Understanding Personality Differences in Software Organizations using Keirsey Temperament Sorter

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Abstract

In recent years, there has been an increasing interest in exploring personality differences to improve work experience in software organizations. This study presents a personality assessment process conducted on 382 software practitioners using the Keirsey Temperament Sorter II (KTS-II). The primary goal of this assessment is to explore the personality temperaments of software practitioners working in different types of software development organizations. In addition, a novel visualization approach is proposed for arranging temperaments using a periodic table-like structure. The results suggest that our approach provides an effective means to investigate an organizations personality profile while assessing personality types.

Keywords: Keirsey Temperament Sorter, Personality Assessments, Periodic Table-like Visualizations, Personality Profiling, Personality Traits of Software Practitioners

1. Introduction

In the past two decades a number of researchers suggest that the major problems encountered in software development activities are more sociological than technical in their nature [1]. It is therefore becoming increasingly difficult to ignore the fact that software development is a social activity [2, 3] in which software executive teams face challenges related to effective corporate governance.

So far, however, there has been insufficient discussion about the understanding of individuals working in software development organizations regarding their personality characteristics. For the individuals working in such organizations, methods that highlight psychometric differences should

be considered. Such methods should generally involve profiling of the individuals, and should ultimately seek ways to exhibit the personality profile of an organization as a whole. However, such techniques are currently underutilized in software development organizations.

Thus, the current research study aims to investigate a means of assessing the personality types of software practitioners to explore personality profile of a software development organization by using the Keirsey Temperament Sorter II (KTS-II) [4], and to further discuss organizational temperaments by plotting a periodic table-like structure. In light of these objectives, the following research question is addressed in the study: *Do different types of software development organizations favor different kinds of personality temperaments depending on their company profile?*

The remainder of the paper is organized as follows. In section two, authors provide a background for the research. In the third section the methodology of study is described. In the next section, authors give details of an empirical investigation such as the participants and methods used in the study. It is followed by the validity of the assessment. Finally, in the last section, authors discuss the study findings, the limitations, and directions for further study.

2. Personality Background

Personality is an empirically observable construct, which encompasses a combination of temperaments that are known to form the individual differences such as behaving, deciding, and planning [5]. In the history of analytical psychology, Jung was a pioneer who suggested that individuals have predisposed preferences, which can be identified based on their personality types [6]. Jungs perspective can be characterized by dichotomous attributes that oppose each other (e.g. Introversion vs. Extroversion) where each individual has a natural tendency towards one or the other. Based on all the dimensions of personality proposed by Jung (extroversion-introversion (E-I), sensing-intuition (S-N), thinking-feeling (T-F)), Myers and Briggs [7] refined the framework by adding a new personality type indicator, i.e., judging-perceiving (J-P). The extroversion-introversion is a pair that presents how a person is energized either by social gatherings or by being alone. Sensing-intuition is a pair for the perceptual functions, which shows how an individual collects information either by using the five senses (i.e., factual information) in a realistic fashion or by seeking information for more symbolic meanings. The thinking-feeling dichotomy is about the decision-making process of in-

dividuals by either interpreting cause and effect relationships in a more firm way or by taking values or concerns of individuals into account in a more harmonious way. Lastly, judging-perceiving (J-P) is a type which represents individuals' perceptions about life. The Judging personality type prefers to approach life in a structured and systematic way while perceiving type tends to be less structured and more flexible. An illustration would be an individual who might favor a plan-driven life or who might prefer to keep his or her options open (i.e., enjoy exploring alternative ways) and might not be affected by spontaneous events [8].

Although a number of critics question Jungian theory for its ability to measure personality characteristics [9], Myers-Briggs Type Indicator (MBTI), which is based on Jungian theory, has become the most popular with a large body of empirical research studies for personality assessment including the software business and industry [7]. The validity of the MBTI assessments has been questioned by some researchers [10], for psychometric adequacy [9] and for evaluating job success [11]. Yet, many studies confirm the instruments construct validity, i.e., the items in the instrument appear to measure the proposed scales [12]. Evidence suggests that the MBTI is a reliable instrument where confirmatory factor analysis of the four-factor model shows a solid item-to-scale structure [13, 14]. Despite MBTIs validity and reliability as a personality assessment tool, KTS-II [4] has also become one of the most popular free alternative personality assessment instruments. This instrument uses 70 forced-selected items to assess the scores very similar to MBTI. KTS-II involves eight possible bipolar scores that can be transformed into sixteen different personality types. Using the same participants, Kelly and Jugovic [15] used MBTI as a validity criterion and compared the results of the two assessments. They observed moderate to strong correlation between MBTI and KTS-II for the scores of both male and female participants and claimed that these two scales are measuring similar personality constructs. Empirical evidence suggests that KTS-II has satisfactory internal consistency [16, 17].

