

Mapping Job Requirements of Software Engineers to Big Five Personality Traits

Mobashar Rehman¹, Ahmad Kamil Mahmood¹, Rohani Salleh², Aamir Amin¹

¹Department of Computer and Information Sciences

²Department of Management and Humanities

Universiti Teknologi PETRONAS, Bandar Seri Iskandar, 31750 Tronoh, Perak, Malaysia
 mubashir_rehman@yahoo.com, kamilmh@petronas.com.my, rohanisalleh@petronas.com.my,
 aamir-amin@hotmail.com

Abstract - Software engineering is a booming industry and is contributing to world economy in terms of providing employment and monetary benefits. Unfortunately, despite its importance, research in this field is still not mature. Studies so far done in this field have heavily focused on technical aspects rather than non-technical. In fact, software development is a human activity (performed by humans) which emphasizes the importance of research on non-technical (human or soft aspects) of software engineering. Recently there has been an increase on studies which are focusing more on the soft aspects of software engineering. This study also focuses on the human aspect of software engineering namely personality. Software engineers belong to various categories and their roles differ from each other based on their job requirements and skills needed to perform those jobs. This study mapped the hard and soft skills required by various software engineers and then linked them to personality traits using Big Five Personality Traits.

Keywords: Software Engineers; Personality Traits; Big Five; MBTI

I. INTRODUCTION

Software Engineering (SE) will be one of those fields in future which will have *fastest growing employment* [1] and till 2013, this industry will be estimated to be valued at US \$ 457 [2]. Despite its importance to the world economy and continuous research in this field, it's still not mature [3]. This motivates researchers to continue exploring SE. Earlier research in the field of SE focused heavily on technical aspects rather than human or social aspects [4].

This approach was not right as social or human aspects besides technical aspects are crucial for software development because “*software is developed for people and by people*” [4].

Developments in the field of SE and especially emergence of agile methodologies have shifted the focus of software engineering from processes to more towards individuals. Thus those skills which were earlier not considered critical for software engineers are now very critical like “*adaptability, communication, and stress management*” [5]. Therefore, recent trend of research in this field is more towards human or social aspects rather than technical. This was supported by [5] in which it was mentioned that skills which were important some decades ago in SE field may no longer remain relevant.

One of the rising areas of research in SE is personality of individuals. This is because of the fact that software development is an outcome of human activities [5] and when it comes to individuals they have different personalities. Knowing the personality of software engineers is also important because people/individuals are the significant costs to any software development project. As a result selection of individuals should be done carefully while keeping in mind that right people will enhance the chances of project success considerably [6].

Due to the importance of personality difference among individuals, it is important to know which personality traits or characteristics are important for which type of software engineers [5]. Therefore, this study will analyze the personality characteristics required for different kinds of software engineers (System Analyst, Software Designer, Software Programmer, Software Tester, and Software Maintenance). This study enhanced the work done by [7]. They mapped the skills required by software engineers to Myers-Briggs Type Indicator (MBTI) whereas current study mapped the skills required by software engineers to Big Five Personality (BFP) or Five Factor Model (FFM) traits which is another method to assess the personality of an individual.

Reason for using FFM is that researchers have showed concerns on MBTI because of its relationship with Jung's

theory [8] whereas FFM is more acceptable since it broadly encompasses the personality dimension into five main dimensions. Besides, MBTI dimensions can easily be represented by FFM as shown in figure 1.

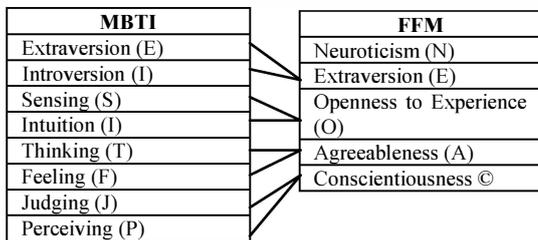


Figure 1: Comparison between MBTI and FFM Source: [9]

II. FIVE FACTOR MODEL

Big five [10] proved to be the basis for development of FFM [11]. FFM consists of five personality domains explicitly neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness [12].

