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Kurzfassung

Der Einfluss der menschlichen Persönlichkeit auf bestimmte Aufgaben wie der Teamarbeit und Teamleistung ist seit über einem halben Jahrhundert ein wichtiges Thema in der Softwareentwicklung. Forscher diskutieren auch heute noch über die verschiedenen Ansätze zur Analyse von Persönlichkeiten und wie diese in der Praxis für verschiedene Fragestellungen eingesetzt werden können. Das Ziel der vorliegenden Arbeit ist es herauszufinden, ob sich die Theorie eines spezifischen psychometrischen Instruments (KTS-II) in der Praxis bestätigen lässt. Dies wird mittels einer umfangreichen Fallstudie, in welcher bestehende Softwareprojekt-Teams befragt werden, untersucht. Zunächst werden theoretische Grundlagen von psychometrischen Instrumenten analysiert und im Detail erläutert. Basierend auf den fachlichen Grundlagen zum Projektmanagement werden die theoretisch am besten passenden Präferenzen und Typen für Projektmitarbeiter und -leiter abgeleitet. Parallel dazu wird eine umfassende Literaturrecherche durchgeführt und die hier beschriebenen Typen erfasst. Dabei zeigte sich, dass die unterschiedlichen Publikationen zu diesem Thema sehr gut übereinstimmende Typen aufzeigen. Als Ergebnis des theoretischen Teils der Arbeit konnten zusammenfassend 10 Hypothesen aufgestellt werden. Im praktischen Teil der Arbeit wird eine Fallstudie durchgeführt, bei der 30 Projektteams aus 14 Unternehmen und insgesamt 243 Personen teilnahmen. Acht der 14 Unternehmen wurden online und 6 offline befragt. Danach wurden die erhobenen Daten ausgewertet, um die aufgestellten Hypothesen anhand der Ergebnisse der Fallstudie zu überprüfen. Durch die Ergebnisse der Fallstudie konnten 9 von 10 Hypothesen bestätigt werden. Weiters wird klar aufgezeigt, dass Projektmanager und -mitglieder einige sehr unterschiedliche psychometrische Eigenschaften haben. Durch die hohe Übereinstimmung der theoretischen Analyse mit den Ergebnissen der praktischen Fallstudie konnten die Validität, Aussagekraft und praktische Anwendbarkeit des KTS-II Instruments nachgewiesen werden.

Schlüsselwörter

Software Projekt Management, Software Projekt Teams, Psychometrische Instrumente, Myers-Briggs Type Indicator, MBTI, Kersey Temperament Softer II, KTS-II, Persönlichkeitstypen, Fallstudie.

Abstract

The influence of personalities on certain tasks like team work and team performance has been a concern in software engineering for over half a century. Today researchers are still debating about the different approaches of analysing personalities and how they could be used in practice for different matters. The goal of this work is to find out if the theories of a specific psychometric instrument (KTS-II) fit to practice in case of software engineering project teams. This is done by setting up an extensive case study, in which existing software project teams are interviewed. First we analyse the theoretical foundations of psychometric instruments and explain them in detail. Based on the technical basis of project management the theoretically best matching preferences and types for project members and managers are derived. In parallel a comprehensive literature analysis was performed. This analysis shows that the different publications on this topic basically agree withj each other. As a result of the theoretical part of the thesis 10 hypotheses were set up. In the practical part of the work a case study is conducted, in which 30 project teams from 14 companies and a total of 243 people took part. Eight of the 14 companies used the online survey and 6 the offline survey. Finally, the collected data was evaluated to check if the hypotheses fit to the results of the case study. The results of the case study confirmed 9 of 10 hypotheses. Furthermore it is clearly shown that project managers and members have some very different psychometric properties. Due to the high correlation of the theoretical analysis with the results of practical case study, the validity, relevance and practicality of the KTS-II instrument could be confirmed.

Keywords

Software Project Management, Software Project Teams, Psychometric Instruments, Myers-Briggs Type Indicator, MBTI, Kersey Temperament Softer II, KTS-II, Personality Types, Case Study.

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1 Introduction

1.1 Background

Software project management today is an art. The skillful integration of software technology, economics and human relations in the specific context of a software project is not an easy task. The software project is a highly people-intensive effort that spans over a very lengthy period, with fundamental implications on the work and performance of many different groups of people. [3]

We can split these people into two groups. The customer represents the first group which in most cases can't be chosen by the company. The other group is the software development team, working on a specific software solution. Our focus will be on the software development project team that consists of a project manager and project members.

1.2 Motivation and Objectives

In this work we don't want to find another instrument for the "personal selection process" or "recruiting", because there are a lot of tools available (e.g. assessment center [4]) and no personal type can assure that a specific type is best fitting for a job. But we can try to find out if there are more common types and interpret why this is the case. We further want to find out if there is a relationship between the theories and practice.

We want to improve the understanding of the common personality types within project teams. That will allow project managers and team leaders to expect and better understand the dynamics governing the interaction of team members during communication, conflict resolution, building of trust and other critical phases of interactive project teamwork.

There are different approaches to analyse personal attributes, which are discussed in the section 2.1 "*Instruments to identify psychological types*". In this thesis the *Keirsey Temperament Sorter (KTS-II)* and the *Myers-Briggs Type Indicator (MBTI)* are used for the case study to determine the personal types of the participants. These psychometric questionnaires are designed to measure psychological preferences on how people perceive the world and make decisions [6].

The questionnaires that were mentioned, are used in a very wide variety of scientific areas. For example the article of Rushton, Morgan and Richard [52] with the title "*Teachers Myers-Briggs personality profiles: Identifying effective teacher personality traits*" from 2007. In this article teachers were asked to take the MBTI test to measure their MBTI-types. Another example is the paper of Neubauer and Fortt [41] with the name "*How MBTI types are represented in team and are individual sports and which leadership styles work best respectively*" from 2013, which tries to find out what kind of MBTI types are common and fitting in sports. An additional example is the article "*Personality Characteristics of Criminals*" of Schuessler and Cressey [53] which tries to find psychometric differences between criminals and non-criminals.

The aim of this work ist to provide and link two theoretical and one practical analyses. In the first theoretical part the MBTI, KTS-II, project managers and project member theories are analysed and it is figured out which types should be preferable or disadvantaged for software project team members and managers in theory. Corresponding hypotheses are set up.

In addition, the second theoretical part summarises which type preferences are already provided in existing literature for managers and members of software project teams or teams and managers in general. By using this existing literature hypotheses are set up. The results will help to improve the existing hypotheses from the first theoretical analysis with the possibility of adding new ones.

The practical analysis (case study) includes the implementation of a questionnaire where different project team members and managers are interviewed to determine their KTS-II types. The analysis of the results of this case study shows if the hypotheses from the theoretical part prove themselves in practice.

1.3 Thesis Structure

The work is structured as follows: First, we define basic principals and concepts that are necessary to understand the work.

The second part focuses on generating the necessary hypotheses. The theoretical as well as the literature analysis are done for both types - project managers and project members. Finally, these analyses are merged to get some overall hypotheses we want to check in practice.

The third part will focus on the practical analysis - the case study. It includes the procedure, the test environment, the structure, the participants, and the case study results.

After creating the hypotheses and looking at the results of the case study, the fourth part will focus on bringing both together. We want to compare the two theoretical analyses to the real world data and results that, were collected during the case study. The focus lies on finding out if the hypotheses hold true.

At the end we will summarise all procedures we have done and interpret the overall results.

2 Basic principles

Purpose of this chapter is to specify the basic principles of necessary concepts that are important for understanding the practical part of this work. Besides specifying these principles and concepts, it is also an aim to delineate their relations and dependencies. Further, it is explained why the tool that was used in the practical part, was chosen and if it is scientifically relevant.

First of all, after the short introduction to psychological types and personality itself, some of the different types for the identification of psychological types are explained briefly. Next, the chosen tools are discussed in detail and their scientific relevances are analysed. In the end there is a short introduction to some basic principles about project teams and project managers.

2.1 Instruments to identify psychological types

The psychological type is commonly referred to as "preference style" and was developed in 1921 by a Swiss psychiatrist named Carl G. Jung who theorised that "*individuals have mental or psychological preferences for performing certain tasks, just as they have physical preferences such as a dominant hand*". [29]

Jung's theory of personality types focuses on the idea of opposite sets of characteristics in human personalities. He theorised that "*much seemingly random variation in behaviour is actually quite orderly and consistent, being due to basic differences in the way individuals prefer to use their perception and judgment*'". [64]

Robins [51] points out that personality itself is defined as "*the sum total of ways in which an individual reacts to and interacts with others*". The past decade experienced an unique rise in the interest in personality theory and measurement. Psychometricians have been particularly concerned with the number and labelling of the fundamental dimensions of personality. [24]

That is the reason why a lot of different psychometric theories, tools, and tests exist. The following list summarises and briefly discusses some important personality tests to get a first overview:

Woodworth Personal Data Sheet (PDS)

The Woodworth's Personal Data Sheet (PDS) was the first personality instrument which was published in 1917. It was designed to help the United States Army to screen out recruits who might be susceptible to shell shock. The test was highly influential in the development of later personality inventories. [27]

Five Factor Model (FFM)

The Five Factor Model (FFM) of personality is a hierarchical organisation of personality traits in terms of five basic dimensions: (1) Extraversion, (2) Agreeableness, (3) Conscientiousness, (4) Neuroticism and (5) Openness to Experience. As a result an own group of tests were developed, basing on these five dimensions. Some examples of these tests are the Revised NEO Personality Inventory (NEO PI-R), the Five-Factor Model Rating Form (FFMRF) and the Big Five Inventory (BFI). [30]

Minnesota Multiphasic Personality Inventory (MMPI)

The Minnesota Multiphasic Personality Inventory (MMPI) is a broad-based test designed to assess a number of major patterns of personality and emotional disorders. It is an extensively updated and re-standardised version of one of the earliest self-report questionnaires designed to help clinical diagnosis. The version 2 (MMPI-II) bases on the Five Factor Model and includes the factors Aggressiveness, Psychoticism, Disconstraint, Negative Emotionality/Neuroticism and Introversion/Low Positive Emotionality. [48]

The MMPI is an important component regarding to psychometric relationships and tests. It is also known as the most widely used and researched standardised psychometric test of adult personality and psychopathology. [9]

Myers-Briggs Type Indicator (MBTI)

The Myers-Briggs Type Indicator (MBTI) is a psychometric measurement instrument based on Jung's theory that classifies individuals based upon their individual preferences. The MBTI consists of 16 distinct preference types comprising four contrary orientations: (1) Extroversion vs. Introversion, (2) Judging vs. Perceiving, (3) Sensing vs. Intuition and (4) Thinking vs. Feeling. [29]

Educators, administrators, and researchers utilise the first letter of each dichotomous scale to identify an individual's preference type. [29] One example of a MBTI type is IPSF (Introversive, Perceiving, Sensing and Thinking Type).

Kersey Temperament Sorter (KTS-II)

The Keirsey Temperament Sorter II (KTS-II) instrument was developed to measure the same variables as the Myers-Briggs Type Indicator (MBTI). The KTS-II instrument has two potential advantages: [47]

1. First, at 70 items, it is 23 items shorter than the MBTI instrument and therefore easier to translate into foreign languages.
2. Second, the KTS-II instrument and Keirsey's underlying temperament theory are focused on behaviors rather than attitudes.

So the major difference between MBTI and KTS-II is the description on the personality types. MBTI is more focused on what people think, while KTS-II is more focused on people's long term behaviour. [43]

Further tests

There are far more personality tests with different approaches, e.g.

- True Colors Personality Test (TCPT)
- Temperament and Character Inventory (TCI)
- Thinking Styles Inventory (TSI)
- Tridimensional Personality Questionnaire (TPQ)
- 16PF Questionnaire (16PF)
- Newcastle Personality Assessor (NPA)

The Kersey Temperament Sorter (KTS-II) was used in this work to test the participants personality types. Due to the KTS-II is based on the MBTI test, the following chapters include the basic and theoretical foundations of the MBTI and the KTS-II tests and theories.

2.1.1 Myers-Briggs Type Indicator (MBTI)

More than five decades ago, Katherine Briggs and Isabel Myers began to work on an instrument to operationalize Jung's theory of psychological types. [25] They have spent many years observing human behaviour. Their ideas can help to explain why different kind of people are interested in different things, prefer different kind of work, and sometimes find it hard to understand each other - all due to basic differences in how people take in information and make decisions about it.

The MBTI instrument was developed with great care and has been used by people around the world for more than 60 years. [39] Today, over three million people a year complete the Myers-Briggs Type Indicator (MBTI). [25] Beside the development also the acceptance of the MBTI took many years of hard work. [55]

The MBTI is often perceived as a "personality test" and was not originally developed as an instructional preference measure, but does in fact, generate this relevant information. It allows institutions to employ one instrument collecting data applicable to many critical success factors rather than using individual instruments for each measure. [29]

In its basic form the Myers-Briggs Type Indicator is a 93-item instrument and the most widely known psychological type tool today. It was estimated that over 2 million copies have been sold annually in 1992 and even nearly twice as much in 2007 (estimated 3.5 million annual sales worldwide). The MBTI is available in more than 21 languages and it has been used in a number of occupational settings. No other psychological testing instrument has been subjected to as many tests of reliability and validity as the MBTI. [55]

The MBTI was developed specifically as a tool for the non-psychiatric population, and is therefore inherently benign. As a founding principle, no type is any better or worse than any other and the testee has the final say as to his or her type designation. [55]

The MBTI measures an individual's personality preferences over four dimensions, and is often used by psychologists in career counselling and group dynamic analysis. [34] The four dimensions and a short description are outlined in Table 2.1 and afterwards described in detail.

Preference Option 1			**Preference Option 2**
E	Extraversion outer world of people	<—> **I**	Introversion inner world of ideas and actions
S	Sensing practical facts	<—> **N**	Intuition imagination and creativity
T	Thinking logical, true or false	<—> **F**	Feeling emotional and subjective
J	Judging closure and certainty	<—> **P**	Perceiving open-ended, uncertainty

Table 2.1: Overview of the four MBTI dimensions [55, 25]

Extraversion vs. Introversion

The first scale represents complementary attitudes towards the external world. While the extrovert prefers looking outward, the introvert has an inward view. Contrary to popular belief, the implications of these terms go beyond the common stereotypes of sociable versus shy. Extroverts are talkative, initiators of conversation, and outgoing. They prefer action and variety. Introverts, in contrast, are quiet, reserved, and respond to conversation rather than initiate it. They prefer silence and time to consider matters. [14]

Further the Extraversion-Introversion preference also tells us how people are energised. Extraverts prefer to focus on the outer world, of people and things. Energy and attention flow out, or are drawn out, to the objects and people in their environment, so extraverts find energy in things and people. They are action oriented and prefer interaction with others and to communicate and process information verbally. Extraverts often show a desire to "talk things out". [64, 35, 19]

Introverts focus on the inner world of ideas, emotions and impressions. They find energy in the inner world of ideas, concepts and abstractions and consequently tend to process information inside their heads. They can be sociable but need quiet to recharge their energies. The main interests of the Introverted type are in the world of concepts, ideas, and inner experiences. Introverts will feel most energised when working on ideas by themselves, often preferring to reflect themselves when undertaking similar learning activities, as they often show "a desire to 'think things out' before talking about them". [64, 35, 19].

Sensing vs. Intuition

The second scale distinguishes the way that individuals assimilate information from the environment. A sensing individual needs to absorb a whole series of facts in linear fashion. These people are very detail oriented, need facts, and rely on them. Sensing individuals dislike new problems unless prior experience shows how to solve them. Focusing on the present and gaining concrete information from their senses are other typical signs of the sensing preference. Adjectives describing sensing people best are realistic, practical and fact-oriented [14, 64, 35].

On the other hand, intuitive people enjoy solving new problems and dislikes performing repetitive tasks. They are qualified as speculative, imaginative and principle-oriented. Intuitive people tend to focus on the future, with a view toward patterns and possibilities. They seek out patterns and relationships among the facts they have gathered. They trust hunches and their intuition and look for the big picture. Of course, we all share both sets of qualities to some degree, but usually one predominates. [14, 64, 35]

Thinking vs. Feeling

The third orientation in the MBTI classification involves the dichotomy of thinking and feeling. Again, these terms are more comprehensive than everyday usage would indicate. In particular, these terms refer to the process of decision-making. This scale of preferences identifies thinking as the logical way of making a decision, while feeling describes the tendency to rely on values as a basis for making decisions. Thinking people are principle-oriented, cool-headed and firm, whereas feeling people are emotion-oriented, warm-hearted and have strong interpersonal skills. [14]

Feeling individuals consider human factors and make judgments based on their value. Conversely, thinking people draw conclusions or make judgments dispassionately and analytically in addition to seek an objective standard of truth. [35]

Judging vs. Perceiving

The fourth scale distinguishes on how individuals orient their lifestyles, organise their world and on how a person approaches life itself. Judging identifies tend to be extremely organised. If a deadline is to be met, a judging person usually finishes the task well in advance. Judging people are decisive, planful, and self regimented. They focus on completing the task, only want to know the essentials, and take action quickly. Deadlines are sacred and are not meant to be stretched. [64, 35, 14]

At contrast a perceiving individuals prefer procrastinating, appear to be disorganized, and seem to be distracted from completing a task until last minute. Perceiving people like to delay decisions, enjoy a flexible and spontaneous approach regarding life and prefer to keep their options open. [64, 35, 14]

The easiest way to distinguish between these two types of individuals is to look at the person's desk. The desk of a judging person is immaculately organized, whereas the desk of a perceiving person appears to be in constant chaos, even though perceiving individuals claim to know exactly where everything is located. [14]

Summarising, the MBTI sorts these four sets of preferences selecting one from each pair, to delineate a person's preferred type. Hence, there are 16 possible configurations. [14] These 16 types can be found in Table 2.2. If the MBTI results reveal that a person is ISTP, the terminology suggests that the person prefers ISTP, rather than being an ISTP. Thus there are no rights or wrongs in the personality types, there are merely preferences. [14]

Myers-Briggs Type Indicator Types			
ISTJ	ISFJ	INFJ	INTJ
ISTP	ISFP	INFP	INTP
ESTP	ESFP	ENFP	ENTP
ESTJ	ESFJ	ENFJ	ENTJ

Table 2.2: The 16 possible MBTI Types.

There are also studies about the percentages of types in specific populations. The following tables show the estimated percentages of the 16 types in the U.S. (Table 2.3 b) and the results of a study about the MBTI-type-distribution in the UK (Table 2.3 a) population.

Both (UK and U.S.) numbers in Table 2.3 show that there are some types that are more common than others. However, these percentages may vary from one country to another.

(a) Percentages of MBTI types in the UK population from a study 2011 [21]

ISTJ	ISFJ	INFJ	INTJ
13.7%	2.7%	1.7%	1.4%
ISTP	ISFP	INFP	INTP
6.4%	6.1%	3.2%	2.4%
ESTP	ESFP	ENFP	ENTP
5.8%	8.7%	6.3%	2.8%
ESTJ	ESFJ	ENFJ	ENTJ
10.4%	12.6%	2.8%	2.9%

(b) Estimates percentages of MBTI types in the U.S. population [20]

ISTJ	ISFJ	INFJ	INTJ
11-14%	9-14%	1-3%	2-4%
ISTP	ISFP	INFP	INTP
4-6%	5-9%	4-5%	3-5%
ESTP	ESFP	ENFP	ENTP
4-5%	4-9%	6-8%	2-5%
ESTJ	ESFJ	ENFJ	ENTJ
8-12%	9-13%	2-5%	2-5%

Table 2.3: Percentages of the MBTI types of the U.S. and the UK population.

It is impossible to write a chapter about MBTI without mentioning the MBTI map of AJOU university (see Figure 2.1). The MBTI map is a "*visualization showing the relationships between human personality descriptors from the Myers-Briggs Type Indicator test ... using subway lines as a metaphor for the connections between the different representative words and personality types*" [49].

The visualisation represents the relationships among the 16 MBTI types of personalities and 39 representative words. The "subway lines" indicate 16 personality types (see Figure 2.1 on the right side). In addition, 161 words are used to describe personalities in the MBTI. These words are hierarchically arranged at the outer circle. The map helps viewers intuitively understand the overall picture of cluster relationships by minimising the repetition of colors and intersecting points of connection among words.

