AN INVESTIGATION OF CULTURAL INTELLIGENCE AS AN ANTECEDENT TO VIRTUAL SOFTWARE DEVELOPMENT TEAM SUCCESS

Paul J. Ambrose, University of Wisconsin – Whitewater, ambrosep@uww.edu
John D. Chenoweth, University of Wisconsin – Whitewater, chenowej@uww.edu
En Mao, Nicholls State University, en.mao@nicholls.edu

ABSTRACT

Globalization spurred the rise of virtual software development teams. The complexity of managing a virtual team is rooted in the diverse cultural makeup of the team. Research increasingly recognizes that culture has significant implications for information systems. We propose in this study that the success of virtual software development team is influenced by cultural intelligence, a recent concept that relates to a person's capacity to recognize, understand, and utilize culture. Based on our review of existing literature on cultural intelligence and virtual teams, a research model is developed and corresponding methodology are discussed. We offer discussion on implications for this research.

Keywords: Cultural Intelligence (CQ), Virtual Teams, Theory Development

INTRODUCTION

Advances in information, communications, transportation and logistics technologies have fostered a global economy where nations, organizations, and individuals seamlessly interact across national boundaries. Constraints on having to collocate production and consumption environments have largely been lifted, and businesses now have the flexibility to globally distribute their value chains. As a result, not just an organization's value chain, but also the industry value chain can be globally distributed for economic, labor, and other benefits. Similar global dispersion is evident in software development. Organizations have taken advantage of the aforementioned benefits to develop software using global teams. A similar trend exists in the open source software development arena where globally distributed developers create and distribute open source software.

Work in such globally distributed value chains is typically carried out by teams whose members are not necessarily collocated, but in turn are globally dispersed as well. This is particularly evident in software development where teams collaborate using information and communications technologies to virtually plan, coordinate, and perform their activities. Success of such business or software development processes depends on the success of these teams. Appropriate management of these teams is critical for their success, and traditional factors such as leadership, motivation, rewards and punishment, and standard operating procedures are also applicable to teams that virtually collaborate. However, since virtual team members originate and are embedded in different cultural settings, it is important to consider the effect of cultural factors on team success.

It is generally accepted that culture is important in organizations and a pertinent issue to information systems management (Dorothy & Timothy, 2006; Hofstede, 2001; Kappos & Rivard, 2008). Recently, there is a rising level of research interest towards culture in the IS context (Kappos & Rivard, 2008). One driving factor is that the IS workforce in general is increasingly diverse in makeup and dispersed across cultures geographically. In particular, with the popularity of outsourcing and globalization, virtual software development teams are bound to be culturally diverse.

The current understanding of culture is fragmented (Kappos & Rivard, 2008). Culture can be quite elusive and difficult to pinpoint with a large number of definitions exist, yet people usually feel that they understand culture (Dorothy & Timothy, 2006; Pauleen, et al., 2006). It is then important to address whether the level of understanding has any impact on their behaviors. Hofstede, a prolific researcher on culture, wrote about how culture shapes organizational theories and behaviors (1996). More importantly, he demonstrates the phenomenon that some people are more attuned to cultural bias than others. The message is clear that the ability to acknowledge, detect, and comprehend culture is quite different one person to the next.

While cultural problems have been identified in software development teams as a critical dimension, many organizations chose not to develop strategies to

address cultural issues and some also limited their software development sites to similar cultures as a way of overcoming cultural challenges (Bose, 2008). In general people acknowledge cultures are different across organizations and nations. The question is how people capitalize on the differences or mitigate any challenges posed by culture.

In this research we focus our attention on managing the impact of cultural factors on virtual team success. Specifically, we introduce the concept of cultural intelligence (CQ), and detail how this impacts virtual team success. The scope of this research is not to identify all cultural factors that impact team success, but rather propose that cultural intelligence is essential to mitigate any issue that may arise on account of cultural factors. The essence of cultural intelligence is to understand the impact of an individual's cultural background on his/ her behavior, and measuring an individual's ability to engage successfully in any environment or social setting (Earley & Ang, 2003).

The rest of the paper is organized as follows. We first discuss relevant literature to expound the importance of cultural intelligence for virtual team success. Next, we present and discuss our research model. In the section following, we propose our research methodology to test the research model. The last section concludes the paper with additional remarks.