Neuroticism: These people are prone to effects of negative experiences [12] thus those who score higher on this trait feel more emotional distress as compare to those who score less on this dimension of personality meaning those who score less will be more calm and relaxed individuals [13]. These people can easily feel “*anxiety, insecurity, depression and hostility*” [14].

Extraversion: People with extravert as their personality trait are assertive, active, talkative, upbeat, energetic and optimistic [12]. These people like the company of other individuals [15] resulting in being social. These people are also energetic, passionate and excited [14].

Openness to Experience: These people are imaginative and creative [16] and because of their imaginative or creative nature they are more into learning about different things [17]. These people appreciate “*art, emotion, adventure, unusual ideas, curiosity and variety of experience*” [14].

Agreeableness: People who fall under this dimension of personality are kind, co-operative and trustworthy [18]. They are also tolerant, sympathetic and emotionally stable individuals [15]. Besides they are also “*trusting, friendly, compassionate, cooperative, compliant, caring and gentle*” [14].

Conscientiousness: These people are more focused towards their goals, disciplined, well organized and are hard workers [12]. They have systematic approach [15] towards achieving their goals. These people prefer to plan first and then act rather than acting spontaneously [14].

III. RELATED WORK

Not enough work exists on the role of personality in software development. Recently few studies have been done which focused on the importance of personality for software development process and software engineers.

It was studied in [5] the kind of personality traits that are important for which type of software engineer. This study used MBTI to assess the personality of software engineers. In [5], authors mapped the soft skills needed by software engineers with the type of personality needed to fulfill those job requirements. According to this study, system analyst should have Extravert (E) and Feeling (F) as their personality traits, software designer should have Thinking (T) and Intuition (N), software developer should have Introversion (I), Sensing (S) and Thinking (T), software tester should have Sensing (S) and Judging (J) and maintenance engineer should have Sensing (S) and Perceiving (P) as their personality traits.

Another study, as in [19] was conducted regarding software personality types in the field of software engineering using MBTI. This study came up with the results that psychological types and software engineers are related to each other. It was concluded in this study that ESTJs, ESTPs, ENTJs and ENTPs are good personality traits for software analysts whereas ISTPs can be good developers. This study also mentioned that ESTJs and ISTJs can be good in managerial positions in software engineering industry whereas for technical persons ISTPs, ESTPs, INTPs and ENTPs are more suitable traits.

Study [15] considered the various personality types in software engineering industry using Big Five Factor. Findings of this study are as follows:

TABLE 1

Big Five Personality Traits & Software Engineers

Neuroticism	Low	Software management engineers, requirement engineers, designers, programmers, testers and evaluators
	Medium	
	High	
Agreeableness	Low	
	Medium	
	High	Software management engineers, requirement engineers, designers, programmers, testers and evaluators
Extraversion	Low	
	Medium	Requirement engineers, testers
	High	software management engineers, designers, programmers, evaluators
Conscientiousness	Low	
	Medium	Software management engineers, programmers, testers
	High	Requirement engineers, designers, evaluators
Openness to Experience	Low	Requirement engineers, designers, programmers
	Medium	Software management engineers, evaluators
	High	Testers

Source: [15]

Another study was conducted [14] to learn the personality of 72 software engineers which included 13 software analyst, 13 architects, 17 developers and 14 testers. They used FFM to assess the personality of these software engineers. Findings of their study are presented in table2 (source: [14]).

TABLE 2

Mean Score of BFP Traits for various Software Engineers

	O	C	E	A	N
MEAN					
Analyst	50.615	63.143	51.571	45.846	64.286
Architect	54.154	67.231	57.308	52.154	64.154
Developer	51.667	52.778	44.111	54.471	59.222
Tester	51.714	66.133	56.000	47.857	63.333

Interesting finding in this study is that all the four categories of software engineers mentioned in table 2 have different means for personality dimensions thus emphasizing the

reality that all personalities are not same and different personalities needs to be considered when assigning roles.