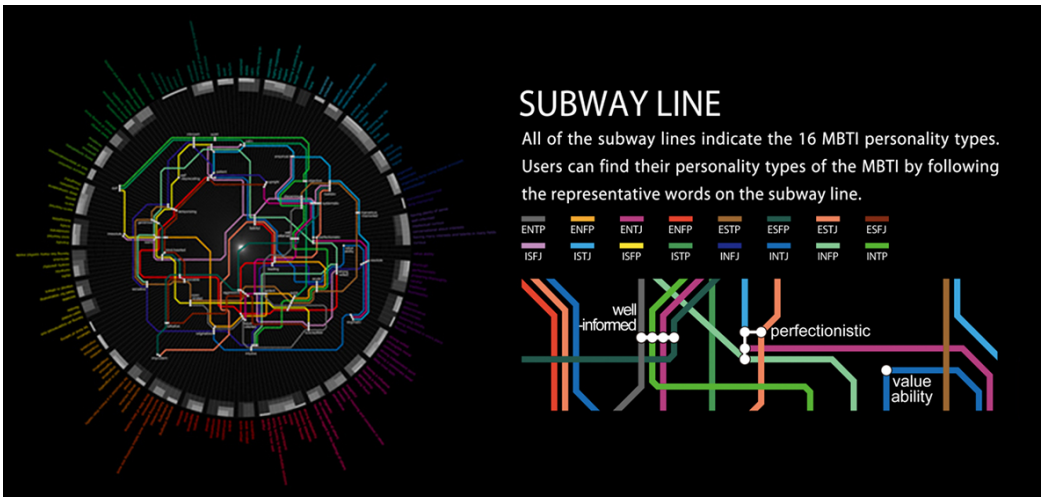

Figure 2.1: Overview and legend of the MBTI map of the AJOU university [49], [60]
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2.1.2 Keirsey Temperament Sorter (KTS-II)

As already mentioned, the Keirsey Temperament Sorter II (KTS-II) instrument was developed to measure the same variables as the MBTI instrument and has two potential advantages over the MBTI instrument for comparative management research [47]:

1. First, at 70 items, it is 23 items shorter than the MBTI instrument and therefore easier to translate into foreign languages.

2. Second, the KTS-II instrument and Keirsey's underlying temperament theory are focused on behaviour rather than attitude.

Researchers used several personality measurement tools to identify personality types such as Myers-Briggs Type Indicator (MBTI) and Keirsey Temperament Sorter (KTS-II). As already explained, the MBTI is often used in educational fields to understand individual differences when creating learning environment that appeals to the different personality types, developing effective teams and guiding individuals for career development. However, Keirsey Temperament Sorter (KTS-II) is applied to assess effective teams in organisations, and career guidance. The major difference between MBTI and Keirsey is the description on the personality types. MBTI is more focus on what people think, where as Keirsey Temperament is more focused on people long term behaviour. [43]

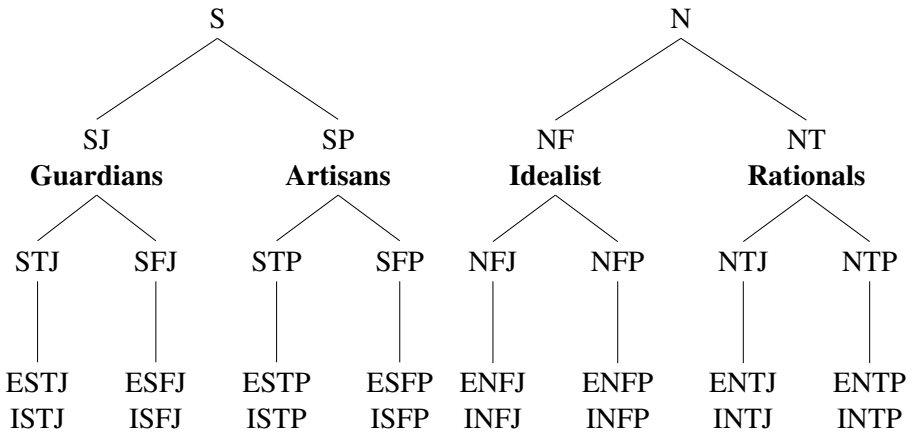

Figure 2.2: Different types and groupings (bold) of the KTS-II [55].

The KTS-II has been very successful with its personality type system that consists of a 70-item instrument and has only two possible responses. Additionally it is available as an online test. In his bestselling books "Please Understand Me" and "Please Understand Me II" Keirsey follows the MBTI tradition of using 16 types.

Keirsey regards the S-N scale as the most important as it relates to the cognitive perceiving function, and in this respect he has gained a lot of followers regarding learning and teaching styles. From his analysis, Keirsey orientates the 16 types into a tree-like structure configuring types into four Temperament groupings, which he calls Guardians, Artisans, Idealists and Rationals (see Figure 2.2) [55]. Another view, including an overview description of these temperament groupings, can be found in Table 2.4.

Temperament	Anchoring Traits	Description	
Artisan (SP)	Sensing & Perceiving	(S) observant	(P) probing
Guardian (SJ)	Sensing & Judging	(S) observant	(J) scheduled
Rational (NT)	Intuiting & Thinking	(N) introspective	(T) tough-minded
Idealist (NF)	Intuiting & Feeling	(N) introspective	(F) friendly

Table 2.4: Another view on the different groupings of the KTS-II [40], [42].

Keirsey gave each of the 16 types an operational name, i.e. Supervisor, Inspector, Mastermind, etc. Table 2.5 shows these operational names. [55]

ISTJ	ISFJ	INFJ	INTJ
Inspector	Protector	Counsellor	Mastermind
ISTP	ISFP	INFP	INTP
Operator	Composer	Healer	Architect
ESTP	ESFP	ENFP	ENTP
Promoter	Performer	Champion	Inventor
ESTJ	ESFJ	ENFJ	ENTJ
Supervisor	Provider	Teacher	Fieldmarshal

Table 2.5: Kersey's type names for all 16 MBTI types. [55, 42]

Table 2.7 shows an overview of the different temperament groupings and all character types. All of them are shortly described. Table 2.7 also includes the distribution of the different groupings present in global population.

Guardians Temperament (SJ)	**Idealists Temperament (NF)**	**Artisans Temperament (SP)**	**Rationalists Temperament (NT)**
Pride themselves on being dependable, helpful and hard-working. Make loyal friends, are responsible parents and stabilizing leaders. Tend to be dutiful, cautious, humble and focused on credentials and traditions. Are concerned citizens who trust authority, join groups, seek security, prize gratitude and dream of meting out justice.	They are enthusiastic, trust their intuition, yearn for romance, seek their true self, prize meaningful relationships and dream of attaining wisdom. Pride themselves on being loving, kindhearted, and authentic. Tend to be giving, trusting spiritual, and are focused on personal journeys and human potential. Make intense mates, nurturing parents, and inspirational leaders.	Tend to be fun-loving, optimistic, realistic, and focused on the here and now. Pride themselves on being unconventional, bold, and spontaneous. Make playful mates, are creative parents, and troubleshooting leaders. Are excitable, trust their impulses, want to make a splash, seek stimulation, prize freedom, and dream of mastering action skills.	Tend to be skeptical, self-contained, and focused on problem-solving and systems analysis. Pride themselves on being ingenious, independent, and strong-willed. Make reasonable mates, are individualising parents, and strategic leaders. Are even-tempered, trust logic, yearn for achievement, seek knowledge, prize technology, and dream of understanding how the world works.
Guardian Character Types	**Idealist Character Types**	**Artisan Character Types**	**Rationalist Character Types**
Inspector: (ISTJ) Super-dependable; responsible; rule-followers; community-minded; not showy.	Champion: (ENFP) Passionate; seek out extraordinary experiences; enthusiastic; outspoken; vivacious, inspiring.	Composer: (ISFP) In tune with their senses; spontaneous; creatively; not verbally expressive; sensitive and kind; long for the outdoors.	Architect: (INTP) Theoretical thinkers; strategic; analytical; precise; pragmatic; curious; reserved.

Protector: (ISFJ) Responsible; traditionalists; stable; loyal; reserved.	Counselor: (INFJ) Interactive; nurturing; quiet influencers.	Crafter: (ISTP) Masters of tool work; love action; spontaneous; thrive on excitement; let actions speak for them.	Fieldmarshal: (ENTJ) Organising; leaders; goal driven; visionary; good communicators; tireless; impartial.
Provider: (ESFJ) Highly cooperative; team-players; detail-oriented; highly social; sympathetic; self-conscious.	Healer: (INFP) Outwardly calm; caring; passionate; great sense of right and wrong; dreamers; welcoming of new ideas and information.	Performer: (ESFP) Full of good humour; skilful at music; comedy and drama; center of attention; pleasure-seeking; generous,	Inventor: (ENTP) Innovative; entrepreneurial; pragmatic; fresh-thinking; bold; easy-going; pioneers.
Supervisor: (ESTJ) Highly social; community-minded; cooperative; demand respect from there; hard-working; dutiful; leaders.	Teacher: (ENFJ) Motivating; good communicators; charismatic; enthusiastic; organised; intuitive; sincere; leaders.	Promoter: (ESTP) Action-oriented; fun and clever; have a theatrical flair; demand challenges; charming; confident; bold.	Mastermind: (INTJ) Complex thinkers; contingency-minded; reluctant to lead; aim for maximum efficient; self-confident; strong-willed; fact-driven.
Guardians in population	**Idealists in population**	**Artisans in population**	**Rationalists in population**
40% to 45%	8% to 10%	35% to 40%	5% to 7%

Table 2.7: Description of all temperament groupings and character types [45, 42] including the distribution of the different groupings present in global population [40]

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2.1.3 Scientific relevance and criticism

Internal reliability is the first step for validating an instrument. Although the reliability of the MBTI instrument has been demonstrated many times [47, 46], Keirsey argued that reliability of the KTS-II instrument was not an important issue. Numerous studies showed that the MBTI has high levels of both reliability and validity. The MBTI is an academically accepted instrument in the categorisation of personality types. [46]

Abramson [47] shows in his study "*Internal Reliability of the Keirsey Temperament Sorter II: Cross-National Application to American, Canadian, and Korean Samples*" that the internal reliability of the KTS-II instrument was satisfying.

Gardner [25] summarises different psychometric properties of the MBTI to show its reliability and validity by using other literature. As a conclusion about the reliability he writes "*The available evidence suggests that the 'estimated reliabilities of type categories appear to be satisfactory in most cases'*" [25].

He also points out that the reliabilities are scoring good values (about 70-80%) but the main problem is the re-test: "*Test-retest reliabilities for continuous scores usually exceed 70 and often surpass 80. However, dichotomous type scores yield lower reliabilities. McCarley and Carskadon (1983) found that only 47 percent of their subjects scored the same on all four scales after five weeks.*"[25]. Nevertheless Gardner points out that even with these results the MBTI type scores are stable: "*Since the chance probability of choosing all four preferences on a retest is only 6.25 percent and the percentage of preferences that remained unchanged on three scales exceeded 80, MBTI type scores appear to be relatively stable*". [25]

Regarding evidence validity he points out: "*Efforts to validate the MBTI have produced mixed results. Carlyn concludes that it 'appears to be a reasonably valid instrument which is potentially useful for a variety of purposes.' Carlson likewise found that MBTI validation studies yielded 'generally positive' results. Others have voiced concerns about the MBTI's factorial, criterion-related and construct validity*". [25]

The European Data Supplement (OPP in Oxford) [21] was "*written to provide MBTI users with a single source of information containing a summary of the research data gathered for European language versions of the MBTI questionnaire*". [21] This large-running test-report is performed every few years and updates the data accordingly. In the report of 2011 the validity was checked by overall 93% of participating people agreeing to the resulted type of the MBTI test. [21]

Overall one can say that the MBTI (and inferring the KTS-II) instrument proves to be scientific relevant because there are a lot of studies and other publications that confirm the validity and reliability over the last 20 years. Additionally the MBTI and KTS-II instruments were used in countless scientific studies and questionnaires and are still common used powerful instruments in companies (2.5 million Americans take an MBTI test each year, see Figure 2.3) [22].

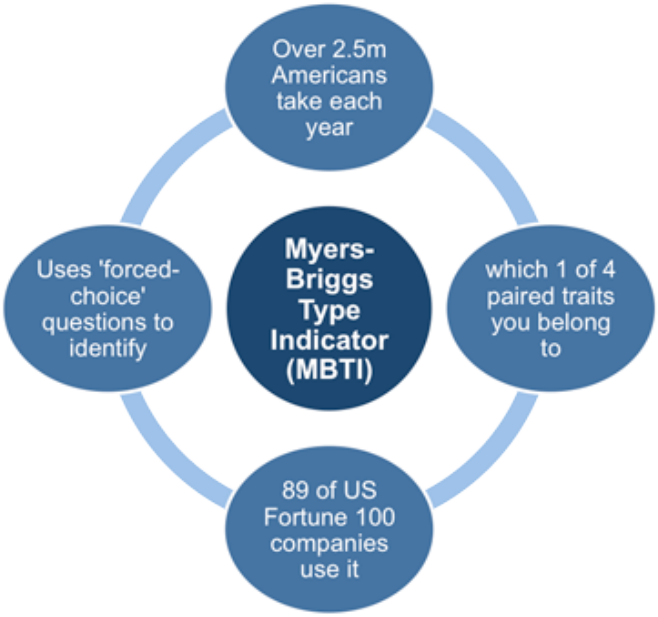

Figure 2.3: Some facts about the use of the MBTI [22].

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2.2 Software project management

A project is defined as a "*short-term venture undertaken to generate a distinctive product. By the term short-term means that each project has a specific start and a explicit end. Distinctive means that the product is distinct in some unique approach from all analogous products*" [18]. That means that a project is temporary with defined scope and resources. A project is not a routine operation but unique.

"*Software project management is the art and science of planning and leading software projects*" [56]. It can be seen as a sub-discipline of project management that is specialised on software and on how these kind of projects are planned, implemented, monitored and controlled.

Software development projects must be performed by developers under the constraint of limited resources. They must be executed by balancing the competing demands for quality, time, and costs. [54]

The case study in chapter 4 not only tries to find the most common MBTI/KTS-II types for projects in general. It is also distinguished between the types of project members and project managers. Furthermore the success of the project plays an important role, because only members of successful project teams are interesting for this study. Therefore one part of the case study focused only on generating an "overall success factor" of the project team (see appendix A.2 for the full questionnaire). More details about the role of success can be found in section 2.2.3 and section 4.4.1. The project managers got some additionally questions about the overall team performance (see appendix A.3 for the additional managers page).

The following chapters shortly specify the terms "software project teams", "software project managers" and "project success".

2.2.1 Software Project Teams

The word "team" defines a group of people that are related in a mutual purpose. Teams are especially preferred to solve complex tasks. Furthermore these tasks can be divided into interdependent subtasks and therefore distributed to different people. A project team works on a specific project (definition of "project" see chapter 2.2). Software project teams (as the name suggests) are project teams that work in the software industry and therefore have a specific software solution as their goal.

Project teams (in general) often include people who do not usually work together. Sometimes even from across multiple geographies and different organisations. Team members

need to have the capability of working together, taking responsibility as individuals, working in functional groups, and joining the project groups for integrating specific tasks into a larger system. [1]

2.2.2 Software Project Managers

A project manager is responsible for the communication, efficient work and the project resources. Furthermore he has to handle risks and issues during all phases of the project. This implicates that he is the most important individual on a project team. A good working project manager is a primary factor in determining project success. Due to this high responsibilities and risks it is very hard to find the "best" project manager. Project failures are often the result of wrong selected project managers and can even be a career-ending executive mistake for those held responsible. [38]

The complexity of the problems that project managers have to face today, requires multiple perspectives and varied expertise. This weighs heavy on project managers as it is their job to find the best combination of people with respect to knowledge, skills, culture, language and aspiration that fulfills theirs expectations. [10, 1].

Software project managers are responsible for recruit people and to structure their project team with the aim of delivering a high quality software products on time and within budget. The allocation of team members to roles, responsibilities, and tasks is also an important part of the software manager's job. [1]

As a consequence there is a lot of literature that tries to find the best fitting project manager for each kind of project, including software projects.

2.2.3 Project success

What does project success mean? Does it mean that a project is automatically successful if it is completed on time and within the planned budget? Or even if it fails to meet these objectives but succeeds in meeting its specified requirements? The answer to these questions are not trivial and have been the subject of many studies.

From the standpoint of industries, it is deeply desired to lead all of the software projects into success ones. Generally speaking, project success is considered from three distinct viewpoints: the quality of the product, the cost of development and the duration of the project. [54] Further, selection of the best possible project managers also plays a big role on the project success (as already mentioned in section 2.2.2 about project managers).

Recently it is said that projects become more and more difficult to be accomplished successfully, because of increased functionality and complexity. Additionally the demands on the short term development and the small amount of budget are clearly other practical reasons. [54]

There are many innovative researches which try to lead projects into success. They also try to explain why some projects are successful and why others are failing. The more interesting question for this thesis is, how to measure if a project was successful after it is finished. One effective way is to ask the project manager and project members to measure their success variables themselves. More details how this was done can be found in section 4.4.1. The success variables and the appropriate questions to obtain them, can be found in Table 4.2.

3 Hypotheses

3.1 Theoretical Analysis

In this chapter we will try to find the best fitting preferences for project members and managers by analysing the theoretical foundations of these two types of people. The basic principles and definitions of project members and project managers were already discussed in chapters 2.2.1 and 2.2.2. The definition of MBTI and KTS-II as well as all types and preferences were part of chapters 2.1.1 and 2.1.2.

This chapter is splitted into two subsections which distinguish between the project member and project manager types. We will try to focus on each possible preference and try to find out why one would be preferable or non-preferable for project managers or project members.

The resulting hypotheses of members will be numbered by H1.x and H2.x for managers. The final summary and an overview of all hypotheses for project members and managers that were derived by the theoretical analysis as well as the literature analysis can be found in chapter 3.3.

3.1.1 Project Members

First, we will take a look at all different preferences and try to distinguish which of them are preferable for software project members.

Extraversion vs. Introversion

> Extroverts are focused on the external world, including people and things. Introverts are inwardly focused and interested in ideals and symbols. It seems obvious that most of software engineers will have the I (introvert) preference because they don't need to communicate very much and focus on their work, which obviously contains a lot of symbols. They often work and solve their problems alone. [66] Thinking of projects you have to expect that a person is able to communicate in an appropriate way to work in a team. Nevertheless in the field of software engineering

you can assume to find more introvert than extrovert people. [23, 7, 16, 28]

H1.1 *There are more software project members with the I (introvert) than the E (extrovert) preference.*

Sensing vs. Intuition

Intuition is unconscious perceiving. It includes the recognition of patterns and abstract ideas, as well as visionary thoughts. Sensing is perceiving with the five senses and focusing on the real world. Programmers in general have to work with patterns and abstract ideas. Otherwise they can not solve a complex technical problem. Software developers in general need this ability too. Thinking of software developers in projects, it is agreeable that they also need to see the "whole picture" of the project and should be able to identify the "real world problem" they are trying to solve. This would suggest that both abilities can be useful. Further the distinction between sensing and intuition seems not to be very relevant to the success of the project or an advantage for a person to be a project developer. [23, 7, 28]

H1.2 *There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*

Thinking vs. Feeling

Thinking is making decisions based on facts and ideas. Feeling is making decisions based upon a personal point of view. People working in technical jobs tend to prefer the thinking preference because they usually have to focus on facts and have to make logical decisions. It seems very obvious that project members in software development should tend to prefer the thinking preference. [23, 7]

H1.3 *There are more software project members with the T (thinking) than the F (feeling) preference.*

Judging vs. Perceiving

Judging identifies the tendency to be extremely organized. A perceiving individual prefers procrastinating, appears to be disorganised, and seems to be distracted from completing a task. The preference of judging and perceiving for project members seem to be quite clearly. A programmer has to be organised and motivated to finish

his tasks. In a project team every member depends on other members and their work. Thereby there is a need in trust that all project members know what to do and try to finish their work in an appropriate way. Therefore a project member should be preferring the judging preference. [23, 28]

H1.4 *There are more software project members with the J (judging) than the P (perceiving) preference.*

Our results suggests that the preferred MBTI types are ISTJ (introvert, sensing, thinking, judging) and INTJ (introvert, intuitiv, thinking, judging).

H1.5 *The most frequently found types of software project members are ISTJ and INTJ.*

3.1.2 Project Managers

Again, we will first have a look on all different preferences and try to distinguish which of them are preferable for software project managers.

Extraversion vs. Introversion

Extroverts are focused on the external world, including people and things. Introverts are inwardly focused, interested in ideals and symbols. It is natural to see project managers as extroverts, because they communicate constantly in many ways and with many people. But to declare that only extroverts belong in project management is to deny a critical part of the profession because they also spend hours alone e.g. scanning reports. Project managers still spend a huge amount of time speaking to groups and individuals, mentoring people, resolving disputes, and so on. The job requires external focus, on both people and things. [7, 16, 28]

H2.1 *There are more software project managers with the E (extrovert) than the I (introvert) preference.*

Sensing vs. Intuition

Sensing is perceiving with the five senses and focusing on the real world. Intuition is unconscious perceiving. It includes the recognition of patterns and abstract ideas, as well as visionary thoughts. [23]

Intuition and Sensing can both serve a project manager well. Many modern management techniques favour the sensing personality type [11]. All these methods focus on concrete, observable outcomes, and explicitly exclude intuitive judgement.

Project managers, particularly experienced, develop a sixth-sense about their projects. They know if the project has a problem and they have an uncanny ability to ask the right questions to uncover that specific problem. Intuitive people look for patterns and have a vision of abstract ideals. Project managers must be capable of abstract thoughts and defending a vision. Even the data-based, sensing manager will look for patterns to form opinions about the likelihood of project success and failure. [7, 16]

H2.2 *There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*

Thinking vs. Feeling

Thinking is making decisions based on facts and ideas, like a judge. Feeling is making decisions based upon a personal point of view. Thinking is more important than feeling for a project manager. Feeling is what compels a manager to leave a dying product feature live, to make design decisions guided by consensus, or not to lack the ability of being direct about what is not on the roadmap instead of fearing to offend someone. But that does not mean that empathy is not important for the end users. Understanding the logical constraints of software design are even more paramount. Project managers also need to be tough and able to take criticism and critical feedback about their products and themselves. [23, 7, 16]

H2.3 *There are more software project managers with the T (thinking) than the F (feeling) preference.*

Judging vs. Perceiving

Judging identifies the tendency to be extremely organised. A perceiving individual prefers procrastinating, appears to be disorganised, and seems to be distracted from completing a task. Perception is important for responding to performance metrics, fixing gaps in the user experience, and dealing with the product's ever-changing competitive weaknesses. Judgment is critical for execution: creating plans and making tough calls when there is not enough data. Regarding software development processes Perceiving is better suited to agile programming and Judging better suited for the waterfall model. [11] For improving an existing product, perceiving is preferable, but a judging project manager is more likely to develop something brand new. [25] Concluding project managers need a balance between the two. [23, 7, 16, 28]

H2.4 *There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*

Our results suggests that the preferred MBTI types for project managers include the E (extrovert) and T (thinking) preference.