2.1. Personality Temperaments

As defined in the previous section, the term personality is generally used to refer to a set of characteristics based on the thoughts, emotional and behavioral patterns that constitute human talents, emotions, habits and skills which are specific to an individual. The term temperament, however, is

generally used to refer to a set of inherited personality types such as intelligence, and the acquired dispositions such as background, social and cultural history [18]. Allport [19] defines temperament as a component that refers to the emotional nature of individuals such as sensitivity to provocation, responsiveness and ability to keep the intensity of mood. Therefore, the notion of temperament can be considered as an intangible substratum (i.e., a basis or a foundation) for a consequent advancement of personality characteristics based on various life experiences that affect individuals' temperaments [20].

According to Keirsey, temperaments are of four kinds [4]:

- Stabilizers (*Guardians*): This temperament can be found in cooperative traditionalists who value protection and stability the most; they prefer to be part of an organization and like to live by the rules. Mostly, they are found to be reliable and hard working individuals.

- Improvisers (*Artisans*): They are equipped with advanced tactical skills and are the most talented group of individuals at using a tool such as software, a screwdriver or a language. They are mostly realistic and sometimes unconventional. They love freedom, and their favorite expression is carpe diem (i.e., seize the day).

- Catalyst (*Idealists*): The people in this temperament is known to be the most communicative type. They are political, enthusiastic, intuitive, and sometimes romantic and spiritual. They love gaining knowledge and self-improvement and also guiding individuals on these kinds of quests.

- Rationalists (*Theorists*): People in this group are known for their logic and problem solving skills. Mostly, they are skeptic, pragmatic and independent. They do not prefer trying to understand how things work. They are not good at diplomacy, and sometimes not good at digesting details.

In addition, Bradbary and Garrett [21] indicate the benefits of using personality temperaments in software team management as follows:

> *"....Say you've got a problem that needs a novel solution. Assign an Inventor (ENTP) or a Crafter (ISTP) to handle the job. Both*

thrive on ingenious problem-solving; they're good with Gordian Knots. If, on the other hand, you've got a large, messy project that needs to be organized and whipped into shape, call on a Field Marshall (ENTJ). These little Napoleons know how to regiment people and resources alike (hence their name). Architects (INTP) are good at big, complex problems that need fine-tuning - its the nature of their intellect to tweak and tinker. And Counselors (INFJ) have a talent for issues that need a touch of tact and empathy." [21, pp. 17].

2.2. The Periodic Table Approach

To facilitate the study of the relationships of personality types, we propose a novel visualization method. The goal is to develop a unique approach for organizing individuals' personality types based on multiple layers of different personality attributes.

The abstract notion of a periodic table approach relies on the fact that there is an axiomatic relationship among a group of entities [22]. However, a common form of a periodic table comprises rows and columns, in which the classification is made by the entities placed across or down the table. To study the interpretations of the people in software teams in terms of their personality types, we composed a structure similar to a periodic table. A periodic table-like structure can be considered as a collection of the personality attributes in a table form, which is used to arrange sixteen distinctive characteristics of personality types (see Figure 1).

The table-like structure is based on categorization of MBTI personality types with respect to Keirsey's personality temperaments, namely idealists, guardians (i.e. stabilizers), artisans, and rationalists, which are shown in different colors in Figure 1. The correspondence between MBTI personality types and Keirsey's personality temperaments were taken from Keirsey's book [4]. Here, we detailed our visualization approach in a periodic table-like structure explained as follows.