Authors in [20] compared the results of previously published 5 studies which used MBTI to assess the personality of software engineers. They came up with the results that there is not enough difference between the results of five studies which were being compared. They concluded that among software engineers, 57.24% have Thinking (T)-Judging (J) personality preference, 51.50% have Sensing (S)-Thinking (T), 49.14% have Introvert (I)-Thinking (T) personality preferences. Thus most of the software engineers have Thinking (T) as personality trait in them.

IV. Software Engineers and Personality Traits

There are different kinds of software engineers based on the activities they perform. Software engineers can be categorized into software management engineers, requirement engineers, program designer, programmer, tester and evaluator [15]. Program designer is also known by software designer and programmer by software developer or simply developer. All of these software engineers perform their activities during a software development life cycle. This software development life cycle consists of following stages: system analysis, design, programming, testing and maintenance [5]. Activities are performed by software requirement engineers at system analyst stage, software designer performs at design stage, programmer/developer performs activities at programming stage, tester performs at testing stage and maintenance engineer performs at maintenance stage. All of these software engineers have different roles to play and they perform different activities. And as we know that no one type of personality can perform all types of jobs so it is important to map different personality characteristics to different job requirement for various activities being performed in the field of software engineering. To do this, job requirements for system analyst, designer, programmer, tester and maintenance engineer mentioned by [5] and [21] are mapped on FFM. Skills required by all these engineers can be categorized into *hard* and *soft* skills. Hard skills mean technical skills and soft skills mean non-technical skills.

A. Software Analyst

System analysis is the first phase of software development. System analyst considers the user's requirements and converts them into a logical model of desired software. This logical model can be graphical or textual description [5]. These job activities require a system analyst to be in direct contact with customer/client and the team which will design the software. This contact requires frequent communication thus an extrovert person will be suitable for this job role.

Besides this, system analyst should also be caring to the needs of clients in order to fully understand the requirements. System analyst should look through the glasses of client to gather client's requirements. In [5] it is also mentioned that system analyst should have Extraverts (E) for communication, and Feeling (F) for caring personality traits in them but they used MBTI to assess the personality of software engineer. Now the Extravert (E) and Feeling (F) dimensions of MBTI are equivalent to extravert and agreeableness dimensions of FFM respectively [9]. Therefore we can say that as far as link between FFM and system analyst is concerned, those individuals will be suitable for this job who have extraversion and agreeableness as personality traits in them (Figure 2).

B. Software Designer

A software designer partitions a software design into sub-components of software [15]. Meaning they need to have "*strong analytical and problem solving skills*" and they should be "*innovative*" [5]. Analytical and problem solving skills are required in order to break the main software into workable components. And for designers, innovativeness is a natural skill [5]. Now strong analytical and problem solving skills are described as a Thinking (T) personality while innovative person has Intuition (N) as personality trait [7]. Thinking (T) and Intuition (N) of MBTI are equivalent to agreeableness and openness to experience [9]. Mapping of skills required for software designer and FFM is shown in figure 3.

C. Software Programmer

Programmer's job is to convert software design into implementation mode. For this, they need to pay attention to very minute details by being logical and analytical [7]. Besides this, they require very less interaction with others as their job requirement does not call for them to do so [5]. Therefore, because of these work requirements,

programmers should be Sensing (S), Introvert (I) and Thinking (T) [5]. When talking about reinterpreting MBTI to FFM, Sensing (S) is equivalent to openness to experience, Introvert (I) to extraversion and Thinking (T) to agreeableness [9]. Mapping of skills required for software programmer and FFM is shown in figure 4.

C. Software Tester

Testing is the process of finding bugs in the software and is done through unit-testing and integration testing [5]. Purpose of this testing is to ensure that software is meeting all the requirements [15] mentioned by client. Debugging is a frustrating activity, it requires attention to the details and removing bugs can cause change in the thinking of software engineers [15]. Besides, pressure to meet deadlines is also another important feature in software development. Therefore, paying attention to minute details and meeting deadlines are the two skills software testers need to have thus making Sensing (S) and Judging (J) personality traits important for them [5]. These Sensing (S) and Judging (J) dimensions of MBI are equivalent to openness to experience and conscientiousness [9]. Mapping of skills required for software tester and FFM is shown in figure 5.

