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A rule-based model for software development team composition: Team leader role with personality types and gender classification

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ABSTRACT

Context: Recent studies have established the fact that the supply of handy and successful software has decreased to 6%. The past studies have also attributed this supply failure to software development team composition factor. To overcome this problem, it is also suggested in the past studies that the soft skills of team member must be considered along with the hard skills.
Objective: Keeping in view this problem, this study aimed to look for in-depth understanding of team-lead role with personality types of member. This study also included gender to see its diverting impact on personality types and job role, since past studies have also raised many issues pertinent to these two variables.
Method: This study used the experimented data to develop the rule-based model for software development team composition by keeping gender as major effecting variable with personality. There were three independent predictor variables: Team leader role, Personality types, and Gender; and one outcome dependent variable: team performance. Additionally, personality types of team members were measured by using Myers–Briggs Type Indicator(MBTI) instrument. This study divided the experiments into two stages. The first stage was descriptive examination of factual figures of data for model development. Whereas, the second stage was predictive experiments of data for developing the model.
Results: The findings revealed that each gender emerged compatible with different types of personality for the same role. For instance, descriptive analysis part of this research highlighted that feeling(F) personality males were appropriate for team leader role, on another hand, thinking(T) personality females were suitable for the team lead role.
Conclusion: The conclusion can be drawn with the claim that the personality types of software development team roles fluctuate by gender type. Besides, this study revealed and ensured that gender should be kept in the consideration when composing teams based on personality types.

1. Introduction

This study is the continuation of our previous presented work [1] in which the role of programmer was determined with generated rules (if –then) applying MBTI test for making effective software development team composition. Moreover, the work was conducted to address the need of software development which is gaining the exponential fame into the modern world of technology. Therefore, the current study focuses on personality types to produce the rule-based modeling for software team composition by including team leader role of software development applying MBTI personality test.

The demand of software is increasing exponentially in every field. But, the detrimental decrease is observed to successful software development [2]. Many factors are identified that can impact the overall development process. In which, inappropriate team composition is one of the important factors [3–5]. According to Bell [6], team composition is a configuration of members based on their attributes that can strongly influence on the team processes and outcomes. She further maintained that past studies have categorized the team composition research into three dimensions: (1) characteristics of team members (e.g., number of team members, members' abilities, demographics, and personality traits), (2) measurement of these characteristics, (3) and the analytical

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perspective used to approach team composition. Normally, team composition is based on the technical fragment of the work. However, software development integrates the technical part of work with social norms. For example, Capretz and Ahmed [7] asserted that team can be ideal if the hard (technical) skills are combined with soft (non-technical: personality) skills. In the same vien, Dingsøyr and Dybå [8] maintained that isolation of either skills (i.e., technical or social) can be one of the reasons of poor development. Additionally, it is also believed that the consideration of technical skills of developers can be advantageous as long as software developers are evaluated by their personalities, which is a soft skill, to evaluate their temperaments to work under cooperative principles with other team members [9].

Although plethora of research has been carried out in the past to explore the key importance of team composition and personality types in the software engineering, but what personality types are handy and beneficial for an ideal and effective teamwork is still a question for the researchers [10–12]. For instance, an extrovert (E) personality preference is suggested for programmers by Gorla and Lam [13] and, whereas, Capretz and Ahmed [7] suggested an introvert (I) personality trait for programmers. It may be because now a days software development complexity is increasing which demands different personality profiles [14], or different personality profiles are required for male and female developers [15]. Therefore, it is suggested in the past studies that maturity is required in the personality based research in software development.

Consequently, this paper addresses and contributes in the field of software engineering (SE), which offers a rule-based model of effective software team composition by using rough set's technique. This model composes three predictor variables i.e., team role, personality types and gender to determine team effectiveness. To the best of researchers' knowledge, the combination of the three variables in determining software team performance by employing rule-based techniques provides a novel approach in SE domain. Therefore, the implications of the paper can be concluded as follows:

i. This research would benefit and enable managers to sort out effective team members equipped with soft skills, which is personality types, in order to compose an effective team for software development.
ii. The findings of this research have produced a rule-based model for the software team composition, which is standard technique where results come in if-then form understandable by human.