Rationalists are shown in dark blue colors that are depicted in the rightmost column, artisans are shown as the two middle columns, stabilizers are residing in both sides of rationalists and idealists (as the 2th and 4th column), and idealists are illustrated as the leftmost column (see Figure 1). In this representation, the first three columns store the feeling types while the 4th, 5th, and 6th columns are only filled with thinking types. In addition, the rows depict groups of introversion or extroversion layers where each layer only

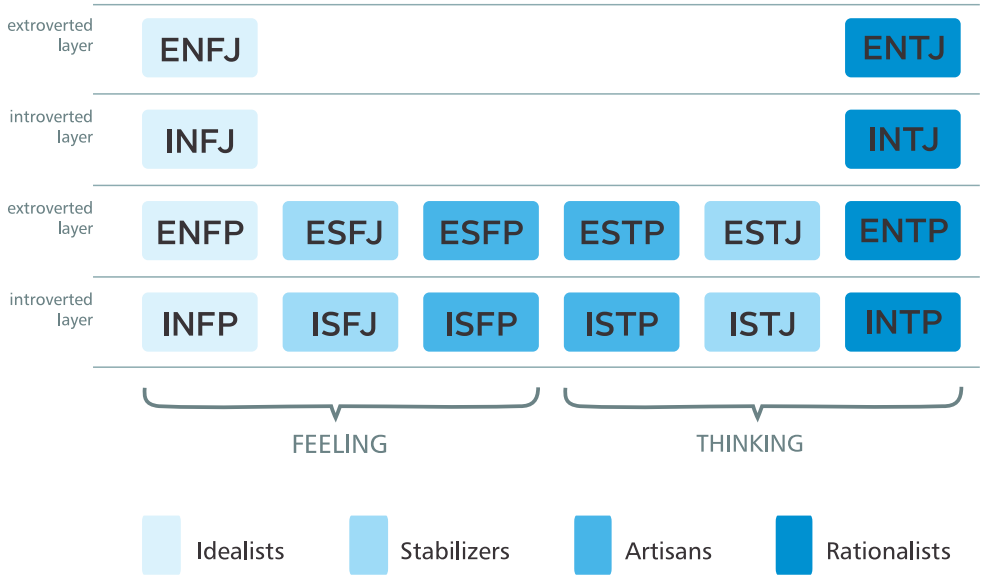

Figure 1: *The Periodic Table Type Classification for Personality Types*

contains the same social attribute (i.e., either extroversion or introversion). The vertical columns on both sides of the periodic table-like structure show the degree of rationality and emotionality of the personality types. The leftmost column denotes altruistic personality types while the rightmost column stores personality types that are more individualistic. The columns that are vertical inside the structure are constructed regarding individuals' negation and social stabilization characteristics [23].

Figure 1 provides a template for periodic table-like visualization (i.e. holistic snapshot) of a software organization in terms of practitioners' personality types. Therefore, a periodic table-like structure is employed to illustrate personality types in software development organizations in our study. The proposed visualization technique presents the personality types of software practitioners in a clustered fashion where it enables the researchers to explore various characteristics of individuals (e.g. extroversion and introversion, feeling and thinking, etc.) in a well organized manner, and most importantly, using the lens of *Kersian* temperament theory. Consequently, it provides the opportunity to analyze the social structure of a company, which could be useful to understand the diversity in personality characteristics of the

software development organization as a whole. This allows managers not only to explore the motivations of practitioners in their organization based on their respective temperaments but also help them to seek ways to deal with the events and conflicts based on the individual differences of software practitioners.

To sum up, the periodic table form gives a complete visual representation of MBTI based personality types classified by using the temperament information extracted from Keirsey's book [4], which demonstrates the benefits of external representations of practitioners in software development organizations. Ultimately, a goal is to investigate the relationships between the temperament of individuals and the cultural and intellectual aspects of software development organizations.

2.3. Personality Research in Software Engineering

Preliminary work on the impact of personality types on software team structures was undertaken by White [24], who reported that the diversity of personality types were beneficial for dealing with a number of software development activities. Kaiser and Bostrom [25] also conducted a study, which confirmed that personality types have a significant impact on the success of a management information systems team. They hypothesized that successful project teams usually include a variety of personality types. Consequently, it was claimed that the absence of a feeling (F) personality type in a team directly affects project success.

Moreover, to improve pair forming process and its effectiveness, Sfetsos et al. [26] empirically investigated the effect of MBTI personality types and Keirseys temperaments over novice (student) developers in pair programming. Their study also supported the idea that pairs with diverse personalities were more effective than homogeneous pairs. Based on the MBTI personality types, Dick and Zarnett [27] claimed that pair programming was only suitable for a limited number of people and therefore teams should be formed taking different personality types into account.