THEORETICAL BACKGROUND

Virtual Teams

Advances in communications technology coupled with cost-conscious staffing decisions and the need to find qualified personnel across the globe have led to the increased use of virtual teams. Virtual teams consist of geographically dispersed individuals using information technology to achieve a common goal. Increased research on virtual teams has mirrored the growth in use of virtual teams (Caya, Mortensen, & Pinsonneault, 2008). Much has been studied about the factors related to the success of virtual teams.

The effectiveness of virtual teams is related to the use of structured processes (Massey, Montoya-Weiss, & Hung, 2003), team member trust (Jarvenpaa & Leidner, 1999; Jarvenpaa, Shaw, & Staples, 2004), communication (Henderson, 2008; Hinds & Mortensen, 2005), team- and self-efficacy (Fuller, Hardin, & Davison, 2007) and task-IT fit (Maznevski & Chudoba, 2000). Obstacles to effectiveness include the degree of geographic dispersion (Huang & Trauth, 2008) and conflict (Hinds & Mortensen,

2005; Kankanhalli, Tan, & Kwok-Kee, 2007; Wakefield, Leidner, & Garrison, 2008).

These factors are often impacted by the degree of global dispersion of a virtual team. As expected globally dispersed virtual teams to have a high degree of cultural diversity. An increase in diversity has been shown to have an increase in conflict (Vodosek, 2007). Globally dispersed teams may also suffer from trust issues (Jarvenpaa & Leidner, 1999) and a lack of shared understanding among team members (Cramton, 2001). And cultural diversity often impacts communication as messages are misinterpreted (Shachaf, 2008).

Cultural Intelligence

General intelligence is defined as the 'ability to grasp and reason correctly with abstractions and solve problems' (Schmidt & Hunter, 2000). While the concept of general intelligence has a long history, specific intelligences such as social intelligence (Thorndike & Stein, 1937), and practical intelligence (Sternberg, et al., 2000) to name some, have been developed to understand and evaluate intelligence in specific domains. With an increase in cross-cultural interactions it was soon imperative to measure and evaluate cultural intelligence, so as to manage and enhance cross-cultural interactions, especially in a global workplace. Building on seminal work on cultural intelligence by Earley and Ang (2003), Ang and Van Dyne (2008) define cultural intelligence (CQ) as an individual's capability to function and manage effectively in culturally diverse settings.

Cultural intelligence is a multi-dimensional construct. Earley and Ang (2003) identify 4 dimensions of CQ – metacognitive, cognitive, motivational, and behavioral CQ. These dimensions are elaborated by Ang and Van Dyne (2008) as follows. *Metacognitive CQ* addresses an individual's conscious cultural awareness during cross-cultural encounters. This dimension taps into the ability of people to consciously question their cultural assumptions and adjust their cultural knowledge based on their cross cultural interactions. *Cognitive CQ* is the knowledge of different cultural norms, practices, and conventions which has been acquired by an individual through educational and personal experiences. This dimension thus taps into the level of cultural knowledge possessed by an individual. *Motivational CQ* addresses the capability of an individual to direct attention and energy toward learning about appropriate responses and functioning accordingly in cross-cultural interactions. This is considered an important dimension, as it is a source

of drive, and triggers effort and energy to function suitably in novel cultural situations. *Behavioral CQ* is the ability to exhibit appropriate verbal and non-verbal actions when interacting with individuals from different cultures.

A comprehensive nomological network of antecedents and criterion constructs of cultural intelligence was developed by Ang and van Dyne (2008). Antecedents presented in this nomological network include other intelligence correlates such as social, emotional, and practical intelligence, and distal factors such as ethnocentrism, demographics, biographical information, self-monitoring, self-evaluation, and personality. Criterions included in this nomological network are anxiety, apprehension, and uncertainty in cultural situations, performance, cultural adaption, and situational factors such cultural distance. Shannon and Begley (2008) identify 3 key antecedents to CQ that are important in a global work place – language acquisition, international work experience, and diversity of social contacts. These 3 antecedents are further elaborated from Shannon and Begley (2008) as follows. Language acquisition