D. Software Maintenance

Software requires maintenance once it is operational. Software maintenance engineers needs to have Sensing (S) personality trait because such people prefer to work on the lines which have already been tested and proved successful [7]. These engineers also need to be observing and focusing [5]. Perceiving (P) people can be good software maintenance engineer because they are open and adaptable to changes [7]. Perceiving (P) and Sensing (S) of MBTI are equivalent to conscientiousness and openness to experience respectively [9]. Mapping of skills required for software maintenance engineer and FFM is shown in figure 6.

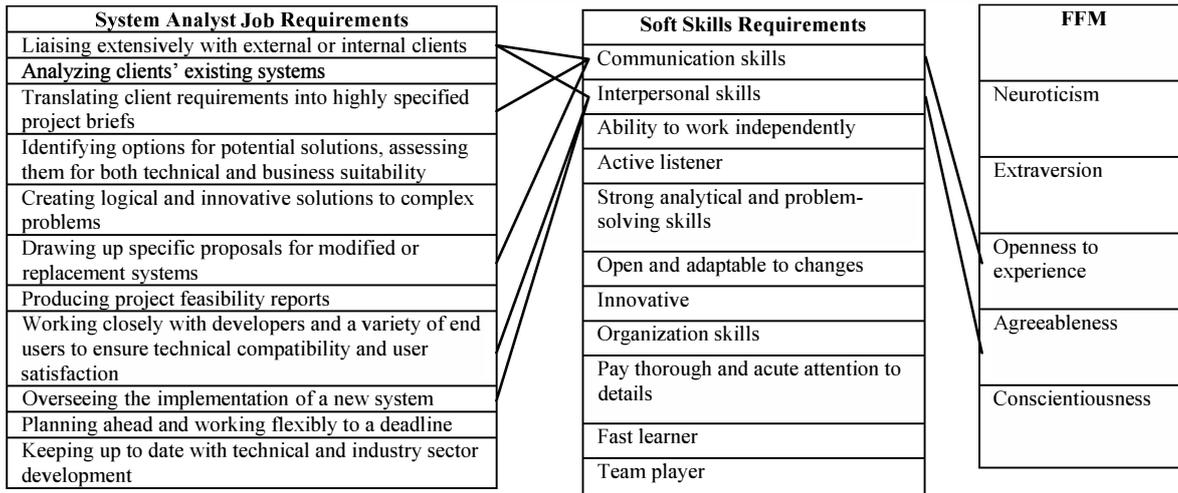


Figure 2: Mapping Soft and Hard Skills Required by System Analyst to FFM

Source: System Analyst Requirements [7] and [21]; Mapping of Hard and Soft Skills: [7]