Prior studies that noted the importance of personality research in software engineering point out that the socio-type ISTJ was found as the most frequent type in this particular domain. Bush and Schkade [28] found that 25% of scientific programmers were ISTJ, while Buie [29] singled out 19% of programmers and further Smith [30] found 35% of system analysts to be ISTJ. A two-phased MBTI-based study by Turley and Bieman [31] reported that the programmers in their small empirical sample were mostly found to

be introverted (I) and thinking (T) type. He claimed that individuals with NF type suffered from a lack of process-based thinking. However, a limitation of this study was that the sample size was relatively small.

From an industrial point of view, Hardiman [32] examined a group of software engineers who were found to be ENTJ, INTJ, ESTJ, ISTJ, ISFJ, and ENTP. Several researchers have found that different personality types can have different skills and their ratio varies in different cultural and company-based settings. They concluded that a team with a variety of personality types is important to improve the effectiveness of a software team.

Carpetz [33] found that introverted and thinking types are found more than other types (e.g. ISTJ) whereas Da Cunha and Greathead (2007) found 6% ISTJ in their study. Based on 92 participants organized in small teams, Gorla and Lam [34] reported that sensing (S), and judging (J) may be more suitable as programmers characteristics. According to a survey conducted by Varona et al. [35] on 103 participants, a noticeable personality type was ESTJ. This suggests a potential shift to extroversion type in the software engineering domain, which complies with the fact that new software projects require workforce with more social skills.

One of the more significant findings to emerge from the literature review is that personality types of software practitioners could have an impact on the productivity of software development [33]. However, to our knowledge, these findings have not yet been investigated from an entire organizational perspective.

This paper attempts to show that providing such a holistic perspective would have several benefits to software executive teams. Firstly, a valuable contribution here is to help senior executives explore software practitioners' communication and interaction preferences, which may help them to develop strategies to avoid or resolve conflicting situations within the software organization. In fact, our approach should guide them in tailoring an organizational process. Secondly, evidence suggests that selecting a software development methodology is affected by the personality types of software practitioners [23]. A holistic viewpoint provides some support for selecting a suitable software development process. It may help to improve or change the organizational culture. Thirdly, we believe that it is vitally important for a software development organization to build a corporate strategy for its company-wide human resource planning process. In particular, a personality type visualization method could be beneficial to assess the distribution of personality types of in a software organization as a whole.

3. Participants and Methods

The process of collecting data from software companies is a challenging endeavor. Therefore, in this exploratory study, a cross-sectional design was selected to investigate the personality differences in three software development organizations. The goal is to collect data in a single point in time, which can be considered as a cost-effective method, and it can be conducted in a short period of time.

This study adopted the Keirsey Temperament Sorter (KTS-II) to assess software practitioners' personality types. KTS-II is a self-assessed personality questionnaire, which has 70 forced choice questions [4]. This instrument identifies four main distinctive categories of personalities (i.e., temperaments) based on patterns of human behavior. It has been used as a framework to investigate the personality types of over forty million individuals from 140 different countries[1].

After getting informed consent from the individuals, an online survey was conducted incorporating the KTS-II and some general questions to gain demographic information such as age, gender, years of experience, and job title. This survey was administered to software practitioners in their work environment. Data were collected from three middle-sized software development organizations, which were initially analyzed with the SPSS data package. The total number of participants was 382 (54% male, 46% female). Among the respondents 263 were from Company A, which uses a traditional approach to software development. A traditional software company is one that develops a software product to sell to a customer (e.g. Microsoft). Conventionally, most of their product offerings are desktop applications. On the other hand, 82 participants were from Company B, which is a research and development institution aiming to build next generation technological solutions. Lastly, 37 respondents were from a software company that develops software as a service, which refers to a business model where customers are paying a fee to gain access to a software product.

Most of the participants were working in development teams consisting of such roles as IT specialist, software developer, software tester, system analyst, and software architect. The average age was 35.1. Almost all (90%) participants had industrial experience, and 50% had less than 3 years, 40% had 3 to 14 years of experience in the software development business.

[1] http://www.keirsey.com/aboutkts2.aspx

All participants were required to complete an online assessment of KTS-II, which was conducted via the Internet through the LimeSurvey application (www.limesurvey.org).

The personality types of all participants were assessed using KTS-II. The goal of the assessment was to reveal participants' personality types based on the questions in the questionnaire: 10 for E-I, 20 for S-N, 20 for T-F, and 20 for J-P. As a result of the assessment, the eight bipolar scales of KTS-II produced satisfactory results.

