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GLOBAL VIRTUAL TEAMS PERFORMANCE MEASURING MODEL FOR GLOBAL SOFTWARE DEVELOPMENT PROJECTS

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By

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GLOBAL VIRTUAL TEAMS PERFORMANCE MEASURING MODEL FOR GLOBAL SOFTWARE DEVELOPMENT PROJECTS

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October 2017

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Global virtual teams (GVTs) comprise team members who are geographically dispersed, culturally varied and mainly depend on information and communication technology (ICT) for communication. Despite the advancement of technology, achieving the efficient performance of GVTs remains a challenge. The reviewed literature has highlighted the importance of training and development, organizational commitment and motivation in enhancing the performance of these teams. However, previous studies have shown that the measurement of GVT performance is lacking in terms of online training and development, organizational commitment, and motivation. Therefore, this study aims to identify the main challenges encountered by GVTs in global software development (GSD) projects; examine the relationship among online training and development, organizational commitment, motivation, and performance of GVTs in GSD projects; and propose a model.

A literature review was conducted, and the conceptual model was delivered to achieve the research objectives. Subsequently, a confirmation study that included an expert review, pilot study and survey were conducted among 103 respondents. Then, the performance measurement model (PMM) for GVTs in GSD projects was proposed based on the result of the confirmation study. Finally, a prototype was developed based on the proposed model. This prototype was validated through a survey conducted among developers and project managers. The proposed PMM includes four major components, namely, performance measurement processes, mapping strategy for performance evaluation, measurements and performance analysis. Finally, the PMM was verified by experts.

The result of the confirmation study showed the validity and reliability of the proposed model. The validity of the prototype was confirmed by project managers in IT companies. The result of the expert review confirmed that the PMM can assist project managers in measuring the performance of GVTs in GSD Projects.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

MODEL PENGUKURAN PRESTASI PEMBANGUNAN PERISIAN MAYA UNTUK PROJEK PEMBANGUNAN PERISIAN GLOBAL

By

ALI YAHYA GHENI

Oktober 2017

Pengerusi : Yusmadi Yah Jusoh, PhD
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Pasukan maya global (GVTs) terdiri daripada ahli-ahli pasukan yang berada di lokasi yang berbeza, pelbagai budaya, dan terutamanya bergantung kepada teknologi maklumat dan komunikasi (ICT) untuk berkomunikasi. Walaupun terdapat kemajuan yang pesat di dalam teknologi ICT, prestasi GVTs masih lagi mencabar. Kajian lepas telah menekankan kepentingan latihan dan pembangunan, komitmen organisasi, dan motivasi dalam meningkatkan prestasi pasukan. Kajian lepas yang berkaitan dengan prestasi GVTs 'menunjukkan bahawa terdapat kekurangan pengukuran prestasi GVTs dari segi latihan dalam talian dan pembangunan, komitmen organisasi dan motivasi. Oleh itu, objektif kajian ini adalah untuk mengenal pasti cabaran utama yang dihadapi oleh GVTs dalam projek Pembangunan Perisian Global (GSD), mengkaji hubungan antara latihan dan pembangunan dalam talian, komitmen organisasi, motivasi dan prestasi GVTs dalam Projek GSD, serta mencadangkan model. Sehubungan dengan itu, dalam usaha untuk mencapai objektif kajian, kajian literatur telah dijalankan danmodel konseptual telah dibangunkan. Seterusnya, pengesahan kajian yang merangkumi ulasan pakar, kajian rintis dan kajian selidik telah dijalankan terhadap 103 responden. Kemudian, berdasarkan pengesahan hasil kajian, Model Pengukuran Prestasi (PMM) untuk GVTs dalam Projek GSD telah dicadangkan. Akhir sekali, prototaip telah dibangunkan berdasarkan model yang dicadangkan dan disahkan melalui kajian yang dijalankan dalam kalangan pembangun dan pengurus projek. PMM yang dicadangkan merangkumi empat komponen utama iaitu proses pengukuran prestasi, strategi pemetaan untuk penilaian prestasi, pengukuran, dan analisis prestasi. Akhir sekali, PMM telah disahkan oleh pakar-pakar.

Keputusan pengesahan hasil kajian menunjukkan kesahihan dan keboleh penerimaan model yang dicadangkan. Kesahihan prototaip juga telah disahkan oleh pengurus projek di syarikat IT dimana kajian telah dijalankan. Hasil ulasan pakar yang

mengesahkan bahawa PMM berupaya membantu Pengurus Projek untuk mengukur prestasi GVTs dalam Projek GSD.