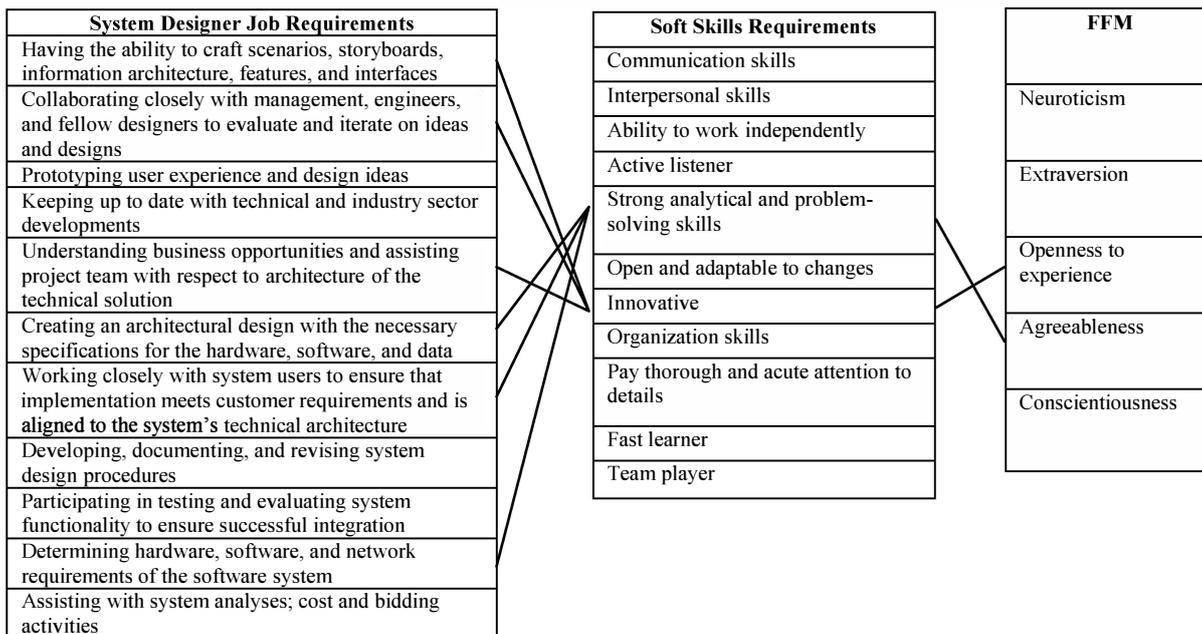


Figure 3: Mapping Soft and Hard Skills Required by Software Designer to FFM

Source: Software Designer Requirements [7] and [21]; Mapping of Hard and Soft Skills: [7].

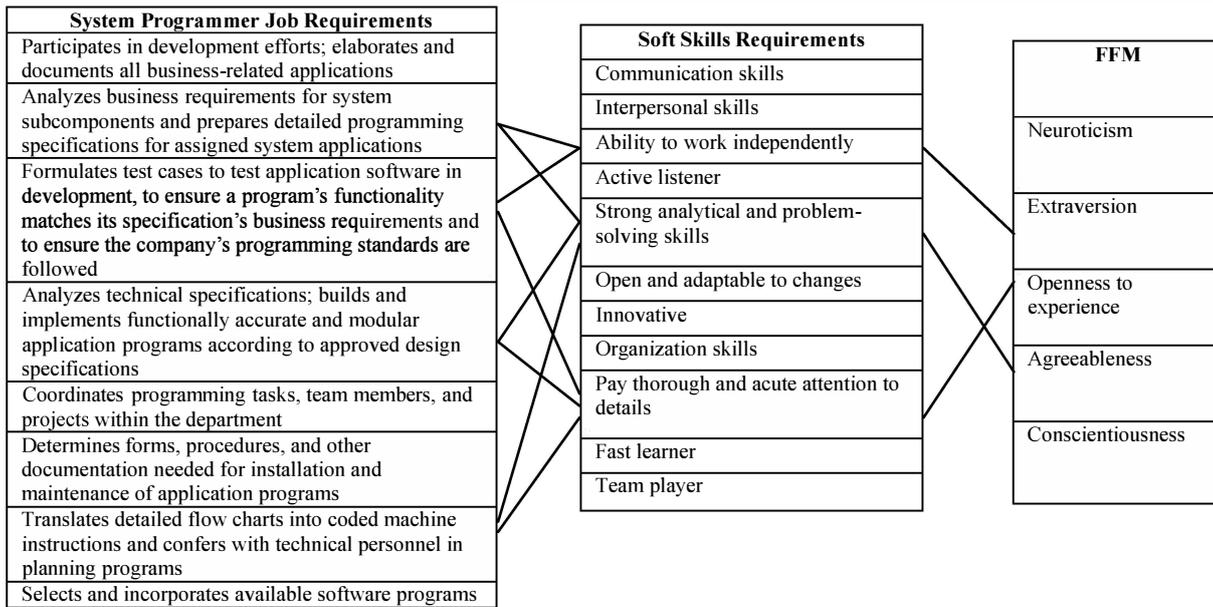


Figure 4: Mapping Soft and Hard Skills Required by Software Programmer to FFM

Source: Software Programmer Requirements [7] and [21]; Mapping of Hard and Soft Skills: [7]