4. Results

The results obtained from the analysis of 16 MBTI personality types indicated that the most common personality type was ESFJ (9.4%), followed by ESFP (7.3%), INFJ (6.8%), and ISTJ (6%). However, the types INTP (4.7%) ISTP (4.2%), and ESTP (4.2%) were relatively less common than the other personality types (see Table 1). Although there is a visible balance on the distribution of personality types, (E)xtroversion and (F)eeling personality types were found to be slightly higher than the other personality preferences. A reason for this is that we have 46% female participants where the feeling type is more prevalent. In addition, as agile software development methodologies require more social interactions and suggest customer involvement [36], an increasing proportion of software practitioners are reported to be more extroverted. This finding is in agreement with previous studies [35, 37], which showed evidence of increased extroversion in software practitioners' personality profiles.

ISTJ	**ISFJ**	**INFJ**	**INTJ**
n=23	n=32	n=26	n=22
6%	8.4%	6.8%	5.8%
ISTP	**ISFP**	**INFP**	**INTP**
n=16	n=24	n=19	n=18
4.2%	6.3%	5.0%	4.7%
ESTP	**ESFP**	**ENFP**	**ENTP**
n=16	n=28	n=23	n=25
4.2%	7.3%	6.0%	6.5%
ESTJ	**ESFJ**	**ENFJ**	**ENTJ**
n=27	n=36	n=25	n=22
7.1%	9.4%	6.5%	5.8%

Table 1: *Percentage of Participants (n=382) in MBTI Types*

To explore Keirsey's temperaments, our next step was to visualize the personality profile of the companies using a periodic table-like approach. We, therefore, constructed a periodic table for each company. Table 2 illustrates company A, which is a traditional company that prefers conventional software development methods for building desktop applications. Although the company has quite good distribution of personality preferences, it is apparent from Table 2 that the stabilizer temperament is likely to be dominant (e.g. ESFJ 12.17%, ESTJ 9.13%). This result may be explained by the fact that the social structure of a conventional organization has a strong hierarchical establishment and concrete rules and therefore, mostly prefers to follow software development standards and procedures.

ENFJ 5.7%					ENTJ 3.43%
INFJ 7.22%					INTJ 3.43%
ENFP 5.32%	ESFJ 12.17%	ESFP 7.6%	ESTP 4.56%	ESTJ 9.13%	ENTP 3.8%
INFP 5.32%	ISFJ 10.65%	ISFP 6.84%	ISTP 4.18%	ISTJ 7.99%	INTP 2.66%

Table 2: *Periodic Table of (%) Personality Types of Company A*

Table 3 presents the personality profile of company B. The company is a research-based software development institution, which shows some difference in personality preferences. Firstly, it shows a significant amount of rationalist temperament (e.g. ENTP 15.86%, INTJ 14.63%). This temperament profile usually fits with individuals who desire to understand more about natural phenomena and expand their knowledge, and ultimately enjoy working on complex structures. In addition, it is not surprising to discover that a group of idealists (e.g. ENFJ 9.8%, ENFP 8.5%) has also been found in the social structure of the organization. In fact, people with this temperament prefer jobs that improve the social welfare of society.

ENFJ 9.76%					ENTJ 12.2%
INFJ 6.1%					INTJ 14.63%
ENFP 8.54%	ESFJ 2.44%	ESFP 3.65%	ESTP 1.22%	ESTJ 2.43%	ENTP 15.86%
INFP 4.88%	ISFJ 2.44%	ISFP 2.44%	ISTP 1.22%	ISTJ 1.21%	INTP 10.98%

Table 3: *Periodic Table of (%) Personality Types of Company B*

Finally, the third software development organization develops software as a service application to manage GSM operators (see Table 4). The development organization has short production cycles with reduced upkeep costs. However, to satisfy their users they should rapidly take into account current and emerging technologies. Consequently, they adopt agile development

methodologies to produce marketable software artifacts in deadline-driven environments. The most common personality temperament in this company was artisans (e.g. ESFP 14%, ISFP 11%). A possible explanation for this is that this temperament involves self-confidence and skills to adapt, which are very important aspects of an agile software practitioner [36]. In addition, this company was weakly dominated by rationalists (e.g. ENTJ 8.1%, ENTP 5.4%). This may be because of the fact that these individuals prefer to work for such an organization due to their knowledge-seeking personality, and eventually their desire to develop cutting-edge technologies.