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I certify that a Thesis Examination Committee has met on 3 October 2017 to conduct the final examination of Ali Yahya Gheni on his thesis entitled "Global Virtual Teams Performance Measuring Model for Global Software Development Projects" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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I hereby confirm that:

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Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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LIST OF ABBREVIATIONS

AOT	Access to Online Training
AVE	Average Variance Extracted
CMV	Common Method Variance
CR	Composite Reliability
GPF	Global Virtual Teams Performance
GPF.PE	Global Virtual Teams Performance. Project Effectiveness
GPF.PF	Global Virtual Teams Performance. Project Efficiency
GSD Projects	Global Software Development Projects
GVTs	Global Virtual Teams
ICT	Information and Communication Technology
IPMA	Importance Performance Map Analysis
IS	Information Systems
IT	Information Technology
KPIs	Key Performance Indicators
LAN	Local Area Network
MO	Motivation
OC	Organizational Commitment
OC.AF	Organizational Commitment. Affective Commitment
OC.CN	Organizational Commitment. Continuance Commitment
OC. NR	Organizational Commitment. Normative Commitment
PBOT	Perceive Benefits from Online Training
PLS-SEM	Partial Least Squares- Structure Equation Model
PMM	Performance Measurement Model
SDLC	System Development Life Cycle
SSOT	Supervisory Support for Online Training
SUS	System Usability Scale
TPM	Technology Park Malaysia
WAN	Wide Area Network

CHAPTER 1

INTRODUCTION

1.1 Background

The operations of companies and organizations have become increasingly automated and computerized. These companies have also become increasingly dependent on often complex information technology (IT) systems. Large amounts of money are invested in IT projects aimed at developing, improving, and maintaining these systems (Von et al., 2011). Advances in IT, coupled with comparative pressures, have led to the growing use of global virtual teams (GVTs) for diverse activities such as product development, customer care, system design and programming, and building design construction (Erasmus et al., 2010). Essentially, GVTs are teams that are distributed across national boundaries and connected through advanced IT systems such as email, instant messaging, and video conferencing (Wildman & Griffith, 2015).The research on GVTs is important in the information system (IS) field because GVTs are dependent on information communication technology and the use of other technologies; GVTs also consists of people from different cultures (Yusof & Zakaria, 2012).

In measuring the performance of individual and team outcomes, many organizations develop a system. Some organizations concentrate on the team outcomes because they believe that the team bond would be threatened by focusing too much on individual performance. However, most organizations select team and individual outcomes. In face-to-face teams, individual output may be more obvious than that in a virtual setting. Therefore, GVT measures must include an explicit determination of individual contributions (Gibson & Cohen, 2003). For example, regarding team outcomes, organizations evaluate team outcomes such as creativity, quality, cost, quantity, and timeliness of deliverables.

Organizations evaluate the same outcomes at the individual level by measuring the extent to which each individual team member meets personal milestones and deadlines compared to the overall performance of the team (Gibson & Cohen, 2003).

1.2 Research Problem

Despite the technological advancement, GVTs still face many challenges in achieving their performance (Niazi et al., 2016; Rutz & Tanner, 2016; Saafein & Shaykhian, 2014; Saxena & Burmann, 2014; Batarseh et al., 2017). The reviewed literature in GVT performance has shown that many studies on this subject have been conducted. These studies highlight the importance of online training and development to the GVTs and its effect on its performance. The existing works present certain variables

such as online trainingand development and GVT performance. However, measuring these combined studies are still insufficient to achieve a high level of GVT performance and need to include measuring additional related variables to achieve high GVT performance. Training is lacking to prepare team members to work in global virtual teams (Brewer, 2015; Ruivo et al., 2014; Gladden, 2014; Lee, 2013). Furthermore, team training programs have had limited success within geographically diverse, virtually interactive teams, which reflects negatively on GVT performance (Wildman & Griffith, 2015). With the growing popularity of GVTs and the unique challenges faced in this area, researchers must investigate new strategies that will aid in managing these challenges (Wildman & Griffith, 2015; Lacerenza et al., 2015).

The results of the survey conducted by the researcher shows that certain factors affect GVT performance; these factors include cultural differences, language problems, time-zone differences, team size, technical problems, lack of trust, lack of sufficient training, and ICT problems. Finally, the researcher aims to propose a performance measurement model (PMM) to measure the GVT performance in global software development (GSD) Projects. Finally, a PMM will be proposed to measure the GVT performance in global software development (GSD) Projects.

1.3 Research Question

This section presents three research questions, which are as follows:

1. What are the factors that affect the GVT performance in GSD projects?
2. What are the key performance indicators (KPIs), measures, and variables for assisting the GVT performance in GSD projects?
3. How to measure the GVTs performance involving online training and development, organizational commitment, and motivation in GSD projects?