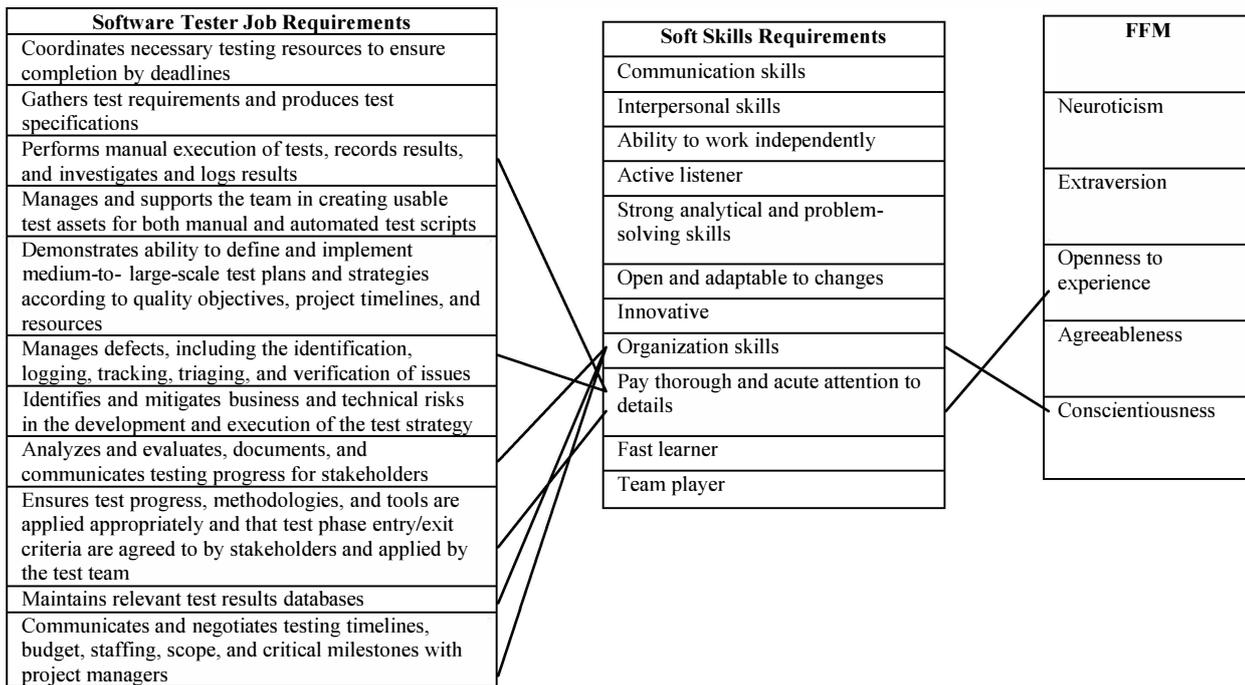


Figure 5: Mapping Soft and Hard Skills Required by Software Tester to FFM

Source: Software Tester Requirements [7] and [21]; Mapping of Hard and Soft Skills: [7].