ENFJ 5.41%					ENTJ 8.11%
INFJ 5.41%					INTJ 2.7%
ENFP 5.41%	ESFJ 5.41%	ESFP 13.51%	ESTP 8.11%	ESTJ 2.71%	ENTP 5.41%
INFP 2.7%	ISFJ 5.41%	ISFP 10.81%	ISTP 10.81%	ISTJ 2.71%	INTP 5.41%

Table 4: *Periodic Table of (%) Personality Types of Company C*

5. Validity of the assessment

A common technique to assess the construct validity of an instrument is exploratory factor analysis (EFA) [38]. It is a frequently used method to analyze empirical data by grouping interrelated variables into factors (i.e., a linear combination of items), which are composite and constructed to capture a significant amount of the variance. Ultimately, the goal is to summarize the relationships between a set of variables by reducing its dimensionality into a set of manageable factors.

To explore the underlying factor structure of the KTS-II instrument, we performed exploratory factor analysis on the responses (n=382). The two-step process of factor extraction and factor rotation were conducted using 70 items of the questionnaire. To investigate the adequacy of responses for factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy confirmed that the sample was adequate for EFA (0.731), and Bartlett's test of sphericity was significant ($p < 0.01$), both of which were conducted before the factor extraction process.

To assess the hypothesized four-factor structure, first, the sample was analyzed using principal component analysis and then, to minimize the complexity of loadings for identified components, varimax rotation method was conducted on the data. To define the amount of variance for hypothesized factors, eigenvalues were calculated and a plot of ordered eigenvalues (i.e.,

scree plot) was used to verify the number of factors extracted [39]. Most importantly, it was suggested as a common rule that the eigenvalues (i.e., variances), which are greater than one can be considered as more stable, and account for more variability [40].

The scree plot of eigenvalues for the 70 questionnaire items are reported in Figure 2 verifies the extraction of four factors.

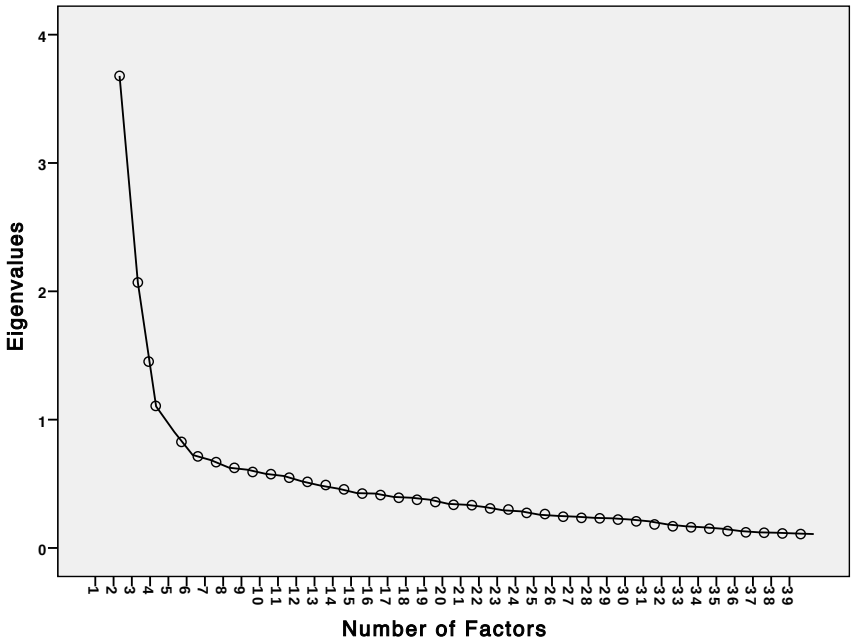

Figure 2: *Scree Test of Eigenvalues*

The analysis suggests that all factor loadings were above 0.580 for items in the questionnaire after factor extraction and rotation. As shown in Figure 2, there were four factors (parallel to the MBTI scales), which are extracted with an eigenvalue of one or greater. The result of the factor extraction and rotation indicates that a four-factor model yielded satisfactory results, which explained 66.16% of the total variance. The first factor (E-I) explained 7.61% of the total variance while the second, third and fourth factors (S-N, T-F and J-P) accounted for 19.37%, 27.81% and 17.31% of the total variance

respectively. Consequently, EFA process provides evidence for the validity of the four-factor structure.