refers to 'the extent to which individuals can speak easily and accurately in the language that cross-cultural interactions require'. This is considered critical to acquiring cultural knowledge reflected through an understanding of different cultures' economic, legal, and social systems and is related to cognitive and behavioral CQ. International work experience abets the acquisition of knowledge, skills, and behaviors that are critical for working in environments consisting of individuals from different cultures. This antecedent helps increase intercultural communication skills, adaptability, and flexibility, especially in volatile environments and is related to metacognitive, motivational, and behavioral CQ. Diversity of social contacts and extended contact with members of different cultures can help reduce stereotyping, and foster positive intergroup attitudes and social acceptance. This antecedent is related to metacognitive, cognitive, and behavioral CQ.
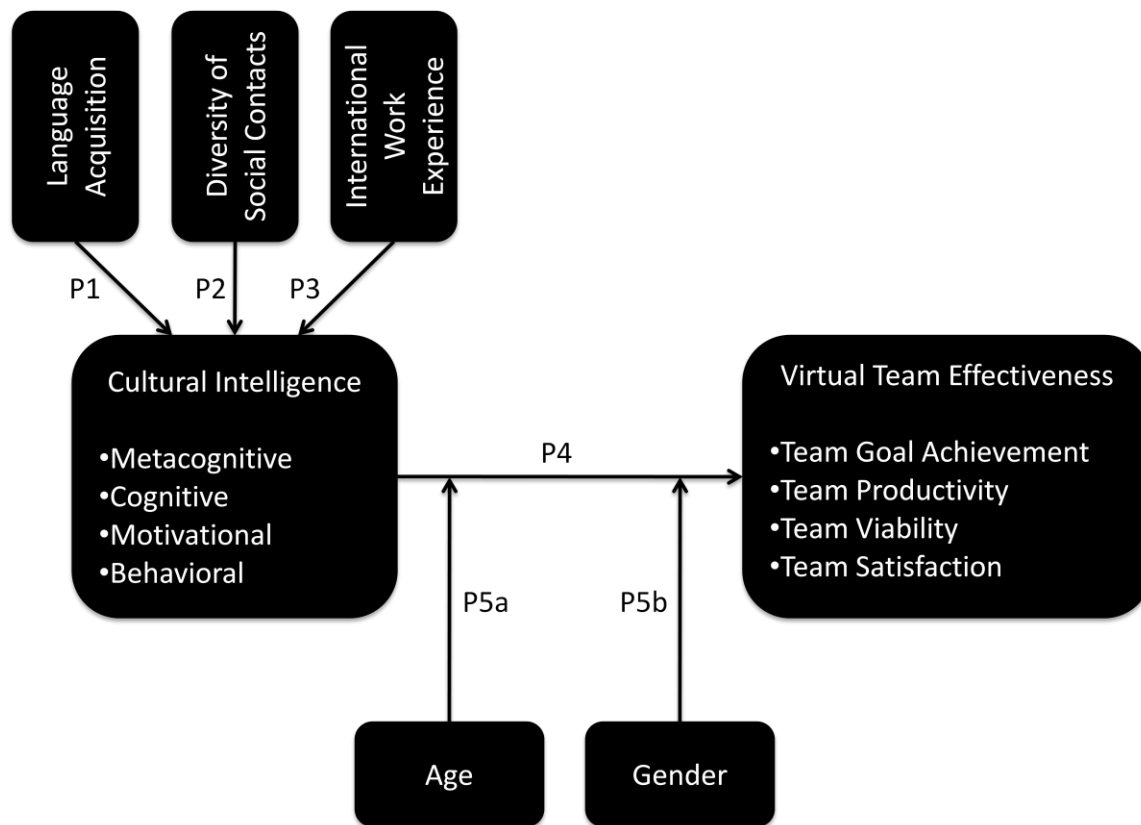
RESEARCH MODEL

Figure 1: Research Model

The research model shown in Figure 1 contains 5 propositions. Propositions 1, 2 and 3 present the antecedents of cultural intelligence. Proposition 4 is the main thesis of this research linking cultural intelligence to virtual team performance. Proposition 5a&b depicts the moderating effects of age and gender.

In this research, we conceptualize virtual team effectiveness along four dimensions: team goal achievement, team productivity, team viability and team satisfaction. *Team goal achievement* is defined as the extent to which the team meets its stated objectives. *Team productivity* is the degree to which an output meets or exceeds standards. *Team satisfaction* is the extent to which the team members feel good about their team. *Team viability* is the likelihood that the team would be willing to work together in the future.