H2.5 *The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*

3.2 Literature Analysis

In this chapter we will focus on results and findings in existing literature. It is splitted into two subsections which distinguish between the project member and project manager types. The analysis of the member types can also include literature about programmers (without special focus on projects) and managers in the technical environment in general for the manager types. This allows us to find more research results and to combine it with the project-specialised one's.

The resulting hypotheses of members will be numbered by H3.x and H4.x for managers. The goal is to hypothesise using the respective literature. Next, the hypothesis will be revised or confirmed by the following literature.

3.2.1 Project Members

Hardiman [62] points out that the MBTI may be the best predictor of who will become a competent programmer. He observed that the majority of good programmers were ISTJ, INTJ, ESTJ, ENTJ, ISFJ, or ENTP. In brief, they are mostly NTs and SJs. He also implies that NF types tend to have trouble with the sequential and abstract thinking necessary for writing programs.

H3.1	new	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*
H3.2	new	*There are more software project members with the T (thinking) than the F (feeling) preference.*
H3.3	new	*There are more software project members with the J (judging) than the P (perceiving) preference.*

Capretz [12] investigated in 2003 the profile of a group of 100 software engineers (80% male and 20% female) who study in private or public universities and work for the government or are employed by software companies. This study has shown that ISTJ, ISTP, ESTP and ESTJ orientations compose over 50% of the sample and are therefore significantly over-represented, whereas the INFJ, ESFP and ENFJ groups are all particularly under-represented.

H3.1	contradiction	This study shows that S (sensing) is more often found in project member's types then the N (intuitive) preference. H3.4 is formulated as the reverse hypothesis.
H3.2	confirmed	
H3.3	confirmed	
H3.4	new	*There are more software project members with the S (sensing) than the N (intuitive) preference.*

Capretz [14] published in a second study from 2010 that a common thread running through the results of different studies is the prevalence of introverts (I), thinking (T), judging (J), and almost as many sensing (S) as intuitive (N) types among software professionals.

H3.1	confirmed	
H3.2	confirmed	
H3.3	confirmed	
H3.4	contradiction	
H3.5	new	*There are more software project members with the I (introvert) than the E (extrovert) preference.*

Shen, Proir, White and Karananoglu [55] analyzed the 16 MBTI personality types and their dominant features and suggested the following types for members of an engineering team: ISTP, ESTP, INTJ, INTP, ENTJ.

H3.1	confirmed
H3.2	confirmed
H3.3	confirmed
H3.4	contradiction
H3.5	confirmed

Luiz, Capretz, Pinero and Raza [35] published in their article that thinkers (T) and judgers (J) are particularly attracted to software engineering, feelers (F) and perceivers (P) are less inclined towards this field. Furthermore, the three most common personality types, in order of preference, were ISTJ, INTJ and ENTP.

H3.2	confirmed
H3.3	confirmed

Capretz and Ahmed [13] tried to map soft skills and psychological traits to the software life cycle to get the best suited personality types for particular stages. They created very respectable graphics that represent their mappings. Figure 3.1 shows the created mapping for software developer.

H3.1	contradiction
H3.2	confirmed
H3.4	confirmed
H3.5	confirmed

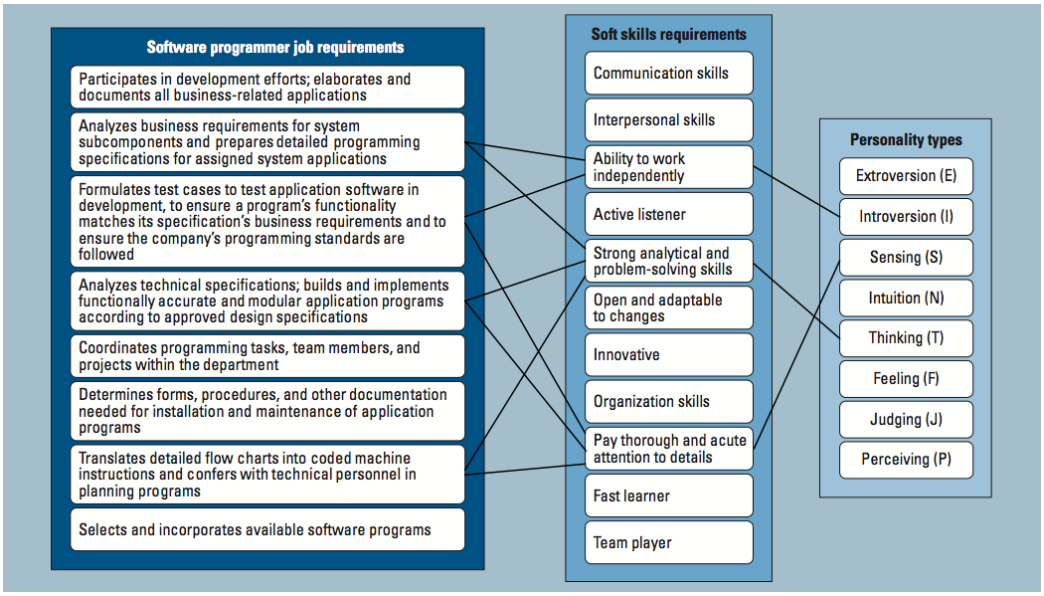

Figure 3.1: Mapping programmers and their skills to personality types by Capretz and Ahmed [13]. Most programmers are introvert (I), sensing (S), thinking (T) types

McConnell [37] refers to two large studies that produced estimates saying that 20-40 percent of software developers prefer the ISTJ or the INTJ personality type. Programmers are widely perceived as introverts, and MBTI statistics show that one-half to two-thirds are introverted compared to about one-quarter of the general population. He indicates because of MBTI theory that between 80 and 90 percent of programmers are T's, compared to about 50 percent of the general population. McConnell also says that programmers are about evenly splitted between S (sensing) and N (intuition).

H3.1 confirmed
H3.2 confirmed
H3.3 confirmed
H3.4 contradiction
H3.5 confirmed

The final summary and an overview of all hypotheses for project members and managers that were derived by the literature analysis as well as the theoretical analysis can be found in chapter 3.3.

3.2.2 Project Managers

McGuire [38] notes that the Myers-Briggs Type Indicator has proven to be of assistance in the prediction of a Project Manager's success. He overlaid, "*based upon years of actual experience and observation in the workplace where candidates are examined for leadership ability, accountability, flexibility, performance under pressure, work ethic, creativity, honesty, and failure patterns. Results are then matched to specific project requirements... The MBTI shows how a candidate will match to the project demands. If the match is not right, undue conflict and tension will result, creating potential project failure points.*".

The results, which led to a graphical overview of the types that are preferred and non-preferred for managers, can be seen in Figure 3.2.

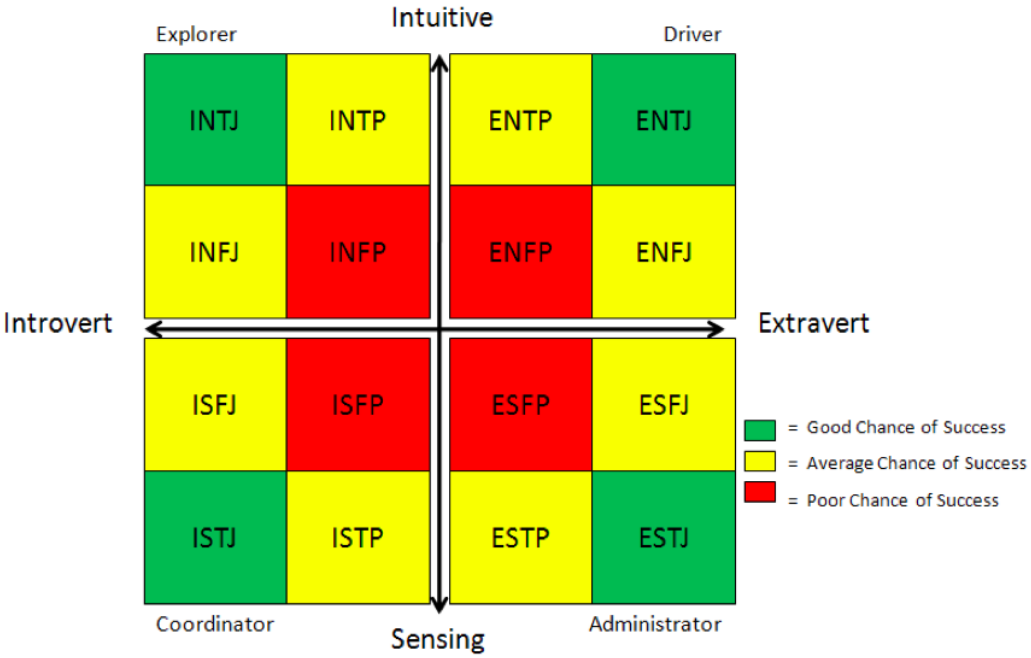

Figure 3.2: Preferred and non-preferred types by McGuire [38] for project managers.

H4.1	new	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*
H4.2	new	*There are more software project managers with the T (thinking) than the F (feeling) preference.*
H4.3	new	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*

Shen, Proir, White and Karananoglu [55] analysed in their work the 16 MBTI personality types and their dominant features and suggested that the team leader role should be chosen from either the ISTJ or ESTJ personality types due to their ability to lead, organise, control, motivate, and coordinate team activities.

H4.1	confirmed
H4.2	confirmed
H4.3	confirmed

Carr, Curd, Dent, Davda and Piper [15] made a MBTI research into the distribution of types with 22.000 managers in 2011. The most frequent type was ESTJ (22.5%), followed by ENTJ, ISTJ and ENTP. The least frequent types were ISFP, INFJ, ESFP and INFP.

H4.1	confirmed
H4.2	confirmed
H4.3	confirmed

Brewer [5] says that he would want the project manger to rate as an ENTJ or an ESTJ. He indicates those two types to be ideal for project management careers. These types would ensure the fact that if important decisions have to be made, they will rely on what they know and make a sage decision.

H4.1	confirmed	
H4.2	confirmed	
H4.3	confirmed	
H4.4	new	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*

Gehring [26] conducted a study which compared the MBTI personality traits theory with project management competencies. After an extensive literature review to identify competencies displayed by successful project managers, Gehring surveyed 49 project managers for their MBTI type. He found out that "*the following MBTI types had preferences that would support project leadership: ISTJ, INFJ, INTJ, ENTP, ESTJ, ENFJ, and ENTJ, with INTJ, ESTJ, and ENTJ being the types containing the most traits that supported project*

leadership competencies".

H4.1 confirmed
H4.2 confirmed
H4.3 confirmed
H4.4 confirmed

Brusman [8] asks in her article "*What Type Makes the Best Leader?* and tries to answer this question by using the results of a study of 26.477 people in a leadership development program. The the following percentage frequencies were reported in this study: 1. ISTJ (18.2%), 2. ESTJ (16.0%), 3. ENTJ (13.1%), 4. INTJ (10.5%). She emphasizes that the question, what type makes the best leader, cannot be answered. The only question that can be answered is which type is more predominant in leadership positions than others.

H4.1 confirmed
H4.2 confirmed
H4.3 confirmed

As an interesting overall impression of the literature analysis it can be said that all different papers, works, studies and statistics basically agree with each other. Just a few contradictions in the analysis of project members could be found.

The final summary and an overview of all hypotheses for project members and managers that were derived by the literature analysis as well as the theoretical analysis can be found in chapter 3.3.

3.3 Overview and Merging

Purpose of this chapter is to summarise all hypotheses that were derived from the theoretical as well as the literature approach. Further, both, the theoretical as well as the literature hypotheses, are compared. If possible, both types of hypotheses are merged and combined into the resulting hypotheses. Again, we start with project members and focus in the second part on project managers.

3.3.1 Project Members

The complete list of the hypotheses for project members that were delivered by the theoretical analysis can be found in Table 3.1.

H1.1	*There are more software project members with the I (introvert) than the E (extrovert) preference.*
H1.2	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*
H1.3	*There are more software project members with the T (thinking) than the F (feeling) preference.*
H1.4	*There are more software project members with the J (judging) than the P (perceiving) preference.*
H1.5	*The most frequently found types of software project members are ISTJ and INTJ.*

Table 3.1: List of hypotheses for project members delivered by theoretical analysis.

The complete list of the hypotheses for project members that were delivered by the literature analysis can be found in Table 3.2. There were 2 hypotheses with contradictions during the setup of the hypotheses (H3.1 and H3.4). In case of H3.4 there are more contradictions than confirmations. These hypothesis therefore is invalid and removed from the list.

H3.1	confirmed (4) contradicted (2)	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*
H3.2	confirmed (7)	*There are more software project members with the T (thinking) than the F (feeling) preference.*
H3.3	confirmed (6)	*There are more software project members with the J (judging) than the P (perceiving) preference.*
H3.4	confirmed (2) contradicted (4)	~~*There are more software project members with the S (sensing) than the N (intuitive) preference.*~~
H3.5	confirmed (4)	*There are more software project members with the I (introvert) than the E (extrovert) preference.*

Table 3.2: List of hypotheses for project members delivered by literature analysis.

If we try to merge the theoretical as well as the literature hypotheses, we see that **H1.1** agrees to **H3.5**, **H1.2** agrees to **H3.1**, **H1.3** agrees to **H3.2** and **H1.4** agrees to **H3.3**. So there is no need to modify them.

H1.5 does not disagree to another hypothesis but can not be merged without loosing some additional restrictions, so this hypothesis is kept. Following we receive the resulting hypotheses for the software project members in Table 3.3. The numbering is done like "PME-Hx", which stands for "**P**roject **Me**mber **H**ypothesis number **x**".

PME-H1	*There are more software project members with the I (introvert) than the E (extrovert) preference.*
PME-H2	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*
PME-H3	*There are more software project members with the T (thinking) than the F (feeling) preference.*
PME-H4	*There are more software project members with the J (judging) than the P (perceiving) preference.*
PME-H5	*The most frequently found types of software project members are ISTJ and INTJ.*

Table 3.3: Complete list of all hypotheses for project members.

3.3.2 Project Managers

The complete list of the hypotheses for project managers that were delivered by the theoretical analysis can be found in Table 3.4.

H2.1	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*
H2.2	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*
H2.3	*There are more software project managers with the T (thinking) than the F (feeling) preference.*
H2.4	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*
H2.5	*The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*

Table 3.4: List of hypotheses for project members delivered by theoretical analysis.

The complete list of the hypotheses for project managers that were delivered by the literature analysis can be found in Table 3.5. There were no contradictions during the setup of the hypotheses so all hypotheses are valid.

H4.1	confirmed (6)	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*
H4.2	confirmed (6)	*There are more software project managers with the T (thinking) than the F (feeling) preference.*
H4.3	confirmed (6)	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*
H4.4	confirmed (2)	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*

Table 3.5: List of hypotheses for project managers delivered by literature analysis.

If we try to merge the theoretical as well as the literature hypotheses, we see that **H2.1** agrees to **H4.4**, **H2.2** agrees to **H4.1**, **H2.3** agrees to **H4.2** and **H2.4** agrees to **H4.3**. So there is no need to modify them. Hypothesis **H2.5** does not disagree to another but can not be merged without loosing some additional restrictions, so this hypothesis is kept.

Following we receive the resulting hypothesis for the software project managers in Table 3.6. The numbering is done like "PMA-Hx", which stands for "**P**roject **Ma**nanger **H**ypothesis number **x**".

PMA-H1	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*
PMA-H2	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*
PMA-H3	*There are more software project managers with the T (thinking) than the F (feeling) preference.*
PMA-H4	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*
PMA-H5	*The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*

Table 3.6: Complete list of all hypotheses for project managers.

Now we completed the needed hypotheses from the literature as well as the theoretical analysis. The results of the case study will show if they hold in practice.

4 Case Study

This chapter discusses how the case study was done. This includes the procedure as well as the structure of the questionnaire. Further we take a look at the participants and some additional difficulties regarding privacy policy with the participating companies. At the end of this chapter we look at the results of the case study in detail.

4.1 Procedure

The first step was to define the structure of the test. It included questions like on- or offline testing and how the success of a project can be measured which is described in section 4.3 in detail. After the correct setup of the test structure, it was necessary to find companies, or more precise project teams, that fit certain prerequisites. These prerequisites include issues like business (only software projects), the size (amount of people who work on this project team), and the success of these projects. This part is described in section 4.4.1 in more detail and also includes the complete list of all participating companies and project teams. Finally, the analysis of the result is the last step of the procedure which was done in section 4.5.

4.2 Test environment

First, there was the question which test environment should be used. Should the case study be set up as an online or offline questionnaire. Both variants have advantages and disadvantages. Online questionnaires for example include the possibility to extend the potential participants on a far larger area such as Germany or Switzerland. It also allows to automatically generate statistics because all data is saved in digital form. Offline testing on the other side includes the advantages of explaining the idea of the case study in a personal and direct way. Further, it is possible to do the case study with all project members and the manager in the same room at the same time which could never be controlled or ensured with an online test environment.

This issue could be solved using the following approach: Online and offline testing are both used to get all advantages. The disadvantages are minimised by additional descrip-

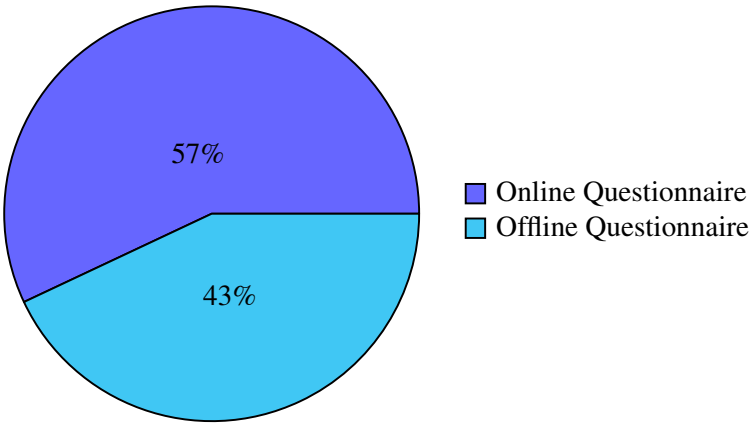

Figure 4.1: The ratio between companies that participated in the online or offline questionnaire.

tions in the online-version and an efficient data import tool (to merge the offline data to the online data in the database) for the online version.

There was also the attempt to balance the participants between online and offline testing, which can be seen in Table 4.1 and Figure 4.1. At the end there were two more companies that were tested online (8) than offline (6).

Participated companies	14
Online questionnaire	8 (57%)
Offline questionnaire	6 (43%)

Table 4.1: The ratio between companies that participated in the online or offline questionnaire.

The technical details of the online questionnaire will now be briefly explained, as it was not only used for gaining and storing the online questionnaire results, but also as a database for all the results of all participating people and for the analysis of the final results.

The interface was implemented using HTML (page structure) and CSS (page layout and style). AJAX (Asynchronous JavaScript and XML) and PHP were used for the dynamics and page logics. MySQL was used for the database to store and analyse the data.

The webpage was reached by a created URL that was unique for each company. After the company confirmed their participation and announced which project teams will participate, they got an unique link. For example a company with the name "The Company One" and the project teams "Project One" and "Project Two" got an unique link "http://www.mylink.com/thecompanyone" which they distributed to their project man-

agers and members. On this page participants could select the corresponding project they are working on from the predefined project list. In this way it was possible to assign people to the correct company. Additionally it was possible to show the participants only a list of projects that are assigned to their company.

4.3 Structure

4.3.1 Offline version

The structure of the questionnaire can be seen on the original sheet in Appendix A.2. It starts with the "general data" which includes the name of the company, the project or department name, the job of the employee, the working time in hours per week, and since when the employee is working at the company.

Additionally there are two questions about the project success and the personal feeling in the project team. These questions are intended to determine the success. Details about that can be found in section 4.4.1. The questions for project members and managers can additionally be found in Table 4.2.

Part two of the questionnaire was mainly about the KTS-II test and starts with some explaining and introducing words. The 70 questions of the test complete the second part.

The third part is meant for the evaluation of the test. First there is an exact explanation how to fill the following scoring sheet. After completing the scoring sheet, the personal KTS-II type is found out.

In the last part the questionnaire ends with some explanations about the different types and their names. It also includes an average percentage calculation of each type in the population. This can be interesting because some types occur more frequently than others.

There is also an additional sheet for project managers, which can be found in Appendix A.3. This sheet includes additional questions to calculate the success of the participating project team and is described in detail in section 4.4.1.