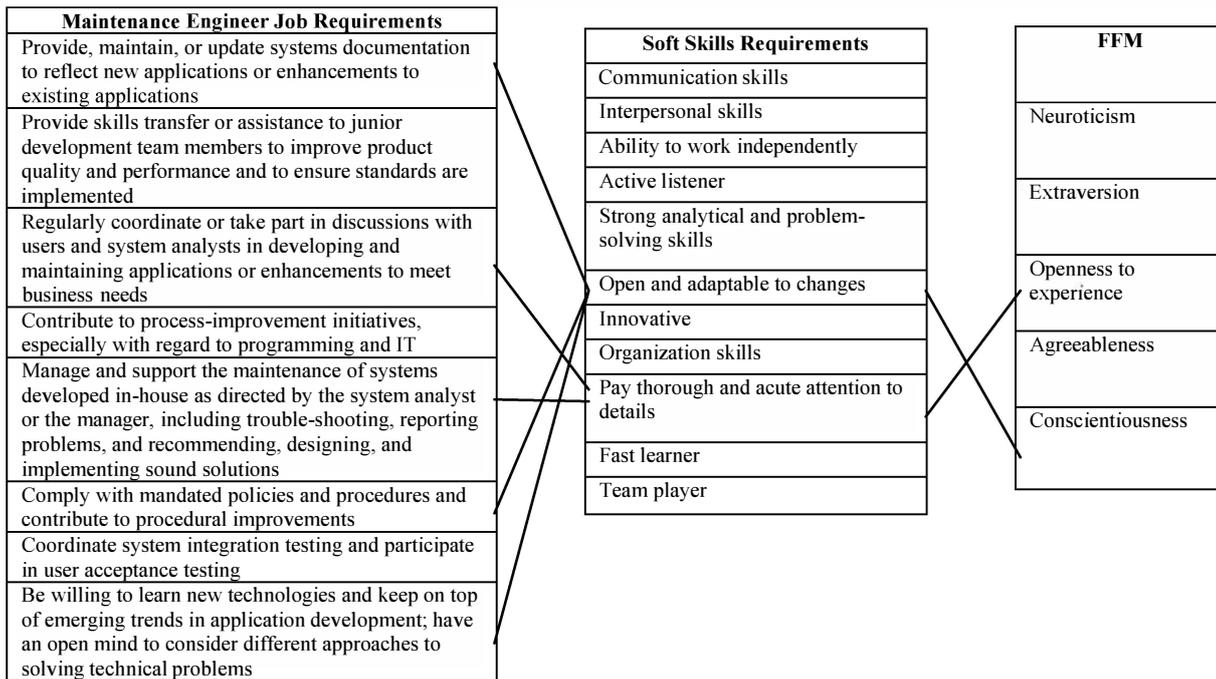


Figure 6: Mapping Soft and Hard Skills Required by Maintenance Engineer to FFM

Source: Maintenance Engineer Requirements [7] and [21]; Mapping of Hard and Soft Skills: [7].

V. CONCLUSION

No person can perform every task perfectly [5]. Few people may excel in one kind of activity while others may perform the same job miserably. This is not due to the inefficient way of performing that particular job, which can be one of the reasons but, it is mainly due to their personality. Because s/he is simply not suited for that job. Thus right person for the right job is vital.

This phenomenon of right person for the right job is also important for software engineering. Software engineering is a human activity and it consists of different types of engineers whose roles or activities they perform differ from each other. Thus it is important to know which personality type will suit which software engineering category.

Results of this study show that software analyst should have extraversion and agreeableness as their personality traits.

Software designer should have agreeableness and openness to experience, software developer should have extraversion, openness to experience and agreeableness, software tester should have openness to experience and conscientiousness and software maintenance engineers should have openness to experience and conscientiousness personality dimensions.

VI. FUTURE DIRECTION

Importance of knowing the personality of software engineers cannot be ignored at any point. Despite its importance, there is no consensus on the personality type of various software engineers. Therefore future studies should empirically assess the personality of software engineers from various cultures (including various countries) in order to understand the difference or similarities between various software engineers. This increase in understanding will boost the chances of success of software projects.