Formal propositions are stated below:

Proposition 1: Language acquisition has a positive effect on cognitive and behavioral cultural intelligence.

Proposition 2: Diversity of social contacts has a positive effect on metacognitive, cognitive and behavioral cultural intelligence.

Proposition 3: International work experience has a positive effect on metacognitive, motivational and behavioral cultural intelligence.

Proposition 4: Metacognitive, cognitive, motivational, and behavioral cultural intelligence have a positive effect on virtual team goal achievement, productivity, viability, and satisfaction.

Proposition 5a&b: The impact of cultural intelligence on virtual team effectiveness is moderated by age and gender.

PROPOSED RESEARCH METHODOLOGY

The proposed model will be empirically evaluated by surveying global software development teams. A close-ended questionnaire containing Likert type scales will be used to measure the research constructs. The predictor, cultural intelligence, will be measured using the 20 item 4 factor CQ scale proposed by Ang, et al (2007). The criterion constructs will be measured using items recommended in (Cote & Miners, 2006; Prati, Douglas, Ferris, Ammeter, & Buckley, 2003; Sy, Tram, & O'Hara, 2006; Turner & Lloyd-Walker,

2008). Both the predictor and criterion are modeled as reflective constructs.

The questionnaire will be self-administered and the key respondent will be a virtual team member. Both team leaders and members will be surveyed. The unit of analysis is the virtual team. 3 – 5 organizations that employ globally dispersed virtual teams will be identified from a pool of organizations that the researchers have existing working relationships. These organizations will be used for the pilot and the main study. Teams that participate in the pilot study will not participate in the main study.

Covariance based structural equation modeling techniques implemented through software such as AMOS or EQS will be used to evaluate the measurement model. The structural model will be appraised using variance based structural equation modeling techniques such as the partial least squares and implemented using software such as SmartPLS. Traditional descriptive and scale evaluation statistical techniques will be used for initial data analysis.

IMPLICATIONS & CONCLUSIONS

As outsourcing and globalization continue to permeate organizations, the ability to understand and manage culture in the context of a virtual software development team will play a vital role in team success. Our research explores the applicability and relevance of cultural intelligence in such context. Our research has potential to pinpoint a critical step in preparing and planning for a virtual software team. Not only is it important to provide culture-specific training and knowledge, it is also necessary to train virtual team members to increase their capacity of cultural intelligence. CQ also can serve as a criterion for virtual team member selection. Our research has the potential to further the development of theory in virtual team management.

REFERENCES

Ang, S., & Van Dyne, L. (2008). Conceptualization of Cultural Intelligence: Definition, Distinctiveness, and Nomological Network. In S. Ang & L. Van Dyne (Eds.), *Handbook of Cultural Intelligence: Theory, Measurement, and Applications* (pp. 3-15). Armonk, NY: M E Sharpe.

Ang, S., Van Dyne, L., Koh, C., Ng, K.-Y., Templer, K. J., Tay, C., et al. (2007). Cultural intelligence: Its measurement and effects on cultural judgment and decision making, cultural adaptation and task performance.

Management and Organization Review, 3(3), 331-357.

Bose, I. (2008). Lessons Learned from Distributed Agile Software Projects: A Case-Based Analysis. *The Communications of the Association for Information Systems, 23*(34).

Caya, O., Mortensen, M., & Pinsonneault, A. (2008, October 10, 2008). Understanding Virtual Team Performance: A Synthesis of Research on the Effects of Team Design, Process, and States, from Available at SSRN: http://ssrn.com/abstract=1282095

Cote, S., & Miners, C. T. H. (2006). Emotional Intelligence, Cognitive Intelligence, and Job Performance. *Administrative Science Quarterly, 51*(1), 1.

Cramton, C. D. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science, 12*(3), 346-371.

Dorothy, E. L., & Timothy, K. (2006). Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. *MIS Quarterly, 30*(2), 357.

Earley, P. C., & Ang, S. (2003). *Cultural Intelligence: Individual Interactions Across Cultures* (First ed.). Stanford, CA: Stanford University Press.