4.3.2 Online version

The online version of the questionnaire is quite similar to the offline version. The main difference are some additional descriptions that were necessary. Further the additional questions for managers (to measure the project success) were only shown, when the "project manager" position was chosen as the job in the project.

After finishing the test the resulting type was automatically calculated and a short description was shown. The automatic calculation of the type, the automatic display of manager‘s additional questions, as well as the pre-defined project group selection (see section 4.2 for details) made it easier, more comfortable and more time-saving to use the online version compared to the offline version.

Overall, the exact same questions in the exact same order were used like in the offline version.

4.4 Participants

4.4.1 Selection of companies

As already mentioned, it was a challenge to find appropriate companies, or more precise project teams, because they have to meet certain prerequisites which include aspects like the business (only software projects), the size (amount of people who work on this project team) and the success of these projects. All of them are described in detail in this section.

Project business

It is pretty obvious that only projects in the software development business are qualified for this case study. However, these software projects may come from very different areas for example from SAP development, web development and system development to programs written in Assembler.

Success of projects

The success of a project was already discussed and defined in the chapter about basic principles (section 2.2.3). There was mentioned that the success of a project plays an important role for this thesis and the questionnaire, because only members and managers of "successful" projects are interesting to be analysed for their MBTI/KTS-II types. Therefore there is a need to verify if a participating project team is successful.

We already mentioned in the chapter about the structure of the questionnaire (section 4.3) that the questionnaire contains two questions for the measurement of the success beside the KTS-II questions. The project managers additionally got six questions for this measurement. These eight questions can be found in Table 4.2.

The resulting values of these questions are used to calculate a success factor for each project. It was already mentioned in section 2.2.3 that there are various discussions about how to find out if a project or project teams in general are successful. There is no "perfect" approach because there are many ways of solving this problem. Some theories say that an effective way is to ask involved people anonymously themselves. The average result of all questioned people will be close to reality. We will use this approach to find out if the tested project teams can be called "successful" due to our own successful factor variable.

The calculation of this variable is now briefly described. First we have to define how to calculate the arithmetical mean, which can be seen in Figure 4.2. The arithmetic mean is an average value, which is defined as the quotient of the sum of the observed values and the number of values.

$$x_{arithm} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

Figure 4.2: Mathematical definition of the arithmetic mean.

First we want to calculate the project success factor for each project team. This first variable will be about the project members of each project. We calculate the mean of both asked success questions (see Table 4.2 left column question 1 and 2). The first question about the success should be more important than the second about the working environment because the estimated success by the project member is more significant than the personal feeling in the team for the success of the project. Therefore the first variable is double weighted, which means that the combined member success variable for the project team is calculated by 2/3 question 1 and 1/3 question 2. The calculation of these variable can be found in Figure 4.3.

The calculation of the overall success factor variable for project managers is easier. We take all eight questions for the success calculations and calculate the arithmetical mean. This calculation can be found in Figure 4.4.

Finally we have to define which values have to be achieved that a project can be seen as "successful". All questions for the success calculation can be answered by using values from zero to ten where zero means "very poor or not true" and ten means "very well or true". We define that a successful project at least means a success factor of 7 for both, the members as well as the manager success variables. Figure 4.5 defines this constraints mathematically.

$$Q1 \rightarrow Values\,of\,question\,1\,(Success)$$
$$Q2 \rightarrow Values\,of\,question\,2\,(Working\,Environment)$$

$$Me_{Q1} \rightarrow Resulting\,success\,variable\,of\,team\,members\,of\,variable\,1\,(Success)$$
$$Me_{Q2} \rightarrow Resulting\,success\,variable\,of\,team\,members\,of\,variable\,2\,(Working\,Environment)$$
$$Me_{SuccessFactor} \rightarrow Resulting\,success\,variable\,of\,team\,members$$

$$Me_{Q1} = \frac{1}{|Q1|}\sum_{i=1}^{|v1|} Q1_i$$
$$Me_{Q2} = \frac{1}{|Q2|}\sum_{i=1}^{|v2|} Q1_i$$
$$Me_{SuccessFactor} = \frac{2 * Me_{Q1} + Me_{Q2}}{3}$$

Figure 4.3: Mathematical definitions of the member success variable of one project.

$$Ma_{QX} \rightarrow Value\,of\,success\,question\,X$$

$$Ma_{SuccessFactor} = \frac{Ma_{Q1} + Ma_{Q2} + Ma_{Q3} + Ma_{Q4} + Ma_{Q5} + Ma_{Q6} + Ma_{Q7} + Ma_{Q8}}{8}$$

Figure 4.4: Mathematical definitions of the manager success variable of one project.

$$Ma_{SuccessFactor} > 7 \ \wedge \ Me_{SuccessFactor} > 7 \Rightarrow project\,is\,successful$$

Figure 4.5: Mathematical definitions if a project is successful.

Project team size

Projects are implemented in teams of different numbers of people. On one side very small projects can consist of only two project members and on the other side very large projects can compromise of thousands of people working on the software. Therefore the projects with different sizes have completely different attributes and processes which would be very difficult to compare.

A project manager for example is more included to the programmer's problems in a small project team with 10 people than in a project team with 500 people. The bigger the project team the more the project manager has to focus on project resource allocation and has less

Success variables for project members	Success variables for project managers
1. **Success**: Estimate the project success of your team on a scale from 0 (not successful) to 10 (very successfully). 2. **Working Environment**: How comfortable do you feel in your project team on a scale from 0 (uncomfortable) to 10 (very well).	3. **Punctuality**: How would you assess compliance and timeliness of dates and milestones in this project group? 4. **Costs**: How would you assess the compliance with the budgeted costs in the project group? 5. **Satisfaction Employee**: How would you assess the satisfaction of your employees? 6. **Satisfaction Customers**: How would you assess the satisfaction of your customers? 7. **Quality**: How would you rate the quality of the project results? 8. **Overall Judgement**: All set objectives of this project group were reached at the right time, in the previously defined quality and with a hight customer satisfaction. Rating scale from 0 (does not agree) to 10 (completely agree).

Table 4.2: Overview of the additional questions (beside the KTS-II questionnaire) for the success measurement.

time for the developers. As a result, big projects use hierarchical arrangements, including "sub-managers" who are responsible for a certain section of the project. This also implies that project managers of smaller projects may have different personality types than project managers of bigger projects because they have different tasks and responsibilities. That is just one of many possible examples, that gives reason to restrict the participating project teams to "smaller" teams from 5-12 people in the questionnaire. It guarantees that there are no consequences of this problem in the collected data.

4.4.2 Difficulties with privacy policy

Problem definition

In times of social media like Facebook and Twitter data security is a top priority. This is an important issue not only for private individuals but also for companies. [44, 67] Especially the protection of data of their own employees is nowadays a priority for companies. [63]

After writing to potential companies and project groups for the participation on the questionnaire it got pretty clear that most companies are interested in the questionnaire and especially to the results of it. But nearly every company and project group had questions about the protection of the "sensible" data that is collected during the process.

Potential participants were anxious that the data of the company as well as the data of the employees would be published and this could have a damaging effect for the company. Further they did not want any "private" data to be published, regarding the size of their projects or which personality types their employee's have.

Therefore there was a need to guarantee companies that their data will only be used in an anonymous way. One way to do this is to set up some kind of contract. Therefore a NDA (Non-Disclosure Agreement) was used, which was signed for participating companies. It included the conditions that all data of the companies, projects, and employees were anonymised in the results for the thesis.

Further it is defined that only

1. the development area and
2. the home country

of the company is allowed to be published. In case of the employee and project data it is only allowed to publish

1. the number of projects of the company,
2. the number of employees of each project team,
3. the results of the KTS-II tests of all employees as well as
4. the results of the additional success questions of all employees.

The full elaborated agreement that was used can be found in appendix A.1. The next subchapter explains some basic principles about NDA's for better understanding the way it was used.

Non-Disclosure Agreement (NDA)

Confidentiality agreements, also referred to as non-disclosure agreements (NDA), are used when the owner of confidential information wishes to protect information from another party [61]. The parties agree that certain types of information that passes from one party to the other or that are created by one of the parties, will remain confidential. These agreements define exactly what information can and cannot be disclosed. The type of information that can be included under the umbrella of confidential information is virtually unlimited [50, 31]

A non-disclosure agreement must contain a time period during which disclosures will be made and the period during which confidentiality of the information is to be maintained. If the information is revealed to another individual or company, the injured party has cause to claim a breach of contract and can seek injunctive and monetary damages. [50]

There are three types of non-disclosure agreements: [31]

1. *unilateral*: One party discloses confidential information to only one other party.
2. *bilateral*: Two parties mutually disclose information.
3. *multilateral*: Three or more parties disclose information among themselves.

By signing a confidentiality agreement, the recipient undertakes the obligation not to disclose the confidential information as defined in the agreement. A confidentiality agreement can typically be detailed in 2 to 4 pages. [61]

4.4.3 Participating Companies and Projects

A total of 30 project teams of 14 different companies took part in the case study. Overall 243 employees of these project teams participated in the questionnaire which consisted of 30 project managers and 213 project members. An overview of the companies, projects and employees, which is represented as a tree, can be found in Figure 4.6.

An overview of the participating companies, including their development area, can be found in the Appendix A.4, that includes the row data of the questionnaire.

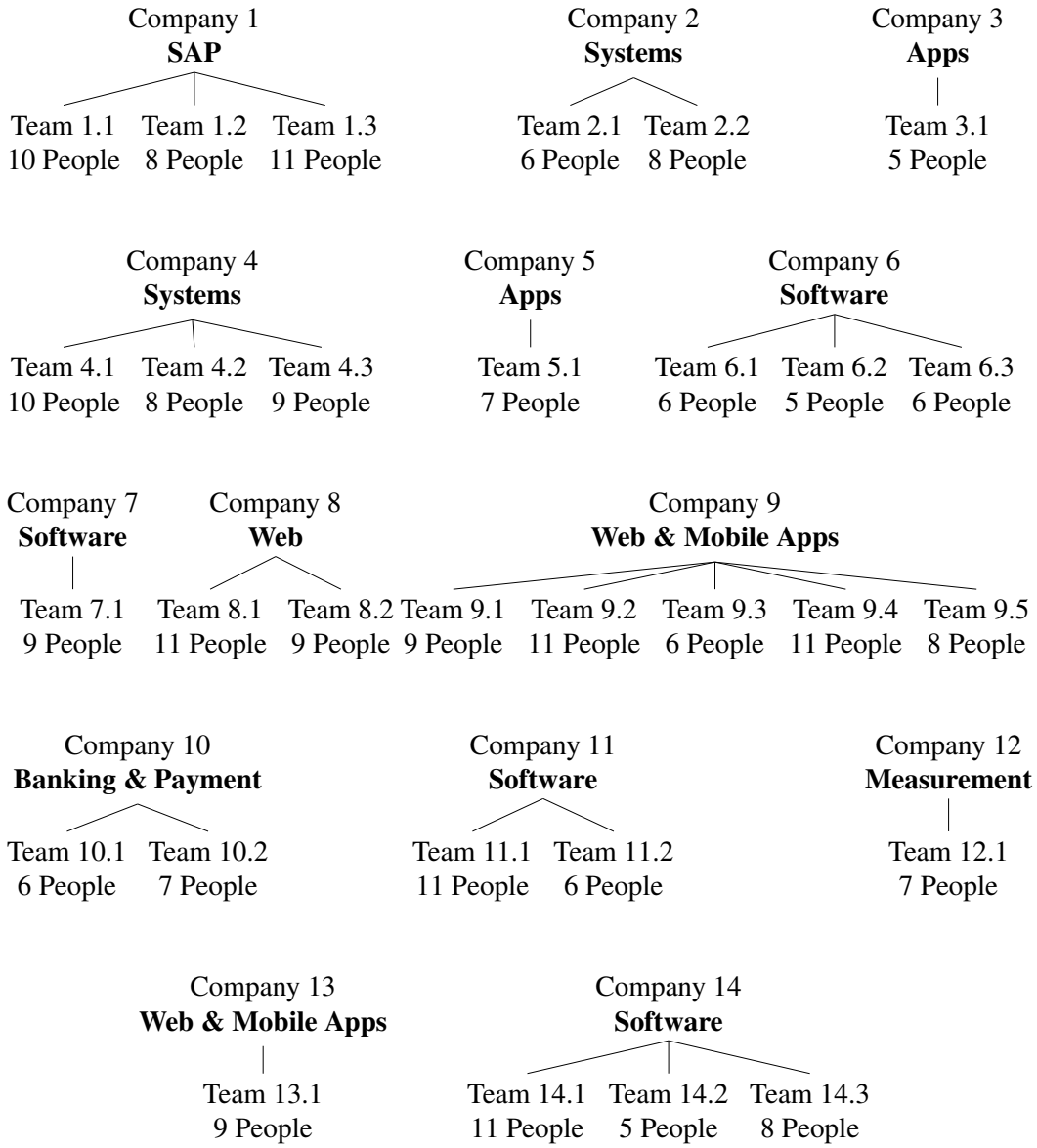

Figure 4.6: Overview of the companies, teams and people per team that participated in the questionnaire.

4.5 Analysis of Results

This section includes the process of analysing the raw data from the questionnaire to gain the relevant information. First the overview shows some general facts about the data like online/offline ratio or the development areas of the participating companies. The part about the success of the projects checks if a project matches the success constraints that were defined in section 4.4.1. The sections about manager and member types are analysing the data. Finally the last section about "group constellations" will look on other regularities or irregularities that were noticed in the data during the analysing process.

4.5.1 Overview

First we are interested in the ratio between online and offline testing. This data was already mentioned in the section 4.2 about the test environment, where it was mentioned that the goal was to balance between both. Table 4.1 shows that there were 14 companies tested which consists of two more companies that were tested online (8) than offline (6). Figure 4.1 visually demonstrates that the goal of a good balance was achieved.

Regarding the different development areas a good distribution can be observed. The 14 companies that participated are splitted into 7 different development areas which can be found in Figure 4.7.

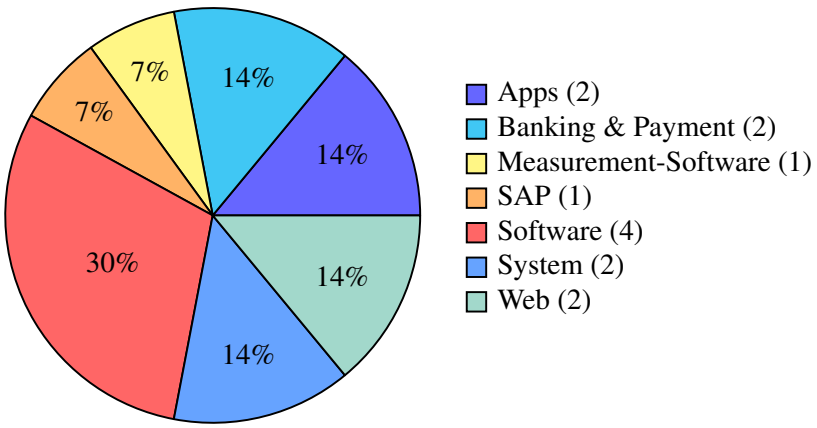

Figure 4.7: The different development areas of the 14 participated companies.

The 14 companies came from three different countries: Austria, Germany and Switzerland. Figure 4.8 shows an overview of how many companies came from which country.

Appendix A.4 shows the raw data of the participating companies and therefore includes the online/offline attribute as well as the development area and home country of each company.

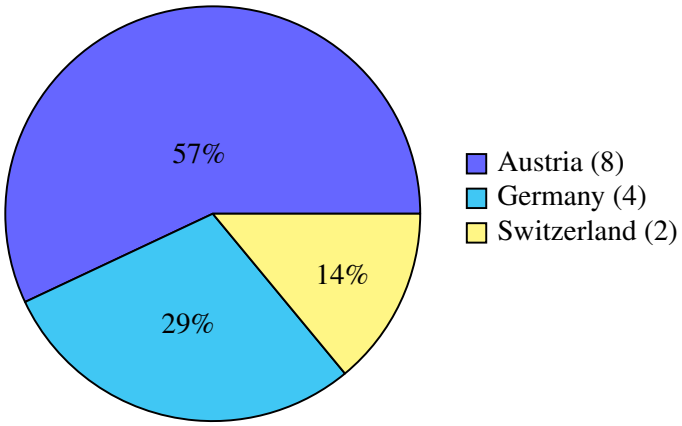

Figure 4.8: Overview of how many companies participated in the questionnaire and from which country they are.

4.5.2 Success of projects

As already mentioned in section 2.2.3 it is important to check if the participating project teams can be called "successful". In section 4.4.1 we defined how to measure this success and defined therefore some success factor variables. The methods are now used to calculate these success variables for all project teams.

Table 4.4 shows the results of these calculations. The columns "MeQ1" and "MeQ2" are the calculated mean for the success questions of project members. The column "Me Success Factor" represents the calculated overall function for project members (The calculation of this variable was defined in section 4.4.1).

The columns "MaQ1" to "MaQ8" represents the answers to the success questions of the project managers of the specific project team. Unlike the columns for the project members, these numbers are no means because every project team has only one project manager. The column "Ma Success Factor" represents the final representing project manager success factor for the specific project team (The calculation of this variable was defined in section 4.4.1).

We defined in section 4.4.1 that we want at least a value of 7 for both, the members as well as the managers success factor. If we take a look at Table 4.4 we will see that all of these factors exceed the value of 7 (the important success factors are marked in bold). That means all data of all teams are used for the following analyses.

Company ID	Me Q1	Me Q2	Me Success Factor	Ma Q1	Ma Q2	Ma Q3	Ma Q4	Ma Q5	Ma Q6	Ma Q7	Ma Q8	Ma Success Factor
Team 1.1	8.7	8.9	**8.7**	9	8	9	10	7	9	9	9	**8.8**
Team 1.2	8.6	9.4	**8.9**	9	8	7	9	8	10	6	8	**8.1**
Team 1.3	9.1	9.1	**9.1**	8	10	9	8	9	10	9	8	**8.9**
Team 2.1	7.6	9.2	**8.1**	10	10	9	5	9	9	8	9	**8.6**
Team 2.2	8.7	8.9	**8.8**	9	8	7	9	8	9	7	9	**8.3**
Team 3.1	9.0	8.8	**8.9**	10	10	9	9	8	10	9	9	**9.3**
Team 4.1	8.4	9.3	**8.7**	9	9	9	8	7	9	10	9	**8.8**
Team 4.2	9.1	8.1	**8.8**	10	9	8	9	10	9	9	8	**9.0**
Team 4.3	9.1	9.1	**9.1**	10	9	7	10	10	7	9	8	**8.8**
Team 5.1	7.5	9.2	**8.1**	7	8	10	9	8	7	9	8	**8.3**
Team 6.1	8.4	8.6	**8.5**	8	9	7	10	9	7	8	9	**8.4**
Team 6.2	8.0	9.5	**8.5**	7	8	7	6	9	9	8	7	**7.6**
Team 6.3	9.6	9.6	**9.6**	9	8	7	9	8	9	10	7	**8.4**
Team 7.1	8.4	8.6	**8.5**	10	9	8	7	10	9	7	10	**8.8**
Team 8.1	8.4	8.9	**8.6**	8	7	9	8	7	9	10	8	**8.3**
Team 8.2	7.1	8.4	**7.5**	10	9	7	10	9	7	9	7	**8.5**
Team 9.1	9.0	9.0	**9.0**	9	7	8	10	9	10	8	9	**8.8**
Team 9.2	7.2	8.7	**7.7**	7	8	9	7	8	9	10	8	**8.3**
Team 9.3	8.6	9.0	**8.7**	10	8	6	5	10	7	8	9	**7.9**
Team 9.4	7.6	8.9	**8.0**	9	7	9	8	8	9	8	7	**8.1**
Team 9.5	7.9	9.0	**8.2**	9	9	9	9	7	9	10	9	**8.9**
Team 10.1	8.8	8.4	**8.7**	10	9	8	10	10	10	8	9	**9.3**
Team 10.2	8.0	9.0	**8.3**	8	8	8	9	8	9	8	10	**8.5**
Team 11.1	7.8	9.1	**8.2**	10	9	7	9	10	9	9	9	**9.0**
Team 11.2	7.4	7.8	**7.5**	10	9	9	9	8	7	10	9	**8.9**
Team 12.1	7.8	9.3	**8.3**	9	8	9	7	8	9	7	8	**8.1**
Team 13.1	8.5	8.9	**8.6**	10	9	8	9	10	10	9	8	**9.1**
Team 14.1	7.4	8.6	**7.8**	10	9	10	10	9	8	10	8	**9.3**
Team 14.2	7.5	8.8	**7.9**	9	9	9	9	8	9	9	9	**8.9**
Team 14.3	7.9	9.0	**8.2**	10	9	9	10	10	9	8	8	**9.1**

Table 4.4: Overview of all success variables and calculated success factors.

4.5.3 Members Types

In this section we will focus on the results of the questionnaire regarding the software project members. First we will look at all 4 different dimensions and their eight preferences.

Extraversion vs. Introversion

The results show that there is a clear tendency for the introversion preference for project members. About 88 percent of the participants prefer introvert over extrovert. Figure 4.9 demonstrates the ratio graphically.