Basically, this section of the paper presented the problem, objective, and implication of the study. The following section has highlighted the software engineering literature conducted on the study variables: MBTI, team leader, and gender. In the same vein, the methodology section discusses the experimental part of the study, in which data collection and analysis are highlighted in detail. Moreover, the results and discussion section was divided into two separate sections based on the nature of the analysis: descriptive and Predictive. Once after the results and discussion section, the model development is presented with explanation and proposed algorithm in section number 6. Last of all, the validity threats of the study are discussed in the threats to validity section for explaining the proper use of the model.

2. Related work

One of the considered reasons of all for weak performance and poor results in software project development is the composition of ineffective teams [4,16–19]. A plethora of studies on team composition and personality types in software engineering have been done in the past, but the issue pertinent to a suitable personality composition for effective teamwork is still being questioned [8,20,21]. Additionally, many models of personality composition have been suggested in the past that have failed to win the general consent of researchers. This ambiguity is raised from the different models and theories suggesting different personality types and team composition. For instance, Gorla and Lam [16] suggested an extrovert (E) personality type for programmers while Capretz and Ahmed [7] suggested an introvert (I) personality for programmers. Moreover, the model developed by Capretz and Ahmed [7] was non-empirical, as the model was constructed based on advertisements of jobs. Additionally, the model given by Gorla and Lam [16] was based on empirical data, but authors only focused university students that narrowed the scope of the model. Therefore, the results of that model cannot be generalized to industries. These contradictory suggestions have created many complexities and ambiguities in deciding what personality types are suitable for team organization. Additionally, Cruz and da Silva [22], McLeod and MacDonell [23], and Wiesche and Krcmar [24] asserted that the models suggested in the past for team compositions appeared to be less effective and less lucrative when they were implemented to obtain desired results. According to them, this situation has further intensified the uncertainty among practitioners regarding the effectiveness of these models. In the same vein, Varona et al. [14] also maintained in their review study that increasing complexity in software development requires new personality profiles. They further identified that huge understanding is also required for personality in software engineering.

2.1. MBTI and software development

For the last 50 years, the MBTI has been used as a source for identification of personality preferences and personality type of an individual. This personality type indicator is used for making theories of Jung applicable and useful in everyday life [25]. An individual's personality type in MBTI is assessed on four dimensions: social interaction (extroversion (E) and introversion (I)), decision making (thinking (T) and feeling (F)), information gathering (sensing (S) and intuition (N)), and dealing with the external world (judging (J) and perceiving (P)) [16]. Both Katharine Cook Briggs and her daughter, Isabel Briggs Myers are considered as pioneer of MBTI who have not only extensively studied the work of Jung but they also explored and inter-related different theories of human behavior i.e., theory of psychological types into practical use. The MBTI test allows individual personality type preferences to be classified according to the 16 types with the results reported as a combination of four-dimensional pairs, which are Introversion (I) and Extroversion (E); Thinking (T) and Feeling (F); Sensing (S) and Intuitive (N); and Judging (J) and Perceiving (P). The 16 possible personality combinations are formed from these four dimensions. For the purpose of this study, MBTI personality type instrument is used to assess personality types amongst software team members. The MBTI instrument is chosen, because it is widely used and accepted amongst researchers in software engineering domains [22,26,27].

2.2. Team leader and software development

Leadership is one of the key elements to successful project completion. Based on the definition from Team Software Process (TSP), a team leader can be defined: a team leader is responsible to bring the management in software development projects and he is responsible for outcomes of the development projects [28]. In the same vein, Ruano-Mayoral et al. [28] further maintained that team leader is also responsible for guiding, motivating team members, handling teams and customers issues, and dealing management. They also mentioned that team leader is also required to follow the deadlines to produce the projects from assigned resources.