Fuller, M. A., Hardin, A. M., & Davison, R. M. (2007). Efficacy in technology mediated distributed teams. *Journal of Management Information Systems, 23*(3), 209-235.

Henderson, L. S. (2008). The impact of project managers' communication competencies: validation and extension of a research model for virtuality, satisfaction, and productivity on project teams. *Project Management Journal, 39*(n), 48-59.

Hinds, P. J., & Mortensen, M. (2005). Understanding Conflict in Geographically Distributed Teams: The Moderating Effects of Shared Identity, Shared Context, and Spontaneous Communication. *Organization Science, 16*(3), 290-307.

Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organziations across Nations* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Huang, H., & Trauth, E. M. (2008). *Cultural influences on temporal separation and coordination in globally distributed software development.* Paper presented at the Twenty Ninth International Conference on Information Systems, Paris.

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and Trust in Global Virtual Teams. *Organization Science, 10*(6), 791-815.

Jarvenpaa, S. L., Shaw, T. R., & Staples, D. S. (2004). Toward contextualized theories of trust: the role of trust in global virtual teams. *Information Systems Research, 15*(3), 250-267.

Kankanhalli, A., Tan, B. C. Y., & Kwok-Kee, W. (2007). Conflict and Performance in Global Virtual Teams. *Journal of Management Information Systems, 23*(3), 237-274.

Kappos, A., & Rivard, S. (2008). A Three-Perspective Model of Culture, Information Systems, and Their Development and Use. *MIS Quarterly, 32*(3), 601-634.

Massey, A. P., Montoya-Weiss, M. M., & Hung, Y. T. (2003). Because Time Matters: Temporal Coordination in Global Virtual Project Teams. *Journal of Management Information Systems, 19*(4), 129-155.

Maznevski, M. L., & Chudoba, K. M. (2000). Bridging space over time: Global Virtual Team Dynamics and Effectivess. *Organization Science, 11*(5), 473-492.

Pauleen, D. J., Evaristo, R., Davison, R. M., Ang, S., Alanis, M., & Klein, S. (2006). Cultural Bias in Information Systmms Research and Practice: Are you coming from the same place I am? *The Communications of the Association for Information Systems*.

Prati, L. M., Douglas, C., Ferris, G. R., Ammeter, A. P., & Buckley, M. R. (2003). Emotional Intelligence, Leadership Effectiveness, and Team Outcomes. *International Journal of Organizational Analysis, 11*(1), 21.

Schmidt, F. L., & Hunter, J. E. (2000). Select on Intelligence. In E. A. Locke (Ed.), *The Blackwell Book of Organizational Principles* (pp. 3-14). Oxford: Blackwell.

Shachaf, P. (2008). Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study. *Information & Management, 45*(2), 131-142.

Shannon, L. M., & Begley, T. H. (2008). Antecedents of the Four-Factor Model of Cultural Intelligence. In S. Ang & L. Van Dyne (Eds.), *Handbook of Cultural Intelligence: Theory, Measurement, and Applications* (pp. 56-70). Armonk, NY: M E Sharpe.

Sternberg, R. J., Forsythe, G. B., Hedlund, J., Horvath, J. A., Wagner, R. K., Williams, W. M., et al. (2000). *Practical Intelligence in*

Everyday Life. New York: Cambridge University Press.

Sy, T., Tram, S., & O'Hara, L. A. (2006). Relation of Employee and Manager Emotional Intelligence to Job Satisfaction and Performance. *Journal of Vocational Behavior, 68*, 461-473.

Thorndike, R. L., & Stein, S. (1937). An evaluation of the attempts to measure social intelligence. *Psychological Bulletin, 34*, 275-285.

Turner, R., & Lloyd-Walker, B. (2008). Emotional Intelligence (EI) Capabilities Training: Can it develop EI in project teams? *International Journal of Managing Projects in Business, 1*(4), 512-534.

Vodosek, M. (2007). Intragroup conflict as a mediator between cultural diversity and work group outcomes. *International Journal of Conflict Management, 18*(4), 345-375.

Wakefield, R. L., Leidner, D. E., & Garrison, G. (2008). A Model of Conflict, Leadership, and Performance in Virtual Teams. *Information Systems Research, 19*(4), 434-455.

Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing, 60*(2), 31-46.