands

Lyons, S.T., Higgins, C.A., & Duxbury, L. (2010). Work values: Development of a new three-dimensional structure based on confirmatory smallest space analysis. *Journal of Organizational Behaviour, 31*(7), 969-1002. doi: 10.1002/job.658

Male, S.A., Bush, M.B., & Chapman, E.S. (2011). An Australian study of generic competencies required by engineers. *European Journal of Engineering Education, 36*(2), 151-163. doi: 10.1080/03043797.2011.569703

Meyer, J.P., Stanley, D.J., Herscovitch, L., & Topolnytsky, T. (2002). Affective, Continuance, and Normative Commitment to the Organization: A Meta-analysis of Antecedents, Correlates, and Consequences. *Journal of Vocational Behaviour, 61,* 20-52. doi:10.1006/jvbe.2001.1842

Miscenko, D., & Day, D.V. (2015). Identity and identification at work. *Organizational Psychology Review,* 1-33. doi: 10.1177/2041386615584009

Molleman, E., & Rink, F. (2015). The antecedents and consequences of a strong professional identity among medical specialists. *Social Theory & Health, 13*(1), 46-61. doi:10.1057/sth.2014.16

Möwes, R.A. (2016). *The career Compass: Discovering Diversity in STEM Students' Professional Identity and its Effects on their Intended Career Choice* (master's thesis). University of Twente, Enschede.

Passow, H.J. (2007, June). What competencies should engineering program emphasize? A meta-analysis of practitioners' opinions informs curricular design. In *proceedings of the 3rd International CDIO Conference* (pp.1-36).

Patterson, C., Crooks, D., & Lunyk-Child, O. (2002) A new Perspective on Competencies for Self-directed Learning. *Journal of Nursing Education, 41*(1), 25-31. Retrieved from: https://files.itslearning.com/data/656/1348/SDL/Patterson%20et.al%20(2002).pdf

Pratt, M.G., Rockmann, K.W., & Kaufmann, J.B. (2006). Constructing professional identity: The role of work and identity leaning cycles in the customization of identity among medical residents. *Academy of management journal, 49*(2), 235-262. Retrieved from: http://mario.gsia.cmu.edu/micro_2007/readings/pratt_etal_2006.pdf

Raemdonck, I. (2006). *Self-directedness in learning and career processes. A study in lower-qualified employees in Flanders.* (Doctoral dissertation). Retrieved from Ghent University Academic Bibliography. (7051535).

Raemdonck, I., van der Leeden, R., Valcke, M., Segers, M., & Thijssen, J. (2012). Predictors of self-directed learning for low-qualified employees: a multi-level analysis. *European Journal of Training and Development, 6,* 572 – 591. doi:10.1108/03090591211245495

Roberts, B.W., & Robins, R.W. (2000). Broad dispositions, broad aspirations: the intersection of personality traits and major life goals. *Personality and Social Psychology Bulletin, 26*(10), 1284-1296. doi: 10.1177/0146167200262009

Ros, M., Schwartz, S.H., & Surkiss, S. (1999). Basic individual values, work values, and the meaning of work. *Applied psychology, 48*(1), 49-71. doi: 10.1111/j.1464-0597.1999.tb00048.x

Savickas, M.L., & Porfeli, E.J. (2012). Career-adapt-abilities scale: construction, reliability, and measurement equivalence across 13 countries. *Journal of Vocational Behaviour, 3,* 661-673. doi: 10.1016/j.jvb.2012.01.011

Schmitt, T.A. (2011). Current methodological considerations in exploratory and confirmatory factor analysis. *Journal of Psychoeducational Assessment*, *29*(4), 304-321. doi: 10.1177/0734282911406653

Schwartz, S. J., Luyckx, K., & Vignoles, V. L. (Eds.), *Handbook of identity theory and research*. New York: Springer New York.

Settersten, R.A., & Meyer K.U. (1997). The Measurement of Age, Age Structuring, and the Life Course. *Annual Review of Sociology, 23*, 233-261. doi: 10.1146/annurev.soc.23.1.233

Sheldon, K.M., Elliot, A.J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of personality and Social Psychology, 80*(2), 3e25. doi: 10.1037//O022-3514.80.2.325

Skorikov, V. B. & Vondracek, F. W. (2011). Occupational identity. In: S. J. Schwartz, K. Luyckx & V. L. Vignoles (Eds.), *Handbook of identity theory and research* (pp. 693-714). New York: Springer.

Stockdale, S. (2003). Development of an instrument to measure selfdirectedness. Dissertation Abstracts International, 59 (6A), 1969. (UMI No. 3092836).