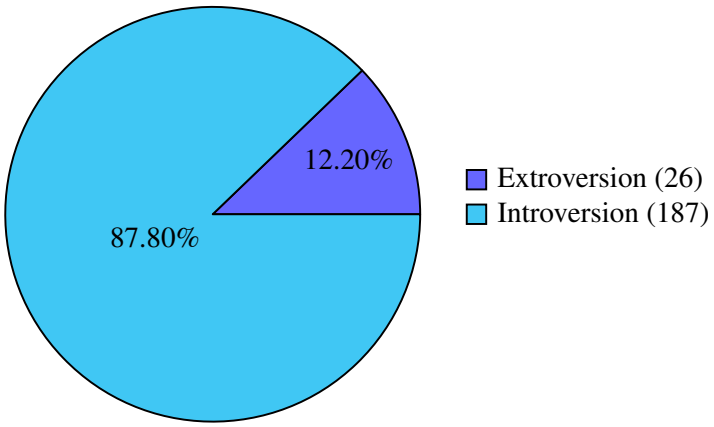

Figure 4.9: The ratio between Introversion (I) and Extraversion (E) of software project members.

Sensing vs. Intuition

The results show that there is nearly a perfect split between the sensing and intuition preference for project members. About 54 percent of the participants prefer sensing over intuition. Figure 4.10 demonstrates the ratio graphically.

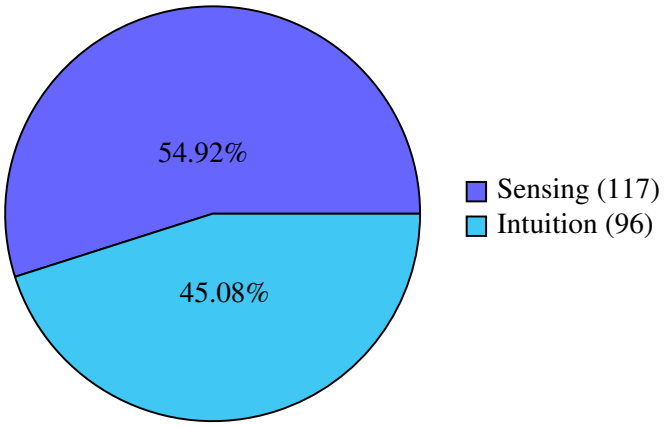

Figure 4.10: The ratio between Sensing (S) and Intuition (N) of software project members.

Thinking vs. Feeling

The results show that there is a clear tendency for the thinking preference for project members. About 89 percent of the participants prefer thinking over feeling. Figure 4.11 demonstrates the ratio graphically.

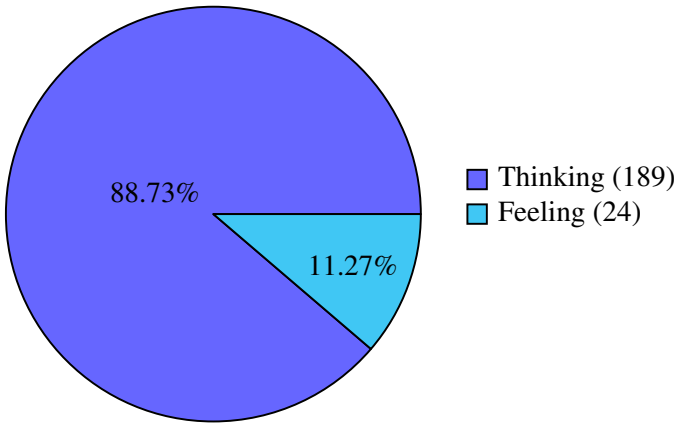

Figure 4.11: The ratio between Thinking (T) and Feeling (F) of software project members.

Judging vs. Perceiving

The results show that there is a two-thirds majority for the judging preference for project members. About 73 percent of the participants prefer judging over perceiving. Figure 4.12 demonstrates the ratio graphically.

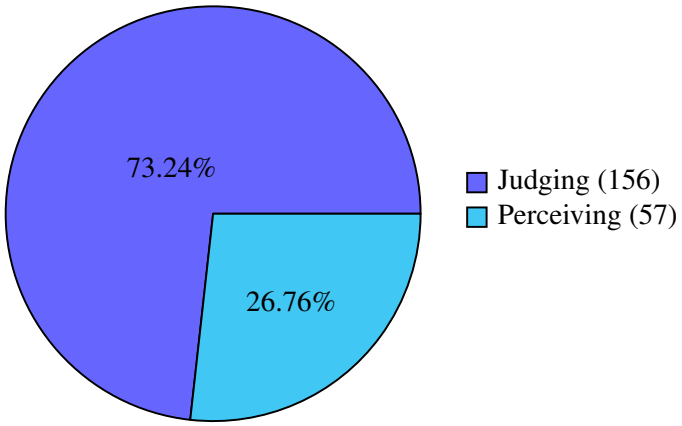

Figure 4.12: The ratio between Judging (J) and Perceiving (P) of software project members.

After the analysis of the different preferences we will now analyse the distribution of the complete KTS-II types including all preferences. Figure 4.13 shows an overview of the distribution of all available KTS-II types and how many of them have occured in the results.

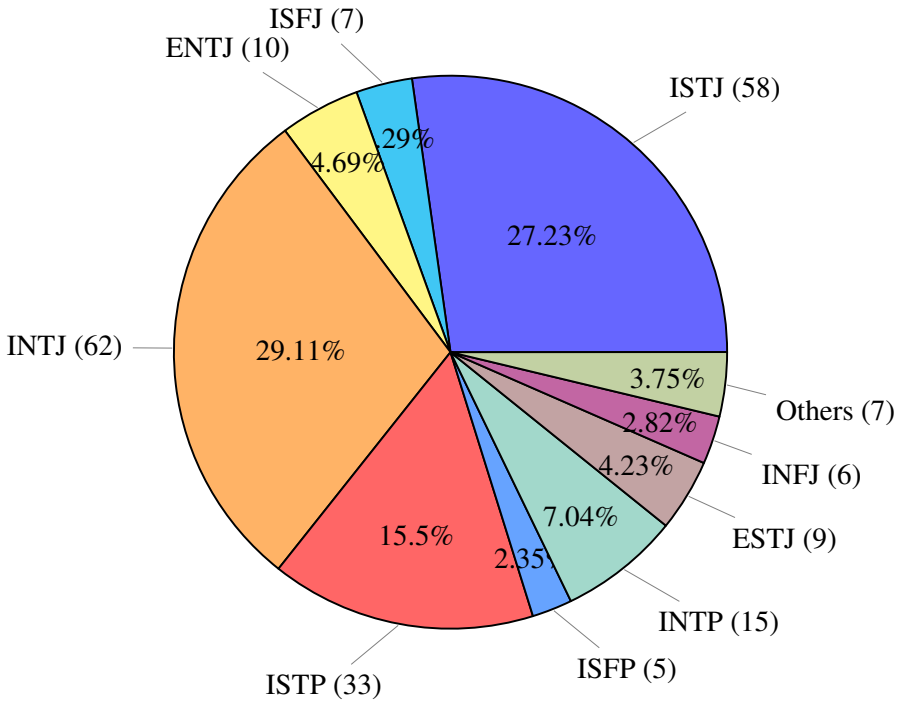

Figure 4.13: Overview of all found types of project members with more than 2 %.

Figure 4.13 only includes the types that got more than 2 percentage of the share. There are 7 of the 16 types that got lower percentage, which means there are less than 4 people

preferring this type. The types INFP, ESTP, ENFP and ESFJ got a number between 1 and 4 people while the types ESFP and ENTP got not even one person preferring this type.

The most common types were INTJ (62 people, 29%) and ISTJ (58 people, 27%) which are very striking beside the others. Together there are more than 50 percentage of people preferring these two types than all other types together. Only the ISTP type was also able to get a share above 10 percentage (33 people) and therefore is also to mention.

Table 4.5 includes all the results of the project members type tests including some statistics about the different preferences, special pair shares and an overview of how many people had specific types.

4.5.4 Manager Types

In this section we will focus on the results of the questionnaire regarding the software project managers. First we will look at all 4 different dimensions and their eight preferences.

Extraversion vs. Introversion

The results show that there is a tendency for the extraversion preference for project managers. About 66 percentage of the participants prefer extrovert over introvert. Figure 4.14 demonstrates the ratio graphically.

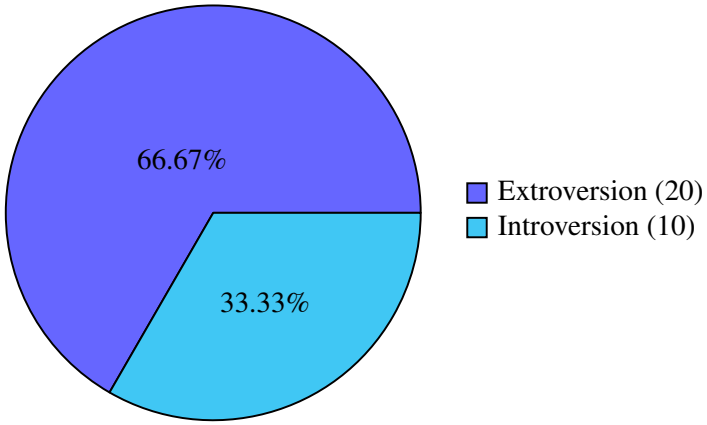

Figure 4.14: The ratio between Introversion (I) and Extraversion (E) of software project managers.

Sensing vs. Intuition

The results show that there is a perfect split between the sensing and intuition preference for project managers. 50 percentage of the participants prefer sensing over intuition and the other 50 intuition over sensing. Figure 4.15 demonstrates the ratio graphically.

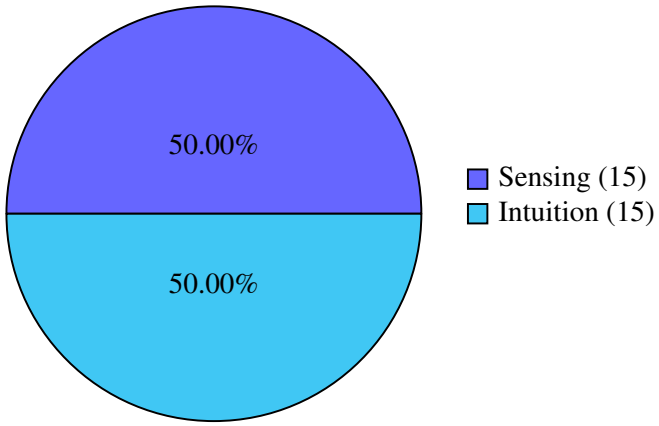

Figure 4.15: The ratio between Sensing (S) and Intuition (N) of software project managers.

Thinking vs. Feeling

The results show that there is a tendency for the thinking preference for project managers. About 76 percentage of the participants prefer thinking over feeling. Figure 4.16 demonstrates the ratio graphically.

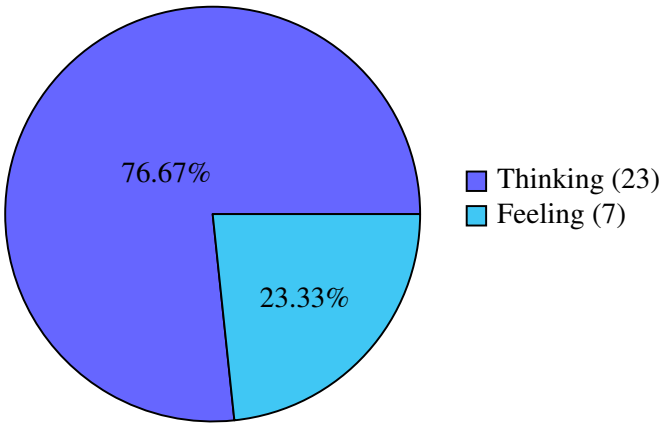

Figure 4.16: The ratio between Thinking (T) and Feeling (F) of software project managers.

Judging vs. Perceiving

The results show that there is a 90 percentage majority for the perceiving preference for project managers. Only about 10 percentage of the participants prefer judging over perceiving. Figure 4.17 demonstrates the ratio graphically.

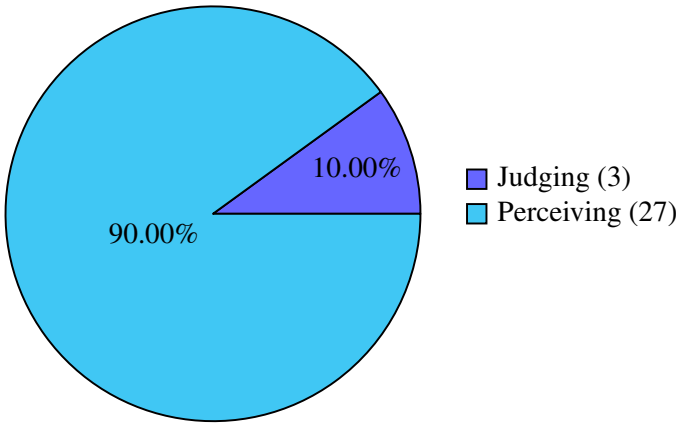

Figure 4.17: The ratio between Judging (J) and Perceiving (P) of software project managers.

After the analysis of the different preferences we will now analyse the distribution of the complete KTS-II types including all preferences. Figure 4.18 shows an overview of the distribution of all available KTS-II types and how many of them have occured in the results.

Figure 4.18 only includes the types that got more than one occurrence in the results. There are 7 of the 16 types that no manager preferred (ISTJ, INFJ, ISFP, ESTJ, ESFJ,ENFJ and ENTJ). The types INTJ, ISTP and ENFP only got one person preferring each type.

The most common types were ESTP (10 people, 33%) and ENTP (7 people, 23%) which are very striking beside the others. Together there are more than 50 percentage of people preferring these two types than all other together. Only the INTP type was also able to get a share above 10 percentage (4 people) and therefore is also to mention.

Table 4.6 includes all the results of the project managers type tests including some statistics about the different preferences, special pair shares and an overview of how many people had specific types.

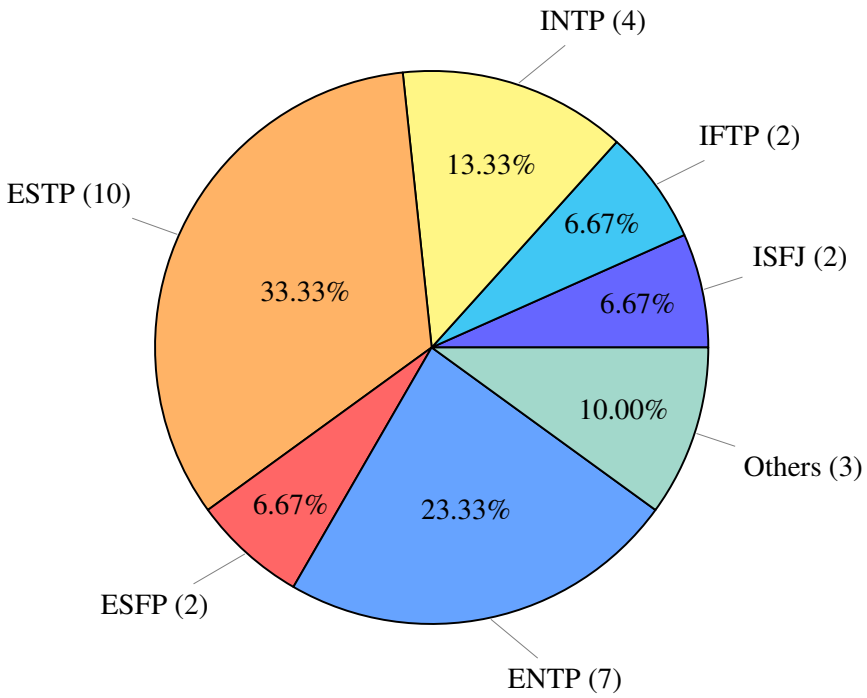

Figure 4.18: Overview of all found types of project managers which occurred more than once.

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4.5.5 Additional group findings

Additionally, beside the planned analysis of the collected data, some "group effects" could be found that are also important to be mentioned here. The following facts could be found during a simple group analysis:

1. 11 out of 30 project teams consist only of project members that are introvert (I).
2. Every project team consists at least of 60% introvert (I) project members.
3. Every project team consists of at least one sensing (S) and one intuitive (N) project member.
4. Every project team consists of at least one thinking (T) and one feeling (F) project member.
5. Every project team consists of at least one judging (J) and one perceiving (P) project member.
6. 26 out of 30 projects include at least one project member with the type INTJ.
7. 29 out of 30 projects include at least one project member with the type ISTJ.

Member Results - All Sixteen Types			
ISTJ n = 58 (27.23%)	**ISFJ** n = 7 (3.29%)	**INFJ** n = 6 (2.82%)	**INTJ** n = 62 (29.11%)
ISTP n = 33 (15.49%)	**ISFP** n = 5 (2.35%)	**INFP** n = 1 (0.47%)	**INTP** n = 15 (7.04%)
ESTP n = 2 (0.94%)	**ESFP** n = 0 (0.00%)	**ENFP** n = 1 (0.47%)	**ENTP** n = 0 (0.00%)
ESTJ n = 9 (4.23%)	**ESFJ** n = 3 (1.41%)	**ENFJ** n = 1 (0.47%)	**ENTJ** n = 10 (4.69%)

Dichotomous Preferences		
E	n = 26	(12.20&)
I	n = 187	(87.79%)
S	n = 117	(54.92%)
N	n = 96	(45.07%)
T	n = 189	(88.73%)
F	n = 24	(11.27%)
J	n = 156	(73.24%)
P	n = 57	(26.76%)

Pairs and Temperaments		
IJ	n = 133	(62.44%)
IP	n = 54	(25.35%)
EP	n = 3	(1.41%)
EJ	n = 23	(10.80%)
ST	n = 102	(47.89%)
SF	n = 15	(7.04%)
NF	n = 9	(4.23%)
NT	n = 87	(40.85%)
SJ	n = 77	(36.15%)
SP	n = 40	(18.78%)
NP	n = 17	(7.98%)
NJ	n = 79	(37.09%)
TJ	n = 139	(65.26%)
TP	n = 50	(23.47%)
FP	n = 7	(3.29%)
FJ	n = 17	(7.98%)
IN	n = 84	(39.44%)
EN	n = 12	(5.63%)
IS	n = 103	(48.36%)
ES	n = 14	(6.57%)
ET	n = 21	(9.86%)
EF	n = 5	(2.35%)
IF	n = 19	(8.92%)
IT	n = 168	(78.87%)

Table 4.5: Overview of the project members KTS-II type results.

Manager Results - All Sixteen Types			
ISTJ n = 0 (0.00%)	**ISFJ** n = 2 (6.67%) + +	**INFJ** n = 0 (0.00%)	**INTJ** n = 1 (3.33%) +
ISTP n = 1 (3.33%) +	**ISFP** n = 0 (0.00%)	**INFP** n = 2 (6.67%) + +	**INTP** n = 4 (13.33%) + + + +
ESTP n = 10 (33.33%) + + + + + + + + + +	**ESFP** n = 2 (6.67%) + +	**ENFP** n = 1 (3.33%) +	**ENTP** n = 7 (23.33%) + + + + + + +
ESTJ n = 0 (0.00%)	**ESFJ** n = 0 (0.00%)	**ENFJ** n = 0 (0.00%)	**ENTJ** n = 0 (0.00%)

Dichotomous Preferences		
E	n = 20	(66.67&)
I	n = 10	(33.33%)
S	n = 15	(50.00%)
N	n = 15	(50.00%)
T	n = 23	(76.67%)
F	n = 7	(23.33%)
J	n = 3	(10.00%)
P	n = 27	(90.00%)

Pairs and Temperaments		
IJ	n = 3	(10.00%)
IP	n = 7	(23.33%)
EP	n = 20	(66.67%)
EJ	n = 0	(0.00%)
ST	n = 11	(36.67%)
SF	n = 4	(13.33%)
NF	n = 3	(10.00%)
NT	n = 12	(40.00%)
SJ	n = 2	(6.67%)
SP	n = 13	(43.33%)
NP	n = 14	(46.67%)
NJ	n = 1	(3.33%)
TJ	n = 1	(3.33%)
TP	n = 22	(73.33%)
FP	n = 5	(16.67%)
FJ	n = 2	(6.67%)
IN	n = 7	(23.33%)
EN	n = 8	(26.67%)
IS	n = 3	(10.00%)
ES	n = 12	(40.00%)
ET	n = 17	(23.33%)
EF	n = 3	(10.00%)
IF	n = 4	(13.33%)
IT	n = 6	(20.00%)

Table 4.6: Overview of the project managers KTS-II type results.

5 Results and discussion

In this chapter we will focus on the results of both previous analyses. The hypotheses that were produced by the findings of the theoretical combinations as well as the literature research will now be compared to the results of the case study. First we start with the project members and the second part will deal with the project managers. This will be done by looking on all hypotheses and on wether all of their statements match the results of the case study.

5.1 Project Members

The first hypothesis for software project members tells us that there should be more people preferring the introvert than the extrovert preference.

PME-H1 *There are more software project members with the I (introvert) than the E (extrovert) preference.*

The results of the case study show that this is the case. About 88 percentage of the tested project members prefer the introvert over the extrovert preference. Figure 4.9 shows the clear majority of the introvert preference graphically. **Hypothesis PME-H1 confirmed.** This symbolises a very clear result which therefore is very meaningful.

