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Text A: Software Engineering Team Diversity and Performance

Adapted from Vreda Pieterse, Derrick G. Kourie and Inge P. Sonnekus, Proceedings of SAICSIT 2006, pp180-186.

It is commonly recognised that various factors influence software engineering team performance. Factors which are believed to play a role are team skill, managerial involvement as well as software development tools and methods [Guinan et al. 1998]. Other factors that have been researched are team size [Biffl and Halling 2003], team role allocation according to personality [Gorla and Lam 2004], and skill diversity [Smith et al. 2001]. This research reports on an investigation into the role of personality diversity within teams of tertiary students taking a course in software engineering. …A number of researchers have discussed the influence of team heterogeneity on successful team performance. Bradley and Hebert [1997] summarises the general conclusion of a number of studies as follows: For complex problem solving, such as information systems system development, teams made up of different types of individuals with a variety of skills, knowledge, abilities and perspectives are more effective than groups that are more homogeneous. In other words, diversity in skills and knowledge combined with a balance of personality types is desirable for effective teams. Bradley and Hebert [1997] emphasises the influence of personality type. They maintain that each personality type has a positive contribution to make to the overall effectiveness of the team and that a balance of personality types in a team should be sought. In an experiment involving two teams they found that personality types appear to be an important explanatory variable for differences in team performance. They conclude that teams that are heterogeneous in terms of personality type are more likely to create innovative solutions. In an extensive study spanning several years, Belbin [1981] defined eight team roles based on personality types. Belbin identified team structures in terms of his team roles and argues that it is possible to create a winning team by carefully selecting the right mixture of members in terms of their personalities and mental abilities. An experiment by Rutherfoord [2001] was based on the formation of software engineering project teams in a tertiary institution by grouping members according to their personality types as identified by the application of the Keirsey Temperament Sorter [Keirsey and Bates 1984]. Heterogeneous teams showed a more open, communicative and varied approach to problem solving and enjoyed the teamwork more than homogenous teams. This was consistent with the one of the prominent themes throughout the studies conducted by Belbin [1981]. Gorla and Lam [2004] consider the four dimensions of personality as identified by the application of the Keirsey Temperament Sorter [Keirsey and Bates 1984] to assess the personalities of the members of the software project teams in their study. They identified ideal personality types for three team roles (team leader, systems

analyst, and programmer, respectively) and concluded that the presence of the identified personality traits in each of the roles impacts positively on team success. They also linked team performance to the heterogeneity of personality dimensions identified between team leader and the rest of the team. Essentially these models emphasise the need for diverse personality traits in a team.

Text B: Effect of team diversity on software project performance

Adapted from Ting-Peng Liang, Chih-Chung Liu, Tse-Min Lin and Binshan Lin, 2017, Industrial Management and Data Systems (IMDS), 107(5), pp. 636-653.

In search of factors for successful team performance, researchers have examined various personality characteristics of team members. As software development is a labour- and knowledge-intensive task, teamwork in software projects has been long acknowledged as a crucial criterion for the successful design and deployment of software projects (Jiang et al., 2003; Gottschalk and Solli-Sather, 2007). Every software project will inevitably face the issue of team composition. It has interested researchers whether bringing diversity in team composition would promote successful teamwork and further lead a project towards fulfilment of its mission, vision, and values. To quantify successful team performance, researchers have studied the personality characteristics, interpersonal relationships and interactions among team members (Barki and Hartwick, 2001; Gottschalk and Karlsen, 2005). Previous research, however, has not shown any major consistent effects of team member diversity on work performance. Byrne's (1971) similarity-attraction theory suggested that similarity in interaction, value, and demographics are favoured virtues in team composition as they help maintain effective work environments. In contrast, some diversity theorists and group researchers (Cox et al., 1991; Jehn, 1995; Guzzo and Dickson, 1996) have proclaimed the benefits of diversity in workgroups. Current findings about the effect of diversity on team performance are mixed (Williams and O'Reilly, 1998). Therefore, further research is required to identify the factors underlying the relationship between team diversity and software team performance.

…This research provides a model to explain the effect of diversity on software team performance and an empirical study to test this model. We report two major findings. First, knowledge diversity (KD) significantly increases task conflict, and task conflict positively affects team performance. Project leaders can leverage the knowledge differences of members in order to achieve higher performance. Second, value diversity (VD) increases relationship conflict, which negatively affects performance. People with different backgrounds and belief systems are put together in a team, chances of disagreement and conflict among them increase. Hence, the diversity of values among team members should be minimized. Moreover, interpersonal relationships must be managed carefully in situations where team members have very different values. These findings will help decision makers manage software projects by selecting appropriate team members and effectively managing diversity in workgroups for project success.

Second, our empirical results highlight the importance of diversity among team members. This can help

management in human resource allocation and team building. Team members may differ in knowledge, social category, and values. These diversities influence the performance of a team. KD, as measured by differences in education and experience, is beneficial to a software team. This may be because that software projects are quite complex and need different skills at different stages of a project (Olla and Atkinson, 2004). Knowledge difference among members provides more flexibility in matching skills and tasks. Educational diversity may facilitate team members' learning from others, which in turn improves teamwork skills. Members with different professional experience may provide a variety of viewpoints and help improve the quality of decision making. These factors may save mission-critical projects at critical junctures (Liu et al., 2006). Project leaders can gain advantages by leveraging the knowledge differences of members.