Tajfel, H. and Turner, J. C. (1986). The social identity theory of inter-group behavior. In S. Worchel and L. W. Austin (eds.), *Psychology of Intergroup Relations*. Chigago: Nelson-Hall

Trouw (2010, October 9). Randstad ziet gat in de markt voor oudere vaklieden. Retrieved from: http://www.trouw.nl/tr/nl/4324/Nieuws/article/detail/1813893/2010/10/09/Randstad-ziet-gat-in-de-markt-voor-oudere-vaklieden.dhtml

UWV (2015). UWV: arbeidsmarkt techniek en ICT trekt verder aan. Retrieved from: http://www.uwv.nl/overuwv/pers/persberichten/2015/uwv--arbeidsmarkt-techniek-en-ict-trekt-verder-aan.aspx

Valeri, L., and VanderWeele, T.J. (2013). Mediation analysis allowing for exposure-mediator interactions and causal interpretation: theoretical assumptions and implementation wit SAS and SPSS macros. *Psychol Methods,* 18(2) 137-150. doi: 10. 1037/a0031034

Van der Horst, A.C., Klehe, U.C., & Van der Heijden, B. (in preparation). How to stay in the race?

Van der Werff, S., & Berkhout, E. (2015). Studie & Werk 2015 [Study & Work 2015]. (Research report No. 2015-20). Retrieved from: http://www.seo.nl/fileadmin/site/rapporten/2015/2015-20_Studie__Werk_2015-def.pdf

Veiga, J. F. (1973). The mobile manager at mid career. *Harvard Business Review, 51,* 115- 119.

Volkerink, M., Berkhout, E., Bisschop, P., & Heyma, A. (2013). *Monitor technische arbeidsmarkt* [Monitor technical workfield]. (Research report No. 2013-61). Retrieved from: http://www.seo.nl/pagina/article/monitor-technische-arbeidsmarkt-2013/

Whitbourne, S.K., & VanManen, K.W. (1996). Age differences in and correlates of identity status from college through middle adulthood. *Journal of Adults Development, 3*(2). 59-70. Retrieved from: http://link.springer.com/article/10.1007%2FBF02278772

Appendix A – Established factors within the domain of interests

	Rotated factor loadings				
Item	Social	Girly	Politics	Nature	Traveling
team sports	.71				
partying	.69				
entertainment (i.e. cinema, bowling)	.65				
socializing	.52				
fashion & design		-.84			
shopping		-.80			
beauty & health		-.73			
dancing		-.54			
politics			.86		
community involvement			.72		
gardening				.81	
animals	.32*			.74	
camping					.85
adventure sports					.69
travel			.353*		.60
Eigenvalues	3.62	1.81	1.68	1.16	1.09
% of variance	24.13%	12.06%	11.20%	7.76%	7.27%
Cronbach's α	.67	.72	.61	.53	.60

*Items with a second factor loading >.3 that were not removed due to factor collapsing

Appendix B – Established factors within the domain of competences

	Rotated factor loadings					
items	Managerial skills	Engineering skills	Collaboration skills	Public speaking skills	Communication skills	Research skills
negotiation	.81					
entrepreneurship	.78					
conflict management	.74					
convincing others	.66					
time management	.66					
social networking	.66					
decision making	.63					
leadership & management	.61			.38*		
designing systems and products		.78				
putting math, science and engineering knowledge into practice		.78				
math, science and engineering		.73				
establishing goals for product design		.67				
developing solutions to complex problems		.63				
listening to others			.88			
collaborating with peers			.71			
collaborating with people outside my own discipline			.68			
collaborating in a diverse context (i.e. culture, gender, ethnicity)			.62			
adapting to changing conditions			.61			
giving a presentation				.74		
chairing meetings	.36*			.71		
communicating verbally				.58		
speaking a second language (e.g. Dutch, Chinese)					-.78	
gaining new skills					-.56	

using multimedia to communicate (i.e. skype, twitter)					-.49	
scientific writing						.69
conducting scientific research						.63
develop new theories on math, science and technology		.52*				.53
Eigenvalue	9.42	3.18	1.87	1.26	1.09	1.02
% of variance	34.90%	11.76%	6.93%	4.68%	4.03%	3.79%
Cronbach's α	.90	.84	.81	.82	.66	.78

*Items with a second factor loading >.3 that were not removed due to factor collapsing