Taking a look on the general distribution of the types in different populations (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) we know that about 35 to 40 percentage of people prefer the introvert preference. This makes the result of 88 percentage of project members preferring the introvert preference in relation to the general population even more meaningful. That also implies that about 60 to 65 percentage of people who prefer the extrovert preference, generally speaking, would not fit to a project member position. So one could say that about 35 to 40 percentage of people in the overall population own the preferred introvert preference that project members in general prefer.

The second hypothesis for project members predicts a split between the sensing and the intuitive preference.

PME-H2 *There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*

The case study shows that there is indeed the tendency of a balance between these two preferences. There are 96 people preferring the sensing and 117 people preferring the intuitive preference. This means a split of about 55 to 45 percentage (graphical visualisation see Figure 4.10). You can not say unequivocally that one of the types is more preferred than the other one from these data. **Hypothesis PME-H2 confirmed.**

Thinking about a comparison to the general population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) we can see that about 60 percentage of people prefer the sensing preference. Overall one can say that a ratio of 60:40 is more balanced than one-sided which agrees to the results of the case study. One possible implication of this result can be that this attribute is not as important as others because it lies almost in the same section as the overall population.

Hypothesis three predicts that project members prefer the thinking over the feeling preference.

PME-H3 *There are more software project members with the T (thinking) than the F (feeling) preference.*

The results of the case study fit nearly perfectly to this hypothesis. About 89 percentage (189 people) prefer the thinking preference and only 11 percentage (24 people) the feeling preference. This ratio is graphed in Figure 4.11. In case of the project members the result between these two preferences was the clearest from the whole case study. **Hypothesis PME-H3 confirmed.**

A comparison to the overall population we can see that the split between the two preferences is nearly balanced (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations). Our results show that project members clearly prefer the thinking preference and therefore suggests that this preference is quite important in comparison to the total population.

The fourth hypothesis says that project members prefer the judging over the perceiving preference.

PME-H4 *There are more software project members with the J (judging) than the P (perceiving) preference.*

As presented in Figure 4.12 indeed there is a clear tendency for the tested project members to prefer judging over perceiving. The resulting ratio is 74 percentage (156 people) for judging against 26 percentage (57 people) for perceiving. This result might be not as clear as the others but the overall tendency (two-thirds majority) is sufficient to confirm the hypothesis. **Hypothesis PME-H4 confirmed.**

The ratio of these preferences in the general population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) shows that there is a balanced split of the judging and perceiving preference. The result of the case study shows that the project members clearly prefer the judging over the perceiving preference. Therefore the result can be seen as important because the split between the two preferences differs obviously between the general population and the case study results.

The last hypothesis for project members includes the prediction of the most common types for software project members which should be ISTJ and INTJ.

PME-H5 *The most frequently found types of software project members are ISTJ and INTJ.*

As shown in Figure 4.13 the types INTJ (62 people, 29%) and ISTJ (58 people, 27%) are the most used ones. Together there are more than 50 percentage of people preferring these two types than all other together. **Hypothesis PME-H5 confirmed.**

Again we want to compare the result to the share of types in the overall population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations). We can see that about INTJ has a share of about 1-4 percentage in the overall population. This result is incredibly meaningful because our result shows that 29 percentage of our tested project members prefer this type. Not quite that extreme is the comparison of the second most-common type during the case study. In the overall population there are about 11-14 percentage of people preferring the ISTJ type. The case study resulted in a 27 percentage share for this type.

Combined more than half (56%) of the participated project members in the case study but only 12-18 percentage of people in the overall population prefer these types. This is a very interesting result which can be interpreted in a way that only 12-18 percentage of people in the population prefer the most common types which project members prefer.

First, the results of the literature analysis were quite consistent across many different sources with only one contradiction. Second, the theoretical analysis fits very well to the literature results. And also the results of the case study fit, in case of project members, very well to the hypotheses. Table 5.1 summarises the results.

Hypothesis		Status
PME-H1	*There are more software project members with the I (introvert) than the E (extrovert) preference.*	Confirmed
PME-H2	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*	Confirmed
PME-H3	*There are more software project members with the T (thinking) than the F (feeling) preference.*	Confirmed
PME-H4	*There are more software project members with the J (judging) than the P (perceiving) preference.*	Confirmed
PME-H5	*The most frequently found types of software project members are ISTJ and INTJ.*	Confirmed

Table 5.1: Confirmed and disproved hypotheses of project members.

5.2 Project Managers

The first hypothesis for software project managers tells us that there should be more people preferring the extrovert than the introvert preference.

PMA-H1 *There are more software project managers with the E (extrovert) than the I (introvert) preference.*

The results of the case study show that this is the case. About 67 percentage of the tested project managers (20 out of 30) prefer the extrovert over the introvert preference. Figure 4.14 shows the clear majority of the extrovert preference graphically. **Hypothesis PMA-H1 confirmed.**

Taking a look on the general distribution of the types in different populations (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) we know that about 60 to 65 percentage of people prefer the extrovert preference. This corresponds approximately to the results of the case study. If you only compare the overall population to the results of the case study one could say that the results are not that meaningful because of the fact that they nearly match. But by looking at the results of project mem-

bers, we found out that 88 percentage of project members prefer the introvert preference. This fact shows that the resulted share is in fact meaningful - because it shows that this preference is very different from project members to managers.

The second hypothesis for project managers predicts a split between the sensing and the intuitiv preference.

PMA-H2 *There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*

The case study shows that there is a perfect balance between these two preferences. There are 15 people preferring the sensing and 15 people preferring the intuitiv preference. This means a split of exactly 50 percentage (graphical visualisation see Figure 4.15). **Hypothesis PMA-H2 confirmed.**

Thinking about a comparison to the general population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) we can see that about 60 percentage of people prefer the sensing preference. Overall one can say that a ratio of 60:40 is more balanced than one-sided which agrees to the results of the case study. This result is quite similar to the results for the project members. This emphasises the statement which was made for project members - that one possible implication of this result can be that this attribute is not as important as others because it lies almost in the same section as the overall population.

Hypothesis three predicts that project managers prefer the thinking over the feeling preference.

PMA-H3 *There are more software project managers with the T (thinking) than the F (feeling) preference.*

The results of the case study fit to this hypothesis. About 77 percentage (23 people) prefer the thinking preference and only 23 percentage (7 people) the feeling preference. This ratio is graphed in Figure 4.16. A two-thirds majority with relatively few records (30 managers) is very significant. **Hypothesis PMA-H3 confirmed.**

A comparison to the overall population we can see that the split between the two preferences is nearly balanced (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations). Our results show that project managers clearly prefer the thinking preference and therefore suggests that this preference is quite important by comparing at the total population.

The fourth hypothesis says that project managers are not preferring the judging or the perceiving preference. It assumes that there should be a split between both preferences.

PMA-H4 *There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*

As presented in Figure 4.17 we see that this is not the case. In fact you can even find the strongest trend in all previous preference comparisons (including the members as well as the managers results). 90 percentage (27 people) prefer the judging over the perceiving (10 percentage, 3 people) preference. Even with the small data set of 30 project managers, this trend speaks clearly against the hypothesis. **Hypothesis PMA-H4 disproved.**

The ratio of these preferences in the general population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations) shows that there is a balanced split of the judging and perceiving preference. The result of the case study shows that the project managers clearly prefer the judging over the perceiving preference. Therefore the result can be seen as important because the split between the two preferences differs obviously between the general population and the case study results.

There are a lot of different possible explanations why especially this preference-set was not resulting as expected. During the literature analysis we pointed out that a judging individual is extremely organised and very focused on completing a task. We also pointed out that for a very planned software development process (e.g. Waterfall model) judging and for a agile programming process the perceiving should be preferred. As a result we set up the hypothesis that there should be a split regarding this two preferences. Additionally during the literature analysis we found 6 sources that confirmed this statement and none that disagreed with it.

So one can say the theoretical hypothesis seems not to be wrong on a general level. It is probably depending on the projects and which software development processes they use. This item was not part of this case study so we can't answer that question here but it would be an interesting topic for a future work to work out if these coherence holds true.

The last hypothesis for project managers includes the prediction of the most common types for software project members which should be including the preferences E (extrovert) and T (thinking).

PMA-H5 *The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*

As shown in Figure 4.18 the types ESTP (10 people, 33%) and ENTP (7 people, 23%) are the most used ones. Together there are more than 50 percentage of people preferring these two types than all other types together. The type INTP gained more than 10% (4 people, 13%). The two most common types include the preferences E (extrovert) and T (thinking) which supports the hypothesis. **Hypothesis PMA-H5 confirmed.**

We want to compare the result to the share of types in the overall population (see Table 2.3 for examples of the type distribution of the UK and the U.S. populations). We can see that about ESTP has a share of about 4-6 percentage in the overall population. This result is incredibly meaningful because our result shows that 33 percentage of our tested project managers prefer this type. Also the comparison of the second most-common type during the case study is very meaningful. In the overall population there are about 2-5 percentage of people preferring the ENTP type. The case study resulted in a 23 percentage share for this type.

Combined more than half (56%) of the participated project managers in the case study but only 6-11 percentage of people in the overall population prefer these types. This is a very interesting result which can be interpreted in a way that only 6-11 percentage of people in the population prefer the most common types which project managers prefer.

First, the results of the literature analysis were completely consistent across many different sources with only no contradiction. Second, the theoretical analysis fit nearly perfectly to the literature result. The results of the case study fit, with one exception, quite well to the hypotheses in case of project managers. Table 5.2 summarises the results.

Hypothesis		Status
PMA-H1	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*	Confirmed
PMA-H2	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*	Confirmed
PMA-H3	*There are more software project managers with the T (thinking) than the F (feeling) preference.*	Confirmed
PMA-H4	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*	Disproved
PMA-H5	*The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*	Confirmed

Table 5.2: Confirmed and disproved hypotheses of project managers.

6 Summary and Conclusion

In this chapter we want to recap the proceeding and results. We started by taking a look at the different areas that are needed for this thesis and their theoretical background and basics. We introduced some instruments to identify psychological types and explained why we prefer the MBTI and KTS-II tests for this thesis.

Further we explained the concepts of both theories in detail including the meaning of the different preferences, the groupings, the 16 types, the temperaments and the scientific relevance and criticism of both instruments. We pointed out that there is legitimate criticism on both tools (KTS-II and MBTI) particularly regarding re-testing and the use of these tests for recruiting. But we also pointed out that there is a lot of literature that confirmed the validity and reliability and that it is academically accepted. Further it is important to know that these tools are in everyday use in some of the biggest and most important companies of the world.

In case of "recruiting" we again want to point out that this thesis is not about how to find new employees for a project. It is about measuring if there are more common types in software project teams and if so, what are the reasons for this fact. We want to understand the dynamics regarding the interaction of team members during communication, conflict resolution, building of trust and other critical phases of interactive project teamwork.

Beside the psychometric basics behind the used tests, we also looked at the theories of software project management which included the definition of software project teams, software project members, software project managers and project success.

The setup of the hypotheses was done in three steps. First we made a theoretical analysis which looked at the software project management, MBTI and KTS-II theories. From this we generated 5 hypotheses for both - the project managers as well as for the project members which - in theory - should hold in practice. The second step was the literature analysis which focused on existing literature and their findings and recommendations. We were able to generate again 5 hypotheses for the project managers as well as for the project members. It was noticeable that the literature very much agrees with each other. Only one contradiction could be found. The third step of the questionnaire part was to merge the resulting hypotheses of the theoretical analysis to the resulting hypotheses

PME-H1	*There are more software project members with the I (introvert) than the E (extrovert) preference.*
PME-H2	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*
PME-H3	*There are more software project members with the T (thinking) than the F (feeling) preference.*
PME-H4	*There are more software project members with the J (judging) than the P (perceiving) preference.*
PME-H5	*The most frequently found types of software project members are ISTJ and INTJ.*
PMA-H1	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*
PMA-H2	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*
PMA-H3	*There are more software project managers with the T (thinking) than the F (feeling) preference.*
PMA-H4	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*
PMA-H5	*The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*

Table 6.1: Complete list of all predefined and merged hypotheses for project managers and members which were obtained by the theoretical and literature analysis.

of the literature analysis. The resulting hypotheses sets (theoretical and literature) were very similar, most of them identical. Therefore, the process of merging them together was quite uncomplicated. The resulted hypotheses for both - members (PME-Hx) and managers (PMA-Hx) can be found in Table 6.1.

As we can see in Table 6.1 the hypotheses for project members and managers are quite different. Only two of the five hypotheses match each other (PME-H2 match to PMA-H2 and PME-H3 matches to PMA-H3). This shows that not every project member automatically can become a project manager.

The procedure, the test environment (online and offline testing), the structure and the participants of the case study were discussed in detail. Especially the participants were considered accurate, because there was a need to define some constraints, which included the definition of the project business (only software projects), the definition of how to measure if a project is successful and the proper project team size. Further, we talked about the privacy policy problems and how it was solved by using a Non-Disclosure Agreement (NDA).

There were two versions of the questionnaire - an online and an offline version. During the offline version, which was done with 6 from 14 companies, it was possible to additionally get verbal feedback about the KTS-II and the results of the participants. About 90 to 95 percentage of people agreed to the types they were assigned to. Only one participant said that he had done an MBTI test before. But all participants were very interested in the topic and the results of the study.

Before starting to take a look at the results of the case study, we calculated our self-defined success factor for all project groups. All projects matched the predefined criteria and therefore could be used. In the result analysis we distinguished between project members and managers and walked step by step threw all preferences. It was very interesting that it was mostly a pretty clear result - either a preference was significantly stronger than the other or they were pretty balanced. At the end we also took a look at the overall distribution of the complete KTS-II types.

During the comparison of the findings of the case study to the created hypotheses we didn't only look if the percentages of the case study fit to the hypotheses, we additionally compared the resulted percentages to the share of the respective preference or type to the share in the overall population. We found out that the hypotheses PME-H1, PME-H3, PME-H4, PME-H5, PMA-H3 and PMA-H5 are very meaningful because the respective share deviates significantly from the overall population. PME-H2, PMA-H1 and PMA-H2 seemed not as meaningful as the others because they gained quite the same share as the overall population. And finally PMA-H4 reached the most interesting result because the hypothesis had to be disproved. We also tried to find out why this can be the case and argued that this preference in case of project managers seems to depend very much on the software development process.

Table 6.2 shows the combined results of all hypotheses and if they were confirmed or disproved.

Table 6.2 shows that 9 of 10 hypotheses were proven right. This is a very satisfactory result for the KTS-II and MBTI instruments because it additionally confirms that the tools have a relevance in practice. Otherwise their theoretical foundations as well as the existing theories (that led to the hypotheses) would not fit that well to the results of the case study.

Hypothesis		Status
PME-H1	*There are more software project members with the I (introvert) than the E (extrovert) preference.*	Confirmed
PME-H2	*There are almost as many software project members with the S (sensing) as the N (intuitive) preference.*	Confirmed
PME-H3	*There are more software project members with the T (thinking) than the F (feeling) preference.*	Confirmed
PME-H4	*There are more software project members with the J (judging) than the P (perceiving) preference.*	Confirmed
PME-H5	*The most frequently found types of software project members are ISTJ and INTJ.*	Confirmed
PMA-H1	*There are more software project managers with the E (extrovert) than the I (introvert) preference.*	Confirmed
PMA-H2	*There are almost as many software project managers with the S (sensing) as the N (intuitive) preference.*	Confirmed
PMA-H3	*There are more software project managers with the T (thinking) than the F (feeling) preference.*	Confirmed
PMA-H4	*There are almost as many software project managers with the J (judging) as the P (perceiving) preference.*	Disproved
PMA-H5	*The most frequently found types of software project managers are types including the E (extrovert) and T (thinking) preference.*	Confirmed

Table 6.2: Overview of the confirmed and disproved hypotheses of project managers and project members.

We defined as our main goal to improve the understanding of common personality types within project teams. This understanding can support project leaders doing their work. The interactions in teams is one example which can be more clear for project managers having the knowledge about the personality types in his team. These interactions are for example including all communication happening in the team and conflict resolution if project members have different points of view, and those differences escalate to a conflict.

Understanding and appreciating the various viewpoints involved in a conflict are key factors in its resolution. Often the knowledge about the involved personality types can have an indication on how the conflict was originated, but also as on how it might be solved.

Many managers believe that one of the main keys to the survival of a business is trust. Trust is a critical issue in any type of relationships because a relationship without trust

is not really a relationship at all. [2] The process of building trust in teams can therefore be seen as a very important one, which can be effectively supported by considering the personality types of the employees. If a leader understands how his employees characters work, he can find efficient ways, considering certain characteristics of the respective types, to respond accordingly to get the best possible way e.g. to build trust in the team.

Additionally beside the communication, conflict resolution, and the process of building trust in the team, the understanding of other critical phases of the interactive project team work can improve, if the personality types of the involved people are considered.

Nevertheless we could only cover a specific area of the context between personality and software project teams which means that there is a great potential for further work. Some of these possibilities are summarised in the following chapter.

7 Future Work

In chapter 4.4.1 we talked about the project team size. We focused only on "small" project teams from 5 to 12 people in this work and we argued that much larger projects can not be compared to smaller one's. Especially the project manager types can be very different because project managers of bigger projects tend to focus more on resource allocation than focusing on the product, the result and the people working in the project team. This consideration could be like an extension of this work to verify if larger projects achieve the same results.

Further a comparison between smaller and bigger projects could be done. A research question could be "*Do the personality types of project managers differ from small to big project teams?*".

Another possible work could be the use of a different personality instrument with the same research question as in this work. There are a lot of different tools and some of them are explained in section 2.1. Mostly these instruments are somehow comparable, what further allows to compare the results of the other instrument to the result of this work.

In chapter 5.2 we analysed the results of the case study and compared it to the theoretical hypotheses that were set up during the different analyses. We found one contradiction there. The hypothesis said that the results of the project managers personality between judging and perceiving should be balanced. We pointed this preference is probably depending on the projects and which software development processes are used. But the software development process was not part of this case study so we can not answer that question. This would be an interesting topic for a future work to show if these coherence holds true during a specialised case study.

In chapter 4.5.5 we talked about some additional interesting regularities and irregularities in the group constellations. This was done by using some very simple group analytic tools. This would be a very interesting topic for a future work which could answer research questions about the group constellations. Group analysis like this could be done in various ways and could deliver useful additional information extending the results of this work.

As mentioned in the conclusion (chapter 6) the understanding of the personality types in project teams was our main goal, but we could only cover a specific area. Based on this work, one can make further steps to team analysis regarding how the knowledge of personality types can be used for the project manager and also for project members. As an example Tuckman's group development model could be used for analysing in which stages which advantages and possibilities are available.

Bibliography

References

[1] Mohammad A. Alkandari. *A Model of Multicultural Software Project Team Management applied in Requirements Engineering*. Virginia Polytechnic Institute and State University, 2012.

[2] Clayton Becton, Allen Wysocki, and Karl Kepner. *Building Teamwork and the Importance of Trust in a Business Environment*. University of Florida, IFAS Extension, 2013.

[3] Barry W. Boehm. "Software Project Management: Principles and Examples". In: *IEEE Transactions on Software Engineering* Vol. 15.No. 7 (1989).

[4] George W. Bohlander and Scott Snell. *Managing Human Resources*. Cengage Learning, 2010.

[5] Jeffrey L. Brewer. "Project Managers, Can We Make Them or Just Make Them Better?" In: *SIGITE'05 (ACM)* (2005).

[6] Isabel Briggs and Peter B. Myers. *Gifts Differing: Understanding Personality Type*. 1st ed. ISBN 0-89106-074-X. California: Mountain View, CA: Davies-Black Publishing, 1980.

[7] Alex S. Brown. *Project Management Personality and Skill Types*. 2002. URL: http://www.alexsbrown.com/pmpersskilltypes.html (last accessed: 02/13/2014).

[8] Dr. Maynard Brusman. *Personality Type in Leaders: What Works*. URL: http://www.workingresources.com/professionaleffectivenessarticles/article.nhtml?uid=10003 (last accessed: 02/11/2014).

[9] Wayne J. Camara, Julie S. Nathan, and Antonio E. Puente. "Psychological Test Usage Implications in Professional Psychology.pdf". In: *Professional Psychology: Research and Practice* 31.2 (2000), pp. 141–145.

[10] M. Canning, M. Tuchinsky, and C. Campbell. *Building Effective Teams Duke*. Duke Corporate Education, USA, Dearborn Trade Publishing, 2005.

[11] L. F. Capretz. "Implications of MBTI in Software Engineering Education". In: *SIGCSE Bulletin* 34.4 (2002), pp. 134–137.

[12] L.F. Capretz. “Personality Types in Software Engineering”. In: *International Journal of Human-Computer Studies* 58.2 (2003), pp. 207–214.

[13] Luiz Fernando Capretz and Faheem Ahmed. “Making Sense of Software Development and Personality Types”. In: *IT Workforce IEEE 1520920210* (2010).

[14] Luiz Fernando Capretz and Faheem Ahmed. “Why Do We Need Personality Diversity in Software Engineering?” In: *ACM SIGSOFT Software Engineering Notes* 35.2 (2010).

[15] Melissa Carr et al. *Ashridge MBTI research into distribution of type*. 2nd. Ashridge Business School, 2004.

[16] Carol Craig. *Management and leadership development*. Centre for Confidence and Well-being. URL: http://www.centreforconfidence.co.uk/resources.php?p=cGlkPTMyNw== (last accessed: 02/13/2014).