1.4 Research Objective

The research objectives are as follows:

1. to identify the factors that affect the GVT performance in GSD projects;
2. to examine the relationship among online training and development, organizational commitment, motivation, and GVT performance in GSD projects; and
3. to propose a model for measuring the GVT performance involving online training and development, organizational commitment, and motivation in GSD Projects.

1.5 Research Hypothesis

This section presents the research hypothesis and sub-hypothesis, which are further discussed in detail in Chapter 2. The five research hypotheses are as follows:

H1: Online training and development in GSD projects has a positive relationship with GVT performance in GSD projects.
H1 (a): Access to online training in GSD projects is related positively to GVT performance in GSD projects.
H1 (b): Developers' perceived degree of support for online training in GSD projects positively affects GVT performance in GSD projects.
H1 (c): Developers' perceived degree of benefits from online training in GSD projects positively affects GVT performance in GSD projects.

H2: Online training and development in GSD projects has a positive relationship with organizational commitment in GSD projects.
H2 (a): Access to online training in GSD projects is positively related to organizational commitment.
H2 (b): Developers' perceived degree of support for online training in GSD projects positively affects their commitment level.
H2 (c): Developers' perceived degree of benefits from online training in GSD projects positively affects their commitment level.

H3: Organizational commitment in GSD projects has a positive relationship with GVT performance in GSD projects.
H4: Organizational commitment mediates the relationship between online training and development in GSD projects and GVT performance in these projects.
H4 (a): Organizational commitment mediates the relationship between accessibility to online training in GSD projects and GVT performance in these projects.
H4 (b): Organizational commitment in GSD projects mediate the relationship between perceived support for online training in GSD projects and GVT performance in these projects.
H4 (c): Organizational commitment mediates the relationship between perceived benefits from online training in GSD projects and GVT performance in these projects.

H5: Motivation moderates the relationship between online training and development in GSD projects and GVT performance in these projects.
H5 (a): Motivation moderates the relationship between accessibility to online training in GSD projects and GVT performance in these projects.
H5 (b): Motivation moderates the relationship between perceived support for online training in GSD projects and GVT performance in these projects.
H5 (c): Motivation moderates the relationship between perceived benefits from online training in GSD projects and GVT performance in these projects.

1.6 Research Motivation

Reviewing the previous studies have highlighted the importance of training and development, organizational commitment, and motivation to the team performance. Thus, a model that includes training and development, organizational commitment, and motivation and examine the relationships among them and their importance to GVTs performance. Hosseini et al. (2013) recommended future grounds for research on GVTs to identify the main key performance indicators (KPIs) considering the driving forces behind migrating from traditional teams to GVTs and the primary objectives defined for GVTs in organizations, as well as determine the best tools to measure the performance of GVTs based on the defined KPIs.

1.7 Research Contribution

This research presents a PMM for GVTs to measure the GVTs performance in GSD projects involving online training and development, organizational commitment, and motivation, which can assist project managers to measure the GVTs performance. Also, this model represents the relationship among online training and development, organizational commitment, motivation, and GVTs performance in GSD projects, which can assist project managers to make correct decisions to support the GVTs performance. Finally, prototype developed based on this model and can be applied in IT companies those depend on GVTs in their work.

1.8 Research Scope

This study aims to examine the relationship among four variables: online training and development, organizational commitment, motivation, and performance of GVTs in GSD projects. Then, this study proposes a model to assist project managers in measuring the GVTs performance involving online training and development, organizational commitment, and motivation as well as GVTs performance in GSD projects.

1.9 Organization of the Thesis

The first chapter provides the introduction that includes the background of the study, problem statement, research objectives, and scope of research, research contribution, and thesis organization. Chapter 2 reviews the literature on the basic concepts of GVTs and provides important information to be considered in answering the research questions in Chapter 1. Chapter 3 explains the research methodology comprising the literature review, confirmation of the study, proposed model, prototype development, and model verification. This chapter also presents the results and findings of the confirmation/preliminary study (expert review and pilot study). Chapter 4 discusses the result of the confirmation study. Chapter 5 discusses the proposed PMM, including its main components. Chapter 6 discusses the prototype development and

implementation in detail, including the development methodology and prototype interfaces. The prototype implementation describes how the prototype is applied to virtual IT organizations, and finally, the results and findings of the functional test for the prototype. Chapter 7 presents results and findings of model verification and prototype validity. An expert review was conducted with experts to verify the PMM for GVTs in GSD projects. Also, a survey was conducted to validate the prototype. Chapter 8 presents the conclusion of this study and directions for future work.

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