Appendix C – Established factors within the domain of values

	Rotated factor loadings					
	Hedonism	Power	Learning	Security	Benevolence	Tradition
freedom	.82					
enjoying life	.72					
fun	.71					
equality	.54					.34*
a varied life	.53					
authority		.84				
social status		.79				
preserving my public image		.71				
influence		.68				
intellectual stimulation			.86			
lifelong learning			.83			
protecting the environment				.80		
job security				.70		
good health				.49		
making a contribution to society				.41		
devotion					.73	
helping people					.70	
forgiveness					.69	
respect for tradition						.79
appreciating history, world affairs and cultures			.492*			.63
Eigenvalue	5.79	2.01	1.67	1.19	1.10	1.05
% of variance	28.93%	10.07%	8.34%	5.94%	5.45%	5.23%
Cronbach's α	.80	.78	.76	.68	.67	.52

*Items with a second factor loading >.3 that were not removed due to factor collapsing

Appendix D – Established factors within the domain of personality

	Rotated factor loadings						
	Conscientiousness	Self-centeredness	Introversion	Openness	Relaxed	Emotionality	Ambitious
Chaotic	.73						
Slack	.72						
Self-disciplined	.69						
Lazy	.59						
Inconsiderate	.55						
Precise	.54						
self-centred		-.82					
arrogant		-.74					
devious		-.67					
Silent			.85				
Reserved			.82				
Introverted			.72				
Artistic				.83			
Philosophical				.77			
Imaginative				.66			
Calm					-.83		
Relaxed					.76		
stable					-.72		
patient					-.64		
sensitive						.88	
emotional						.88	
Competitive							.91
ambitious							-.83
Eigenvalues	3.13	3.06	2.50	1.96	1.77	1.31	1.12
% of variance	13.60%	13.32%	10.88%	8.54%	7.70%	5.69%	4.89%
Cronbach's α	.73	.70	.75	.66	.62	.60	.67

Appendix E – Established factors within the domain of goals

	Rotated factor loadings					
	Security	Comfort	Universalism	Status	Physical	Family
have routine and structure	.79					
lead a predictable life	.69					
be safe from threats in life	.69					
avoid hard work		.86				
have an easy life		.77				
know my purpose in life			-.84			
understand my place in the universe			-.84			
live a spiritual life			-.69			
have plenty of money				.83		
have a prestigious job				.74		
have a high standard of living				.69		
physical exercise					.90	
be in a good physical condition					.79	
have harmonious relationships with my parents and siblings						.85
make my parents proud						.66
have a satisfying marriage/relationship					.35*	.56
Eigenvalues	3.18	2.19	1.52	1.42	1.15	1.04
% of variance	19.92%	13.73%	9.48%	8.86%	7.19%	6.48%
Cronbach's α	.63	.64	.73	.65	.69	.57

*Items with a second factor loading >.3 that were not removed due to factor collapsing

Appendix F Established factor within the domain of self-directed learning

	Rotated factor loadings
	Self-directed learning
Wanneer ik iets nieuws wil leren dat nuttig kan zijn voor mijn [bedrijf] werk neem ik initiatief.	.82
Leren vind ik een belangrijk aspect in mijn werk	.80
Het afgelopen jaar leerde ik voor mijn werk veel nieuwe dingen [bedrijf] op eigen initiatief.	.80
Ik zal nooit te oud zijn om nieuwe dingen te leren voor mijn werk.	.71
Eigenvalues	2.47
% of variance	61.77
Cronbach's α	.78

Appendix G Established factor within the domain of organizational commitment

	Rotated factor loadings	
	Affective	Continuance
Dit bedrijf betekent veel voor mij	.90	
Ik heb het gevoel dat ik echt bij dit bedrijf hoor	.88	
Ik voel me als 'een deel van de familie' in dit bedrijf	.87	
Ik heb het gevoel dat ik te weinig andere opties heb om nu weg te gaan bij dit bedrijf		.81
Op dit moment blijf ik bij dit bedrijf werken omdat dit noodzakelijk is niet omdat ik dit zo graag wil		.73
Er zou teveel in mijn leven verstoord worden als ik nu ontslag zou nemen		.70
Eigenvalues	2.58	1.63
% of variance	42,98%	27,16%
Cronbach's α	.87	.60

Appendix H Established factor within the domain of career adaptability

	Component
	Career adaptability
Ik denk vaak na over wat ik belangrijk vind in mijn loopbaan	.86
Ik praat regelmatig met anderen over mijn loopbaan mogelijkheden	.86
Ik probeer veel te weten te komen over mijn loopbaan mogelijkheden	.84
Ik onderneem actie om mijn loopbaan vorm te geven	.78
Ik heb een plan voor mijn loopbaan	.79
Eigenvalues	3.61
% of variance	45,11%
Cronbach's α	.93