Table 5 shows the relationship between MBTI personality types and the four extracted factors. As understood from Table 5, each factor mostly identifies with one personality type.

	Factor 1	Factor 2	Factor 3	Factor 4
E-I	9	1	0	0
S-N	0	18	1	1
T-F	0	1	16	3
J-P	0	0	2	18

Table 5: *Number of Factors with the highest values of loading in 4-Factor Design*

To sum up, the hypothesized KTS-II model, which is based on 70 items on a four-factor solution, had good fit with the observed data. Therefore, based on the preliminary evidence regarding the validity of the measure, the survey instrument was found to be an appropriate tool to explore the personality temperaments of software practitioners.

5.1. Threats to Validity

Internal validity refers to the confidence (i.e., rigor) in a scientific study where the collected data allows the researcher to draw conclusions regarding cause-and-effect relationships. In this study, we have three different groups of participants who participated voluntarily. Before starting the assessments, we confirmed that all test takers were not affected from any external circumstances such as poor health.

To deal with any instrumentation effect, no changes were made in the survey instrument during the course of the study. Furthermore, we have not observed any change of participants' circumstances, which may cause a change in their preferences during the process. However, similar to all conducted personality assessments, the results were based on self-reports, which rely on what participants report about themselves. In addition, all assessments were started with a short introductory note for the test takers where we mentioned that their results and names would remain anonymous.

The construct validity refers to the interpretations of assessment scores with respect to the defined conceptual structures (i.e., constructs). In fact, factor analysis is a common method for assessing the construct validity of

a psychometric assessment. To assess the validity of the test, we used exploratory factor analysis technique. However, this technique can only suggest a factor structure. In fact, the rules to extract factors are not definitive where results may be constrained with the particular family of methods, which were selected by the researcher.

The external validity refers to a process of the study as to whether the findings are generalizable to other settings. In the current study, collected data from three different companies was analyzed to reveal the personality types of software practitioners where a convenience sample size of 382 software practitioners were selected for the objective of this research. However, further experimental investigations are needed to confirm our results. Finally, the research was conducted using industrial practitioners instead of university students, which should ultimately improve the accuracy of the findings.

6. Discussion and Conclusion

The purpose of this study was two-fold. First, it aimed to determine the personality types of software practitioners using the KTS-II model and to investigate its psychometric properties. Consequently, the temperament of software practitioners based on their personalities, in three software companies working on different domains, were revealed. To obtain support for the validity of the instrument, exploratory factor analysis was conducted. The current study yielded results which corroborate the findings of the majority of previous studies in this field (e.g. [16, 17]).

Secondly, this study highlighted that Keirseyan temperaments differ in different software development organizations based on the business model or the domain of the firm. In order to explore their temperament structure, we proposed a novel visualization idea - a periodic table form. The goal was to classify a software organizations social characteristics with respect to the personality temperaments of its members.

Another significant finding that emerged from this study is that it is important and useful to understand personality temperaments since this ultimately provides feedback on job preferences for software practitioners. This may guide us through the temperaments of participants in different domains in software development organizations, which also enables us to gain a deeper insight into the personality profiles of different forms of software development

organizations. The results of this research support the idea that software organizations specializing in different domains are populated by individuals who have relevant personality temperaments along with specific work requirements. Returning to the research question posed at the beginning of this study, it may be stated that different kinds of software development organizations are likely to favor individuals with different types of personality temperaments. However, these findings are limited by the use of a cross sectional design.

Taken together, the findings of this study have a number of important implications. From the practical point of view, it is important to be aware of the personality types of software practitioners where the results offer some insight into improving communication in software organizations. Such an awareness could be used to refine organizations change management strategy which would potentially enhance organizational productivity. Moreover, the study reveals that software organizations are interested in for finding ways to explore the implications (i.e. the diversities and differences that affects organizational success) of the personality characteristics on team, role, and performance management issues. The empirical findings in this study provide a new understanding of a software organization's social dynamics. Comparison of the findings with those of other studies confirms that personality type awareness can be considered as a key point for improving social aspects of a software development organization.

Lastly, a number of important limitations need to be considered. Firstly, the current investigation was limited within three companies. It is therefore recommended that more research should be conducted on other software development organizations. Secondly, further investigation and experimentation into KTS-II are strongly recommended. Thirdly, a comparative study could be conducted by using different personality assessment tools. Considerably more work needs to be done to determine the implications of personality temperaments on organizational characteristics.

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