REFERENCES

- [1] L.F. Capretz, "Implications of MBTI in Software Engineering Education," *ACM SIGCSE Bull.*, vol. 34, no. 4, 2002, pp. 134–137.
- [2] Datamonitor, "Software: Global Industry Guide," 2006, Available from: http://www.infoedge.com/product_type.asp?product=DO-4959.
- [3] J. Ward, and A. Aurum, "Knowledge Management in Software Engineering – Describing the process," *Proceedings of the 2004 Australian Software Engineering Conference (ASWEC'04)*, September, 2004, pp. 137-146
- [4] M. John, F. Maurer and B. Tessem, "Human and Social Factors of Software Engineering – Workshop Summary," *ACM SIGSOFT Software Engineering Notes*, vol. 30, no. 4, 2005. pp. 1-6
- [5] L. F. Capretz, and F. Ahmed, "Why Do We Need Personality Diversity in Software Engineering," *ACM SIGSOFT Software Engineering Notes*, vol. 35, no. 2, 2010, pp. 1-11
- [6] A. Howard, "Software Engineering Project Management." *Communication of the ACM*, vol. 44, no. 5, 2001. pp. 23-24
- [7] L. F. Capretz, and F. Ahmed, "Making Sense of Software Development and Personality Types," *IEEE IT Professional*, vol. 12, no. 1, 2010, pp. 6-13. IEEE
- [8] R. R. McCrae and P. Costa, "Reinterpreting the Myers-Briggs Type Indicators from the perspective of the five-factor model of personality," *Journal of Personality*, vol. 57, 1989, pp. 17-40
- [9] A. Furnham, The big five versus the big four: the relationship between the Myers-Briggs Type Indicator (MBTI) and NEO-PI five factor model of personality, *Personality and Individual Differences*, vol. 21, no. 2, 1996, pp. 303-307.
- [10] R. L. Goldberg, "Language and individual differences: The search for universals in personality lexicons". In WHEELER, L. (Ed.) *Review of personality and social psychology*. Newbury Park Sage, 1981
- [11] T. P. Costa, and R. R. McCrae, "The NEO Personality Inventory manual," Odessa, FL: Psychological Assessment Resources, 1985
- [12] T. P. Costa, and R. R. McCrae, "NEO PI-R Professional Manual", Odessa, FL: Psychological, Assessment Resources, 1992
- [13] J. E. Bono and T. A. Judge, "Personality and Transformational and Transactional Leadership: A Meta-Analysis," *Journal of Applied Psychology*, vol. 89, no. 5, 2004, pp. 901-910
- [14] L. G. Martinez, A. R. Diaz, G. Licea and J. R. Castro, "Big Five Patterns for Software Engineering Roles Using an ANFIS Learning Approach with RAMSET," MICAI'10 Proceedings of the 9th Mexican international conference on Artificial intelligence conference on Advances in soft computing: Part II, 2010, pp. 428-439
- [15] A. S. Sodiya, H. O. D. Longe, S. A. Onashoga, O. Awodele, and L. O. Omotosho, An Improved Assessment of Personality Traits in Software Engineering, *Interdisciplinary Journal of Information, Knowledge, and Management*, vol. 2, 2007, pp. 163-177.
- [16] P. O. John and S. Srivastava, "The Big Five trait taxonomy: History, measurement, and theoretical perspectives." In E. Pervin & O. John (Eds.), *Handbook of personality* (pp. 102–138). New York: Guilford Press. 1999
- [17] R. R. McCrae, "Social consequences of experiential openness", *Psychological Bulletin*, 120, 1996, pp. 323–337
- [18] G. W. Graziano, and H. N. Eisenberg, (1997), "Agreeableness: A dimension of personality," In R. Hogan, J. Johnson, & S. Briggs (Eds.), *Handbook of personality psychology* (pp. 795–824). 1997, San Diego, CA: Academic Press.
- [19] L.F. Capretz, "Personality Types in Software Engineering," *International Journal of Human-Computer Studies*, vol. 58, n. 2, 2003, pp. 207-214
- [20] R. Sach, M. Petre, and H. Sharp, "The use of MBTI in software engineering," *22nd Annual Psychology of Programming Interest Group*, 19-22 September 2010, Universidad Carlos III de Madrid.
- [21] J. Dolney, *Designing Job Descriptions for Software Development*, In *Information Systems Development Challenges in Practice, Theory and Education*, ed., C. Barry. Springer, 2009, pp. 447-460.