Third, our study shows that VD increases relationship conflict. For example, some members are cautious, whereas some are bold. Some members prefer flexible, open-ended standards, while others prefer clear-cut rules. Differences in personal values among team members may reduce team efficiency. Therefore, VD among members should be minimized in software teams. For cases in which team members have very different values, interpersonal relationships must be managed more carefully. Effective management of VD in workgroups is an increasingly critical requirement for project success.

Finally, managers need to deal with conflict among team members during software development. Conflict is an important organizational process, and not all conflicts are harmful to performance. Constructive conflict, referred to commonly in the literature as cognitive conflict, occurs when team members debate differing task-related opinions such as team goals, key decision areas, procedures, and appropriate choices of action (Jehn, 1994; Pelled et al., 1999). Such exchanges help team members better understand issues surrounding the decision context and synthesize multiple perspectives to derive solutions that are superior to those made by any individual team member (Schweiger et al., 1989). For example, Amason (1996) found that cognitive conflict improves decision quality, consensus among team members, and commitment to decisions. Overall, relationship conflict may lead to negative emotions, such as anger and frustration directed at other team members, and thus it should be minimized for better team cohesiveness. This does not mean that we propose the elimination of drive and passion or the elimination of spirited discussions and debates. Indeed, in some cases these factors are helpful in developing creative and novel solutions to many challenges typically encountered in software projects (Barki and Hartwick, 2017).

Text C: The impact of value diversity on information system development projects

Ting-Peng Liang, Jason Chia-Hsien Wu, James J. Jiang, Gary Klein, 2012, International Journal of Project Management 30, 731–739

Successful completion of development projects is an important issue in the information systems (IS) domain as only 32% of IS projects are considered successful (Standish Group, 2009). Among the recognized factors in achieving desired outcomes to IS projects is composing the best team (Liang et al., 2007). However, one must

not look only to the competencies of the team members, but how well they work together to achieve desired goals. Diversity has come to be considered a prime factor affecting conflict, communication, and coordination behaviors that can impact the success of an IS development project (Liang et al., 2010). Diversity is a complex set of attributes that include perception, traits, knowledge, principles, and personal behavior. Social interaction among diverse individuals can lead to the emergence of new insights and effective learning that elevate team performance or add to detrimental conflict that detracts from effective performance of tasks (Bell et al., 2011; Ely, 2004; Jehn et al., 1999; Van Der Vegt et al., 2005; Wang et al., 2006). The final impact of diversity on performance of tasks will vary by the different forms of diversity that uniquely impact team accomplishment (Jehn et al., 1999). Three forms of diversity are generally recognized by researchers to include demographic diversity, informational diversity, and value diversity (Jehn et al., 1999; Liang et al., 2007). Each of these diversities implies different challenges and opportunities during team composition, task completion, and final team performance (Garrison et al., 2010; Jehn et al., 1999).

Demographic diversity is based on extrinsic traits such as age, gender, and ethnicity. Demographic diversity is potentially detrimental requiring an IS development (ISD) project manager control for the effects of increased conflict that can impede achievement of project goals (Garrison et al., 2010; Trimmer et al., 2002). Informational diversity derives from differences in education and experience that have built unique knowledge bases within each individual. Informational diversity appears to promote creative solutions to problems that arise through an increased critical examination of procedures and tasks, resulting in better team performance (Liang et al., 2010; van Knippenberg et al., 2004). Value diversity relates to individual beliefs, perspectives, and behaviors (Tyran and Gibson, 2008). In other words, value diversity means that team members differ in what they believe are the team's goal or mission or in the principles that must be followed in the pursuit of the goals or mission (Jehn, 1997; Liang et al.,2007). For example, team members who value quality probably disagree with team members who value efficiency on resource allocation, constraining goals of the project, and critical duties (Jehn, 1997). It is generally accepted that value diversity increases conflicts that detract from the accomplishment of team tasks (Barsade et al., 2000)…

Diversity theorists describe the relationship between team diversity, certain team behaviors, and team performance (Garrison et al., 2010; Harrison and Klein, 2007; van Knippenberg and Schippers, 2007). Based upon information-processing theory (Ancona and Caldwell, 1992), some researchers claim that diverse teams can have a positive impact on group performance through an increase in the innovations, information, and knowledge that diversity brings (Chung and Hossain, 2009; Earley and Mosakowski, 2000; Rink and Ellemers, 2006). On the other hand, others point out that team diversity reduces team performance (de Wit et al., 2011; Jackson et al., 2003; Mannix and Neale, 2005). This pessimistic view is based upon a social attraction perspective where people avoid communicating with those who hold views differing from their own as a means of reducing the strain produced by ensuing conflict (Williams et al., 2007). In short, informational diversity should lead to positive team outcomes by stimulating discussions and idea generation while demographic diversity could exhibit a negative effect by stifling participation or adding to harmful communication. In the ISD

project literature these effects tend to hold (Liang et al., 2010). As a third form, values are persistent beliefs that shape behaviors in individuals and groups (Jehn, 1994). Value is an important dimension in understanding attitudes and motivation. Therefore, value compatibility can enhance interpersonal relations and the degree of communication within a team (Hackman, 1990). Empirical evidence also demonstrates that values play an important role in team member relationships and team success (Wang et al., 2006). Consistent values, a lack of value diversity, maintain the mutual confidence and interaction among team members to complete tasks (Dose and Klimoski, 1999). In short, it is believed that similarity in team members' values will decrease conflicts, enhance interpersonal relations, and promote success (Jehn, 1994).