[17] David P. Darcy and Meng Ma. *Exploring Individual Characteristics and Programming Performance: Implications for Programmer Selection*. Department of Decision and Information Technologies, University of Maryland, College Park, 2005.

[18] Dr. N. Ehsan et al. “Effects of Project Manager’s Competency on Project Success”. In: *78-1-4244-6567-5/10 IEEE* (2010).

[19] Ainslie E. Ellis. “Personality type and learning environments: Two case studies”. In: *Annual Ascilite Conference: Who’s learning? Whose technology?* 23rd (2006), pp. 227–235.

[20] *Estimated Frequencies of the Types in the United States Population*. URL: www.capt.org/mbti-assessment/estimated-frequencies.htm (last accessed: 01/18/2014).

[21] *European Data Supplement*. OPP - Oxford, 2011.

[22] *Even Popular Personality Tests are Controversial*. URL: http://www.psychometric-success.com/personality-tests/personality-tests-popular-tests.htm (last accessed: 01/19/2014).

[23] Ben Foster. *The Best Personality Type for Product Management*. 2011. URL: http://www.pmrant.com/2011/02/the-best-personality-type-for-product-management.html (last accessed: 02/13/2014).

[24] Adrian Furham. *The big five versus the big four: the relationship between the MyersBriggs Type Indicator (MBTI) and NEO-PI five factor model of personality*. Vol. 21. No. 2. Pergamon, 1996.

[25] William L. Gardner and Mark J. Martinko. “Using the Myers-Briggs Type lndica tor to Study Managers: A Literature Review and Research Agenda”. In: *Journal of Management* 22.1 (1996), pp. 45–83.

[26] D. R. Gehring. “Applying traits theory of leadership to project management”. In: *Project Management Journal* 38 (2007), pp. 44–54.

[27] Lewis R. Goldberg. *A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several Five-Factor models*. Ed. by F. De Fruyt I. Mervielde I.J. Deary and F. Ostendorf. Vol. 7. University of Oregon and Oregon Reseach Institute, USA, 1999.

[28] Narashimhaiah Gorla and Yan Wah Lam. *Who Should Work with Whom? Building effective software project teams*. Vol. 47. 6. 2004.

[29] Dr. R. Lance Hogan. *Assessment of Technology Graduate Students' Learning Preference Styles Utilizing the Myers-Briggs Type Indicator*. Journal of Industrial Technology, Volume 25, 2009.

[30] Oliver P. John and Robert R. McCrae. *An Introduction to the Five-Factor Model and Its Applications*. University of California at Berkeley, National Institute on Aging, NIH.

[31] Stanley P. Kowalski and Anatole Krattiger. *Confidentiality Agreements: A Basis for Partnerships*. 2007. ISBN: ISBN 978-1-4243-2026-4.

[32] Desiree C. LeBlanc. *The Relationship Between Information Technology Project Manager Personality Type And Project Success*. ProQuest, University of Phoenix, 2008.

[33] James P. Lewis. *Project Planning, Scheduling & Control*. ISBN 978-0-07-146037-8. McGraw Hill, 2005.

[34] Pamela Ludford and Loren Terveen. *Does an Individual's Myers-Briggs Type Indicator Preference Influence Task-Oriented Technology Use?* University of Minnesota, Department of Computer Science and Engineering, 2007.

[35] Daniel Varona Luiz et al. *Evolution of Software Engineers' Personality Profile*. Vol. 37. 1. 2102, pp. 1–5.

[36] Carolyn Mair, Miriam Martincova, and Martin Shepperd. *An Empirical Study of Software Project Managers Using a Case-Based Reasoner*. 45th Hawaii International Conference on System Sciences, 2012.

[37] Steve McConnell. *After the Gold Rush: Creating a True Profession of Software Engineering*. 1999.

[38] Patrick McGuire. *The New Paradigm For Qualifying Project Managers*. SURREX Project Solutions, 2007.

[39] *Myers-Briggs Type Indicator® Interpretive Report*. CPP, Inc., 2009.

[40] George A. Neal and Jan G. Neal. *Assessment of Keirsey Personality Temperaments among Aerospace Electronics Students*.

[41] Miriam Neubauer and Khairi Fortt. *How MBTI types are represented in team and individual sports and which leadership styles work best respectively*. 2013. URL: http://www.strikingly.com/mbti-in-sports-leadership.

[42] *Official Kersey Webpage*. URL: www.kersey.com (last accessed: 01/19/2014).

[43] Mazni Omar, Sharifah-Lailee Syed-Abdullah, and Naimah Mohd Hussin. *Analyzing Personality Types to Predict Team Performance*. 2010, pp. 624–628.

[44] Stefan Peim. *Datenschutz und Datensicherheit werden für Firmen immer wichtiger*. Allgemeine Zeitung, 2013. URL: http://www.az.com.na/ratgeber-technik-kommunikation/datenschutz-und-datensicherheit-werden-f-r-firmen-immer-wichtiger (last accessed: 03/06/2014).

[45] Deidre M. Pettinga and Jerry Flatto. *Using personality profiling to create project teams*. 2010, 12ff.

[46] Dallas K. Cecil Ph.D. *Personality Types of IT Professors*. Capella University.

[47] Neil R. Abramson Ph.D. "Internal Reliability of the Keirsey Temperament Sorter II Cross-National Application to American, Canadian, and Korean Samples". In: *Journal of Psychological Type* (2010).

[48] Rushton J. Philippe and Irwing Paul. *A general factor of personality in the Comrey Personality Scales, the Minnesota Multiphasic Personality Inventory-2, and the Multicultural Personality Questionnaire*. Vol. 46. 2009.

[49] Maria Popova. *Subway Personality: The MBTI Map*. 2009. URL: http://www.brainpickings.org/index.php/2009/08/10/mbti-map/ (last accessed: 01/22/2014).

[50] David V. Radack. *Understanding Confidentiality Agreements*. Vol. 46. 5. 1994, pp. 68–69.

[51] Stephen Robbins and Timothy A. Judge. *Organizational Behavior*. 12th. New Jersey: Pearson Prentice Hall, 2007.

[52] Stephen Rushton, Jackson Morgan, and Michael Richard. *Teachers Myers-Briggs personality profiles: Identifying effective teacher personality traits*. ScienceDirect, 2007.

[53] Karl F. Schuessler and Donald R. Cressey. *Personality Characteristics of Criminals*. Vol. 55. 5. American Journal of Sociology, 1950.

[54] Abe Seiya et al. *Estimation of Project Success Using Bayesian Classifier*. ACM 1-59593-085-X/06/0005. CSE'06, 2006.

[55] Siu-Tsen Shen et al. *Using personality type differences to form engineering design teams*. Vol. 2. 2007, pp. 54–68.

[56] Andrew Stellman and Jennifer Greene. *Applied Software Project Management*. ISBN 978-0-596-00948-9. O'Reilly Media, 2005.

[57] Flannes Steven and Levin Ginger. *Essential people skills for project managers*. Management Concepts Inc, 2005.

[58] Mary Sumner and Judith Molka-Danielsen. *Global IT Teams and Project Success*. SIGMIS-CPR'10, 2010.

[59] G.J. Teague. *Personality Type, Career Preference and Implications for Computer Science Recruitment and Teaching*. 1998, pp. 155–163.

[60] *The MBTI Map - Visualization of Personality Relation*. Integrated Design Laboratory, AJOU University.

[61] Joe R. Thompson. *Overview of Confidentiality Agreement*. Iowa State University - Extension and Outreach, 2013.

[62] Personality Types and Software Engineers. *L.T. Hardiman*. Vol. 30. 10. 1997.

[63] Danielle Urban. *Protecting employee data: it's a priority for companies with international operations*. Fisher & Phillips LLP, 2013. URL: http://www.lexology.com/library/detail.aspx?g=291527d0-1347-47fc-81ff-84a14144c868 (last accessed: 03/06/2014).

[64] Annette Vincent and Dianne Ross. *Personalize training: determine learning styles, personality types and multiple intelligences online*. Vol. Volume 8. Number 1. MCB University Press, 2001.

[65] Kathy Britain White. *An investigation of task team structure and its impact on productivity*. University of North Carolina, Greensboro, 1984.

[66] Douglass J. Wilde. *TEAMOLOGY: The Construction and Organization of Effective Teams*. Design Division, Mecanical Engineering Standford University, 2007.

[67] Maria Winkler. *Datenschutz in Unternehmen Eine Anleitung für die Umsetzung*. 2/2011. 2011, pp. 104–108.

A Appendix

A.1 Used Non-Disclosure Agreement (NDA)

Unliteral Non Disclosure Agreement

DATE: _____

PARTIES:

(1) _____, a company incorporated in _____ having its registered office at _____ (the "**Disclosor**") and

(2) Andreas Aigner, a student of the Technical University of Vienna incorporated in Austria, 2103 Langenzersdorf, Bahnboden 37 (the "**Recipient**").

AGREEMENT:

1. Definitions

In this Agreement:

"**Agreement**" means this non disclosure agreement and any amendments to it from time to time;

"**Confidential Information**" means:

(a) any information disclosed by the Disclosor to the Recipient before the end of the Term (whether disclosed in writing, orally or otherwise) that at the time of disclosure: (i) was marked as "confidential"; or (ii) should have been reasonably understood by the Recipient to be confidential; and

(b) especially the companies name and collected personal data during the MBTI/KTS-II questionnaire. Only the
-) resulting personal types,
-) the number of participated people
-) the number of interviewed departments and
-) the industry as well as the homeland of the company are
not included as "confidential information". That means that these data can be used anonymously, e.g. "*A company working on SAP projects in Austria*".

"**Term**" means the term of this Agreement.

2. Term

This Agreement will come into force on the date of its execution and will continue in force indefinitely, unless and until terminated in accordance with Clause [4].

3. Confidentiality obligations

3.1 The Recipient agrees and undertakes:

(a) that it will keep all Confidential Information strictly confidential and will not disclose any part of it to any other person without the Disclosor's prior written consent;

(b) that it will use the same degree of care to protect the Confidential Information as it uses to protect its own confidential information of a similar nature, being at least a reasonable degree of care; and

(c) that it will act in good faith at all times in relation to the Confidential Information.

3.2 Notwithstanding Clause [3.1(a)], the Recipient may disclose the Confidential Information to its officers and employees who are bound by a written agreement to protect the confidentiality of the Confidential Information.

3.3 This Clause [3] imposes no obligations upon the Recipient with respect to Confidential Information which:

(a) is known to the Recipient before disclosure by the Disclosor, and is not subject to any obligation of confidentiality; or

(b) is or becomes publicly known through no act or default on the part of the Recipient.

3.4 The restrictions in this Clause [3] do not apply to the extent that any Confidential Information is required to be disclosed by any law or regulation, or judicial or governmental request or order.

4. Termination

4.1 Either party may terminate this Agreement forthwith at any time by giving written notice of termination to the other party.

4.2 Upon and following termination of this Agreement:

(a) Clause [5.3] shall continue to apply; and

(b) the provisions of Clause [3] shall continue to apply in relation to Confidential Information disclosed before the end of the Term.

4.3 Termination of this Agreement will not affect either party's accrued rights as at the date of termination.

4.4 Subject to Clauses [4.2] and [4.3], upon termination, all the provisions of this Agreement will cease to have effect.

5. General

5.1 If a Clause of this Agreement is determined by any court or other competent authority to be unlawful and/or unenforceable, the other Clauses of this Agreement will continue in effect.

5.2 This Agreement may not be varied except by a written document signed by or on behalf of each of the parties.

5.3 Neither party may without the prior written consent of the other party assign, transfer, charge, license or otherwise dispose of or deal in this Agreement or any rights or obligations under this Agreement.

5.4 This Agreement is made for the benefit of the parties, and is not intended to benefit any third party or be enforceable by any third party. The rights of the parties to terminate, rescind, or agree any amendment, waiver, variation or settlement under or relating to this Agreement are not subject to the consent of any third party.

5.5 Nothing in this Agreement shall exclude or limit any liability of a party for fraud or fraudulent misrepresentation, or any other liability which may not be excluded or limited under applicable law. Subject to this, this Agreement constitutes the entire agreement between the parties in relation to the subject matter of this Agreement, and supersedes all previous agreements, arrangements and understandings between the parties in respect of that subject matter.

5.6 This Agreement will be governed by and construed in accordance with the laws of England; and the courts of England will have exclusive jurisdiction to adjudicate any dispute arising under or in connection with this Agreement.

The parties have indicated their acceptance of this Agreement by executing it below.

EXECUTION:

SIGNED by _____
duly authorised for and on behalf
of the Disclosor

.....

Date: _____

SIGNED by
AIGNER Andreas
the Recipient

.....

Date: _____

A.2 Questionnaire for Project Employee's

[1] General Data

Company: _____

Project/Department: _____

Job: ( ) Project Manager ( ) Software Tester
( ) Software Developer ( ) Another: _____
( ) System Architect
( ) Database Developer

Working time in hours / week: _____

Employee in the company since the year: _____

Estimate the project success of your team on a scale of 0 (not successful) to 10 (very successfully): _____

How comfortable do you feel in your project team on a scale of 0 (uncomfortable) to 10 (very well): _____

By completing this questionnaire you agree that your data will be used in an anonymous way in the thesis "***Measuring Personality Types in Software Project Teams***" at the Technical University of Vienna. Thank you and your company for your participation in the study!

[2] Questionnaire Keirsey Temperament Sorter II

Please select option (a) or (b) for each question/statement and cross your option clearly to be able to fill the answer sheet afterwards. There are no right or wrong answers - just choose what feels best for you. At the end of the test you can find the answer sheet where you can evaluate the test and find out your personal KTS-II type.

Please do not think too long about the questions or answers, just answer in a way you would behave in an usual situation. Do not think of any special situations. The goal is to understand yourself and your behaviour and not, for example, how to behave in a way others would think you do.

1. When the phone rings do you
a. hurry to get to it first
b. hope someone will answer

2. Are you more
a. observant than introspective
b. introspective than observant

3.Is it worse to
a. have your head in the clouds
b. be in a rut

4. With people are you usually more
a. firm than gentle
b. gentle than firm

5. Are you more comfortable in making
a. critical judgments
b. value judgments

6. Is clutter in the workplace something you
a. take time to straighten up
b. tolerate pretty well

7. Is it your way to
a. make up your mind quickly
b. pick an choose at some length

8. Waiting in line, do you often
a. chat with others
b. b. stick to business

9. Are you more
a. sensible than ideational
b. ideational than sensible

10. Are you more interested in
a. what is actual
b. what is possible

11. In making up your mind are you more likely
a. to go by data
b. to go by desires

12. In sizing up others do you tend to be
a. objective and impersonal
b. friendly and personal

13. Do you prefer contracts to be
a. signed, sealed, and delivered
b. settled on a handshake

14. Are you more satisfied having
a. a finished product
b. work in progress

15. At a party, do you
a. interact with many, even strangers
b. interact with a few friends

16. Do you tend to be more
a. factual than speculative
b. speculative than factual

17. Do you like writers who
a. say what they mean
b. use metaphors and symbolism

18. Which appeals to you more:
a. consistency of thought
b. harmonious relationships

19. If you must disappoint someone are you
a. usually frank and straightforward
b. warm and considerate

20. On the job do you want your activities
a. scheduled
b. unscheduled

21. Do you more often prefer
a. final, unalterable statements
b. tentative, preliminary statements

22. Does interacting with strangers
a. energize you
b. tax your reserves

23. Facts
a. speak for themselves
b. illustrate principles

24. Do you find visionaries and theorists
a. somewhat annoying
b. rather fascinating

25. In a heated discussion, do you
a. stick to your guns
b. look for common ground

26. Is it better to be
a. Just
b. merciful

27. At work, is it more natural for you to
a. point out mistakes
b. try to please others

28. Are you more comfortable
a. after a decision
b. before a decision

29. Do you tend to
a. say right out what's on your mind
b. keep your ears open

30. Common sense is
a. usually reliable
b. frequently questionable

31. Children often do not
a. make themselves useful enough
b. exercise their fantasy enough

32. When in charge of others do you tend to be
a. firm and unbending
b. forgiving and lenient

33. Are you more often
a. a cool-headed person
b. a warm-hearted person

34. Are you prone to
a. nailing things down
b. exploring the possibilities

35. In most situations are you more
a. deliberate than spontaneous
b. spontaneous than deliberate

36. Do you think of yourself as
a. an outgoing person
b. a private person

37. Are you more frequently
a. a practical sort of person
b. a fanciful sort of person

38. Do you speak more in
a. particulars than generalities
b. generalities than particular

39. Which is more of a compliment:
a. "There's a logical person"
b. "There's a sentimental person"

40. Which rules you more
a. your thoughts
b. your feelings

41. When finishing a job, do you like to
a. tie up all the loose ends
b. move on to something else

42. Do you prefer to work
a. to deadlines
b. just whenever

43. Are you the kind of person who
a. is rather talkative
b. doesn't miss much

44. Are you inclined to take what is said
a. more literally
b. more figuratively

45. Do you more often see
a. what's right in front of you
b. what can only be imagined

46. Is it worse to be
a. softy
b. hard-nosed

47. In trying circumstances are you sometimes
a. too unsympathetic
b. too sympathetic

48. Do you tend to choose
a. rather carefully
b. somewhat impulsively

49. Are you inclined to be more
a. hurried than leisurely
b. leisurely than hurried

50. At work do you tend to
a. be sociable with your colleagues
b. keep more to yourself

51. Are you more likely to trust
a. your experiences
b. your conceptions

52. Are you more inclined to feel
a. down to earth
b. somewhat removed

53. Do you think of yourself as a
a. tough-minded person
b. tender-hearted person

54. Do you value in yourself more that you are
a. reasonable
b. devoted

55. Do you usually want things
a. settled and decided
b. just penciled in

56. Would you say you are more
a. serious and determined
b. easy going

57. Do you consider yourself
a. a good conversationalist
b. a good listener

58. Do you prize in yourself
a. a strong hold on reality
b. a vivid imagination

59. Are you drawn more to
a. fundamentals
b. overtones

60. Which seems the greater fault
a. to be too compassionate
b. to be too dispassionate

61. Are you swayed more by
a. convincing evidence
b. a touching appeal

62. Do you feel better about
a. coming to closure
b. keeping your options open

63. Is it preferable mostly to
a. make sure things are arranged
b. just let things happen naturally

64. Are you inclined to be
a. easy to approach
b. somewhat reserved

65. In stories do you prefer
a. action and adventure
b. fantasy and heroism

66. Is it easier for you to
a. put others to good use
b. identify with others

67. Which do you wish more for yourself:
a. strength of will
b. strength of emotion

68. Do you see yourself as basically
a. thick-skinned
b. thin-skinned

69. Do you tend to notice
a. disorderliness
b. opportunities for change

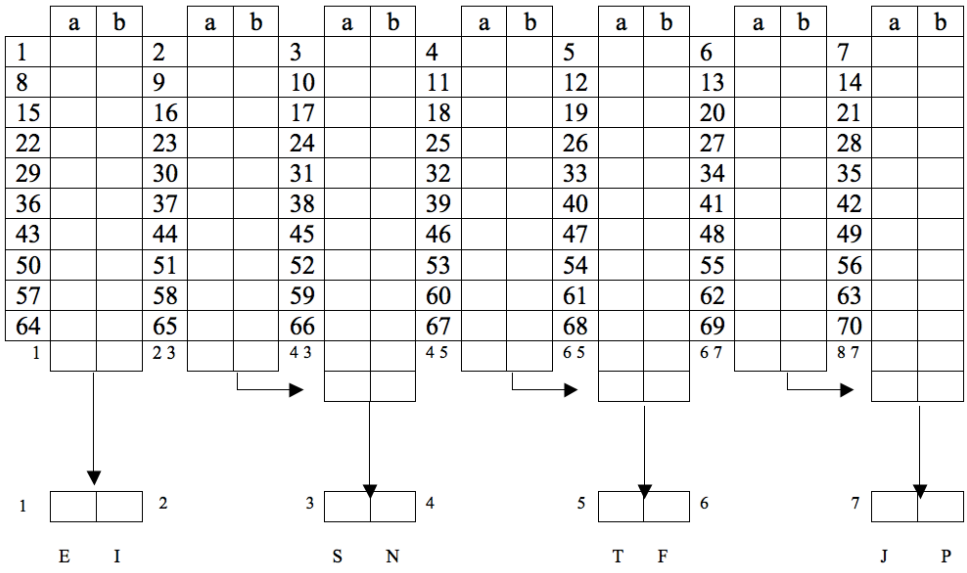
70. Are you more
a. routinized than whimsical
b. whimsical than routinized

[3] Evaluation

I. Add down so that the total number of a answers is written in the box at the bottom of each column. Do the same for the b answers you have checked. Each of the 14 boxes should have a number it.

II. Transfer the number in box #1 of the answer grid to box #1 below the answer grid. Do this for box # 2 as well. Note, however, that you have two numbers for boxes 3 through 8. Bring down the first number for each box beneath the second, as indicated by the arrows. Now add all the pairs of numbers and enter the total in the boxes below the answer grid, so each box has only one number.

III. Now you have four pairs of numbers. Circle the letter below the larger numbers of each pair. If the two numbers of any pair are equal, then circle neither, but put a large X below them and circle it.



Your Type: _____

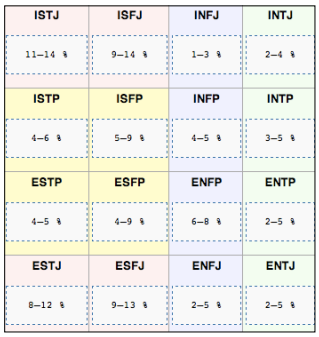
(e.g. ESFP, ISTJ, ENFP, INFP,...)

[4] Making Sense of your Results

You have now identified your MBTI type. Following you can find a brief description of each type. On the Internet you can find far more details on the different types and your specific type.

Type-Overview Frequency of types

SP [Artisans]			
ESTP [Promoter]	ISTP [Operator]	ESFP [Performer]	ISFP [Composer]
SF [Guardian]			
ESTJ [Supervisor]	ISTJ [Inspector]	ESFJ [Provider]	ISFJ [Protector]
NF [Idealist]			
ENFJ [Teacher]	INFJ [Counsellor]	ENFP [Champion]	INFP [Healer]
NT [Rational]			
ENTJ [Fieldmarshal]	INTJ [Mastermind]	ENTP [Inventor]	INTP [Architect]



The Sixteen Types at a Glance

By Charles Martin, Ph.D. (http://www.capt.org/mbti-assessment/type-descriptions.htm)

ISTJ

For ISTJs the dominant quality in their lives is an abiding sense of responsibility for doing what needs to be done in the here-and-now. Their realism, organizing abilities, and command of the facts lead to their completing tasks thoroughly and with great attention to detail. Logical pragmatists at heart, ISTJs make decisions based on their experience and with an eye to efficiency in all things. ISTJs are intensely committed to people and to the organizations of which they are a part; they take their work seriously and believe others should do so as well.

ISFJ

For ISFJs the dominant quality in their lives is an abiding respect and sense of personal responsibility for doing what needs to be done in the here-and-now. Actions that are of practical help to others are of particular importance to ISFJs. Their realism, organizing abilities, and command of the facts lead to their thorough attention in completing tasks. ISFJs bring an aura of quiet warmth, caring, and dependability to all that they do; they take their work seriously and believe others should do so as well.

INFJ

For INFJs the dominant quality in their lives is their attention to the inner world of possibilities, ideas, and symbols. Knowing by way of insight is paramount for INFJs, and they often manifest a deep concern for people and relationships as well. INFJs often have deep interests in creative expression as well as issues of spirituality and human development. While the energy and attention of INFJs are naturally drawn to the inner world of ideas and insights, what people often first encounter with INFJs is their drive for closure and for the application of their ideas to people's concerns.

INTJ

For INTJs the dominant force in their lives is their attention to the inner world of possibilities, symbols, abstractions, images, and thoughts. Insight in conjunction with logical analysis is the essence of their approach to the world; they think systemically. Ideas are the substance of life for INTJs and they have a driving need to understand, to know, and to demonstrate competence in their areas of interest. INTJs inherently trust their insights, and with their task-orientation will work intensely to make their visions into realities.

ISTP

For ISTPs the driving force in their lives is to understand how things and phenomena in the real world work so they can make the best and most effective use of them. ISTPs are logical and realistic people, and they are natural troubleshooters. When not actively solving a problem, ISTPs are quiet and analytical observers of their environment, and they naturally look for the underlying sense to any facts they have gathered. ISTPs do often pursue variety and even excitement in their hands-on experiences. Although they do have a spontaneous, even playful side, what people often first encounter with them is their detached pragmatism.

ISFP

For ISFPs the dominant quality in their lives is a deep-felt caring for living things, combined with a quietly playful and sometimes adventurous approach to life and all its experiences. ISFPs typically show their caring in very practical ways, since they often prefer action to words. Their warmth and concern are generally not expressed openly, and what people often first encounter with ISFPs is their quiet adaptability, realism, and "free spirit" spontaneity.

INFP

For INFPs the dominant quality in their lives is a deep-felt caring and idealism about people. They experience this intense caring most often in their relationships with others, but they may also experience it around ideas, projects, or any involvement they see as important. INFPs are often skilled communicators, and they are naturally drawn to ideas that embody a concern for human potential. INFPs live in the inner world of values and ideals, but what people often first encounter with the INFP in the outer world is their adaptability and concern for possibilities.

INTP

For INTPs the driving force in their lives is to understand whatever phenomenon is the focus of their attention. They want to make sense of the world -- as a concept -- and they often enjoy opportunities to be creative. INTPs are logical, analytical, and detached in their approach to the world; they naturally question and critique ideas and events as they strive for understanding. INTPs usually have little need to control the outer world, or to bring order to it, and they often appear very flexible and adaptable in their lifestyle.

ESTP

For ESTPs the dominant quality in their lives is their enthusiastic attention to the outer world of hands-on and real-life experiences. ESTPs are excited by continuous involvement in new activities and in the pursuit of new challenges. ESTPs tend to be logical and analytical in their approach to life, and they have an acute sense of how objects, events, and people in the world work. ESTPs are typically energetic and adaptable realists, who prefer to experience and accept life rather than to judge or organize it.

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ESFP

For ESFPs the dominant quality in their lives is their enthusiastic attention to the outer world of hands-on and real-life experiences. ESFPs are excited by continuous involvement in new activities and new relationships. ESFPs also have a deep concern for people, and they show their caring in warm and pragmatic gestures of helping. ESFPs are typically energetic and adaptable realists, who prefer to experience and accept life rather than to judge or organize it.

ENFP

For ENFPs the dominant quality in their lives is their attention to the outer world of possibilities; they are excited by continuous involvement in anything new, whether it be new ideas, new people, or new activities. Though ENFPs thrive on what is possible and what is new, they also experience a deep concern for people as well. Thus, they are especially interested in possibilities for people. ENFPs are typically energetic, enthusiastic people who lead spontaneous and adaptable lives.

ENTP

For ENTPs the driving quality in their lives is their attention to the outer world of possibilities; they are excited by continuous involvement in anything new, whether it be new ideas, new people, or new activities. They look for patterns and meaning in the world, and they often have a deep need to analyze, to understand, and to know the nature of things. ENTPs are typically energetic, enthusiastic people who lead spontaneous and adaptable lives.

ESTJ

For ESTJs the driving force in their lives is their need to analyze and bring into logical order the outer world of events, people, and things. ESTJs like to organize anything that comes into their domain, and they will work energetically to complete tasks so they can quickly move from one to the next. Sensing orients their thinking to current facts and realities, and thus gives their thinking a pragmatic quality. ESTJs take their responsibilities seriously and believe others should do so as well.

ESFJ

For ESFJs the dominant quality in their lives is an active and intense caring about people and a strong desire to bring harmony into their relationships. ESFJs bring an aura of warmth to all that they do, and they naturally move into action to help others, to organize the world around them, and to get things done. Sensing orients their feeling to current facts and realities, and thus gives their feeling a hands-on pragmatic quality. ESFJs take their work seriously and believe others should as well.

ENFJ

For ENFJs the dominant quality in their lives is an active and intense caring about people and a strong desire to bring harmony into their relationships. ENFJs are openly expressive and empathic people who bring an aura of warmth to all that they do. Intuition orients their feeling to the new and to the possible, thus ENFJs often enjoy working to manifest a humanitarian vision, or helping others develop their potential. ENFJs naturally and conscientiously move into action to care for others, to organize the world around them, and to get things done.

ENTJ

For ENTJs the driving force in their lives is their need to analyze and bring into logical order the outer world of events, people, and things. ENTJs are natural leaders who build conceptual models that serve as plans for strategic action. Intuition orients their thinking to the future, and gives their thinking an abstract quality. ENTJs will actively pursue and direct others in the pursuit of goals they have set, and they prefer a world that is structured and organized.

A.3 Additional Questionnaire-Sheet for Managers

Manager Questionnaire - Assessment of Project Success

Name of **Company**:	
Name of **Project Group**:	
How would you assess **compliance** and **timeliness** of dates and milestones in this project group?	Rating scale of [0] no date could be adhered to [10] all deadlines have been met
How would you assess the compliance with the budgeted **costs** in the project group?	Rating scale of [0] the costs are far exceeded to [10] the costs are kept to the point
How would you assess the **satisfaction** of your **employees** the project group?	Rating scale of [0] very dissatisfied to [10] very satisfied
How would you assess the **satisfaction** of your **customers** the project group?	Rating scale of [0] very dissatisfied to [10] very satisfied
How would you rate the **quality** of the project results?	Rating scale of [0] low quality to [10] very high quality
All set objectives of this project group were reached at the right time, in the previously defined quality and with a hight customer satisfaction.	Rating scale of [0] does not agree to [10] agree absolutely

By completing this questionnaire you agree that your data will be used in an anonymous way in the thesis "***Measuring Personality Types in Software Project Teams***" at the Technical University of Vienna. Thank you and your company for your participation in the study!

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A.4 Raw Data Companies

Company ID	Development Area	Country	Questionnaire Type
1	SAP	Austria	Online
2	System	Austria	Offline
3	App	Austria	Offline
4	System	Austria	Offline
5	App	Germany	Online
6	Software	Switzerland	Online
7	Software	Germany	Online
8	Web	Germany	Online
9	Web & App	Germany	Online
10	Banking & Payment	Switzerland	Online
11	Software	Austria	Offline
12	Measurement-Software	Austria	Online
13	Web & App	Austria	Offline
14	Software	Austria	Offline

A.5 Raw Data KTS-II Test Results

ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
1	1	1.1	Manager	9	8	ENTP
2	1	1.1	Member	10	10	ISTJ
3	1	1.1	Member	9	8	ISTJ
4	1	1.1	Member	9	10	ENTJ
5	1	1.1	Member	8	10	ISTJ
6	1	1.1	Member	7	9	ISTP
7	1	1.1	Member	9	10	ISTJ
8	1	1.1	Member	8	7	INTJ
9	1	1.1	Member	10	9	ISTP
10	1	1.1	Member	8	7	INTJ
11	1	1.2	Manager	9	8	ESTP
12	1	1.2	Member	8	9	ISFP
13	1	1.2	Member	10	10	ISTJ
14	1	1.2	Member	8	9	INTJ
15	1	1.2	Member	8	10	INTJ
16	1	1.2	Member	9	10	ISTP
17	1	1.2	Member	9	10	ISFJ
18	1	1.2	Member	8	8	INTP
19	1	1.3	Manager	8	10	ENTP
20	1	1.3	Member	9	9	ISFJ
21	1	1.3	Member	8	10	ESTP
22	1	1.3	Member	8	8	INTJ
23	1	1.3	Member	9	9	ISTJ
24	1	1.3	Member	9	10	ISTJ
25	1	1.3	Member	10	8	ISTJ
26	1	1.3	Member	8	8	ISTP
27	1	1.3	Member	10	10	INTJ
28	1	1.3	Member	10	9	ISTJ
29	1	1.3	Member	10	10	INTJ
30	2	2.1	Manager	10	10	ISFJ
31	2	2.1	Member	10	10	ESTJ
32	2	2.1	Member	6	8	ESFJ
33	2	2.1	Member	7	9	INTP
34	2	2.1	Member	8	9	ISTJ
35	2	2.1	Member	7	10	INFP
36	2	2.2	Manager	9	8	ENTP
37	2	2.2	Member	8	9	ISTP
38	2	2.2	Member	9	8	INTJ
39	2	2.2	Member	9	10	INTJ
40	2	2.2	Member	10	9	ISTJ
41	2	2.2	Member	9	10	ENTJ
42	2	2.2	Member	9	7	INTJ
43	2	2.2	Member	7	9	ISTJ
44	2	3.1	Manager	10	10	INFP
45	3	3.1	Member	9	9	ISTJ
46	3	3.1	Member	7	9	INTJ
47	3	3.1	Member	10	8	ISTP
48	3	3.1	Member	10	9	ESFJ

ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
122	8	8.2	Member	7	10	ISTP
123	8	8.2	Member	9	6	ISTJ
124	8	8.2	Member	6	8	INTJ
125	8	8.2	Member	7	7	ISTJ
126	8	8.2	Member	7	9	ISTJ
127	8	8.2	Member	6	9	INFJ
128	8	8.2	Member	6	8	INFJ
129	9	9.1	Manager	9	7	ESFP
130	9	9.1	Member	9	8	ISTP
131	9	9.1	Member	9	8	ESTJ
132	9	9.1	Member	7	7	ISTJ
133	9	9.1	Member	9	10	ISTP
134	9	9.1	Member	10	10	ISTJ
135	9	9.1	Member	9	10	ISTJ
136	9	9.1	Member	9	10	ISFJ
137	9	9.1	Member	10	9	INTJ
138	9	9.2	Manager	7	8	ESTP
139	9	9.2	Member	9	10	ISTP
140	9	9.2	Member	6	8	INTJ
141	9	9.2	Member	9	8	ISTP
142	9	9.2	Member	7	9	INTJ
143	9	9.2	Member	10	9	INTJ
144	9	9.2	Member	7	9	ISTJ
145	9	9.2	Member	6	9	INTJ
146	9	9.2	Member	6	9	ISTJ
147	9	9.2	Member	6	8	ISFP
148	9	9.2	Member	6	8	INTP
149	9	9.3	Manager	10	8	INTP
150	9	9.3	Member	9	10	ISTJ
151	9	9.3	Member	6	9	INTJ
152	9	9.3	Member	9	8	ISTJ
153	9	9.3	Member	9	10	INTJ
154	9	9.3	Member	10	8	ENTJ
155	9	9.4	Manager	9	7	ESTP
156	9	9.4	Member	7	10	ISTP
157	9	9.4	Member	9	10	ISTJ
158	9	9.4	Member	9	10	ISFJ
159	9	9.4	Member	6	8	INTJ
160	9	9.4	Member	7	8	ISTJ
161	9	9.4	Member	10	10	ISTJ
162	9	9.4	Member	6	9	INTJ
163	9	9.4	Member	6	8	ENTJ
164	9	9.4	Member	6	8	INTP
165	9	9.4	Member	10	8	ENTJ
166	9	9.5	Manager	9	9	INTP
167	9	9.5	Member	9	8	ISTP
168	9	9.5	Member	7	10	ISTP
169	9	9.5	Member	8	10	ISTP

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ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
49	4	4.1	Manager	9	9	ESFP
50	4	4.1	Member	7	8	ISTJ
51	4	4.1	Member	5	10	ESFJ
52	4	4.1	Member	10	10	ISTJ
53	4	4.1	Member	10	10	INTJ
54	4	4.1	Member	9	10	ISTP
55	4	4.1	Member	9	10	ISTJ
56	4	4.1	Member	10	10	ISTJ
57	4	4.1	Member	9	8	INFJ
58	4	4.1	Member	7	8	ISTJ
59	4	4.2	Manager	10	9	INTJ
60	4	4.2	Member	8	8	ISTJ
61	4	4.2	Member	10	10	ENFP
62	4	4.2	Member	7	8	ISTJ
63	4	4.2	Member	10	8	INTJ
64	4	4.2	Member	9	6	ISTJ
65	4	4.2	Member	10	9	INTJ
66	4	4.2	Member	10	8	INTJ
67	4	4.3	Manager	10	9	ENTP
68	4	4.3	Member	9	10	ISFJ
69	4	4.3	Member	10	10	ESTJ
70	4	4.3	Member	9	8	INFJ
71	4	4.3	Member	9	10	ESTP
72	4	4.3	Member	9	10	ISTP
73	4	4.3	Member	10	9	INTJ
74	4	4.3	Member	7	8	ISTJ
75	4	4.3	Member	10	8	ENTJ
76	5	5.1	Manager	7	8	ISTP
77	5	5.1	Member	6	8	INTJ
78	5	5.1	Member	8	10	ISTP
79	5	5.1	Member	9	10	ISTJ
80	5	5.1	Member	9	10	ESTJ
81	5	5.1	Member	7	8	ISTJ
82	5	5.1	Member	6	9	INTJ
83	6	6.1	Manager	8	9	INFP
84	6	6.1	Member	9	8	ISTP
85	6	6.1	Member	7	10	ISTP
86	6	6.1	Member	10	9	INTJ
87	6	6.1	Member	6	8	ENTJ
88	6	6.1	Member	10	8	INTJ
89	6	6.2	Manager	7	8	ESTP
90	6	6.2	Member	8	10	ISTP
91	6	6.2	Member	9	10	ISTJ
92	6	6.2	Member	9	10	ESTJ
93	6	6.2	Member	6	8	INTP
94	6	6.3	Manager	9	8	ENFP
95	6	6.3	Member	9	10	ISFJ
96	6	6.3	Member	9	10	ISTP

ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
170	9	9.5	Member	9	10	ISTJ
171	9	9.5	Member	10	9	INTJ
172	9	9.5	Member	6	8	INTJ
173	9	9.5	Member	6	8	INTJ
174	10	10.1	Manager	10	9	ESTP
175	10	10.1	Member	9	8	ISTJ
176	10	10.1	Member	9	8	ISFP
177	10	10.1	Member	9	8	ISTJ
178	10	10.1	Member	10	9	INTJ
179	10	10.1	Member	7	9	INTJ
180	10	10.2	Manager	8	8	ESTP
181	10	10.2	Member	6	8	INTP
182	10	10.2	Member	9	10	INTJ
183	10	10.2	Member	9	8	ISTP
184	10	10.2	Member	10	10	INTP
185	10	10.2	Member	7	9	INTJ
186	10	10.2	Member	7	9	ISTJ
187	11	11.1	Manager	10	9	INTP
188	11	11.1	Member	9	10	INTP
189	11	11.1	Member	10	10	ISTJ
190	11	11.1	Member	9	10	ISFJ
191	11	11.1	Member	7	10	INTP
192	11	11.1	Member	10	9	INTJ
193	11	11.1	Member	6	9	INTJ
194	11	11.1	Member	9	8	ISTJ
195	11	11.1	Member	6	9	INTJ
196	11	11.1	Member	6	8	INFJ
197	11	11.1	Member	6	8	INTJ
198	11	11.2	Manager	10	9	ESTP
199	11	11.2	Member	7	7	ISTJ
200	11	11.2	Member	6	8	INTP
201	11	11.2	Member	9	8	INTJ
202	11	11.2	Member	9	8	ISTP
203	11	11.2	Member	6	8	INTJ
204	12	12.1	Manager	9	8	ENTP
205	12	12.1	Member	9	10	INTJ
206	12	12.1	Member	9	10	INTP
207	12	12.1	Member	10	10	INTJ
208	12	12.1	Member	7	9	ISTJ
209	12	12.1	Member	6	9	INTP
210	12	12.1	Member	6	8	INTJ
211	13	13.1	Manager	10	9	INTP
212	13	13.1	Member	9	8	ISTJ
213	13	13.1	Member	9	10	INTJ
214	13	13.1	Member	6	8	INTJ
215	13	13.1	Member	9	8	ISTP
216	13	13.1	Member	10	10	INTJ
217	13	13.1	Member	9	10	INTP

ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
97	6	6.3	Member	10	10	ISTJ
98	6	6.3	Member	10	10	ISTJ
99	6	6.3	Member	10	8	ENTJ
100	7	7.1	Manager	10	9	ESTP
101	7	7.1	Member	9	8	ESTJ
102	7	7.1	Member	9	8	ISTP
103	7	7.1	Member	7	10	ISTP
104	7	7.1	Member	9	10	ISTJ
105	7	7.1	Member	7	9	INTJ
106	7	7.1	Member	10	8	INTJ
107	7	7.1	Member	6	8	INTJ
108	7	7.1	Member	10	8	ENTJ
109	8	8.1	Manager	8	7	ISFJ
110	8	8.1	Member	7	10	ISTP
111	8	8.1	Member	8	10	ISTP
112	8	8.1	Member	9	10	ISTJ
113	8	8.1	Member	9	10	ESTJ
114	8	8.1	Member	9	8	ISTP
115	8	8.1	Member	10	9	INTJ
116	8	8.1	Member	6	8	INTJ
117	8	8.1	Member	10	8	ENTJ
118	8	8.1	Member	10	8	INTJ
119	8	8.1	Member	6	8	INTP
120	8	8.2	Manager	10	9	ENTP
121	8	8.2	Member	9	10	ISTP

ID	Company ID	Team ID	Type	Success Factor	Feeling Factor	MBTI Result
218	13	13.1	Member	10	9	INTJ
219	13	13.1	Member	6	8	INFJ
220	14	14.1	Manager	10	9	ESTP
221	14	14.1	Member	9	10	INTJ
222	14	14.1	Member	9	8	ISTP
223	14	14.1	Member	7	9	INTJ
224	14	14.1	Member	9	8	ESTJ
225	14	14.1	Member	6	9	ISTJ
226	14	14.1	Member	10	9	INTJ
227	14	14.1	Member	6	9	ENFJ
228	14	14.1	Member	6	8	ISFP
229	14	14.1	Member	6	8	INTP
230	14	14.1	Member	6	8	INTJ
231	14	14.2	Manager	9	9	ENTP
232	14	14.2	Member	7	10	ISTP
233	14	14.2	Member	7	9	ISTJ
234	14	14.2	Member	6	8	ESTJ
235	14	14.2	Member	10	8	ISTJ
236	14	14.3	Manager	10	9	ESTP
237	14	14.3	Member	6	8	INTJ
238	14	14.3	Member	9	8	ISFP
239	14	14.3	Member	7	10	ISTJ
240	14	14.3	Member	10	10	ISTJ
241	14	14.3	Member	7	9	INTJ
242	14	14.3	Member	10	10	ISTJ
243	14	14.3	Member	6	8	ISTJ