A Conceptual model of Knowledge Worker Performance on Knowledge Work Productivity in Software Development process

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ABSTRACT
Knowledge work has become the main asset in competitive world business today. The management needs not only to increase the productivity in the traditional meaning, but also to increase knowledge work and knowledge worker productivity in the organizations. Moreover the most important part of the knowledge work productivity is how to increase the performance of knowledge worker. In the software company most of the process is tending to the knowledge-intensive activity and its success depend heavily on the developers’ knowledge and experience. A conceptual model will be proposed in a way describing the organization to improve the performance of knowledge worker. The methodology begins with a reviewing a theoretical foundation and expert review that provides the scientific basis for measurement knowledge work productivity indicator specifically for software development process. A questionnaire will be constructed in order to investigate the relation between the performance factors and knowledge work productivity. The respondents are software developers from Small Manufacturing Enterprise (SME). The data will be analysed using Structural Equation Modelling (SEM) to identify the significant direct relationship effect among the factors. The proposed model will be helpful for the software developers to identify the key performance indicator and assessing knowledge workers’ performance in SME company.

Keywords: Knowledge work, knowledge worker, knowledge work productivity

I INTRODUCTION
It's never doubt that knowledge worker's productivity will bring about fundamental changes in the very structure and nature of the economic system. According to Drucker (1999) the most valuable assets of a 20th century company were its production equipment and the most valuable asset of a 21st century institution will be its knowledge workers and their productivity. Knowledge work and knowledge worker productivity will increasingly become the key to national prosperity (Xiao and Dai, 2011). In the area of manufacturing today the knowledge worker contribution is important in the 21st century is to increase the productivity of knowledge work not totally base in the traditional measurement input and output. Drucker (1999) warned that improving knowledge worker productivity is the “first survival requirement” of developing nations. With the coming of a knowledge economy era, the knowledge work productivity, which is regarded as the biggest challenge of the 21st century (Drucker, 1999). The nature of knowledge work is complex, difficult to be observed and measured (Davis and Naunman, 1999). It's truly important in knowledge work is to recognize the influence factors of knowledge work (Yi and Shu, 2010). Knowledge worker's performance is absolutely essential to understand in order to improve knowledge work productivity (Xiao and Dai, 2011). Therefore, identifying and recognizing knowledge worker productivity performance is the biggest management challenge of the 21st century. The quality of knowledge worker becomes the emergence keys for the success knowledge work productivity. Other researchers (Davenport and Prusak, 2000; Drucker, 1999) stress the importance of quality as a factor determining the knowledge work. Knowledge work productivity itself emphasized on the quality aspect of knowledge work.

Improving knowledge worker productivity, is a very important part in the software development process and it can be optimized primarily (Davis and Naunman, 1999). In the software development process its widely accepted knowledge has to be managed in all stages of software development from the encapsulation of design requirements to program creation and testing, software installation and maintenance (Desouza, Awazu, & Baloh, 2006). According to Humphrey (1989) the quality of the software product is largely determined by the quality of the process. In fact, knowledge work productivity is a major factor has to be considered in reducing a good quality product in the area of software development (Erne, 2011). Knowledge worker performance factors are absolutely essential to understand and how far it can improve
knowledge work productivity. The complexity of knowledge work should not become an obstacle to explore the knowledge workers performance factors. Specifically the performance factor of knowledge worker needs to identify and analyses ultimately to improve the knowledge work productivity in software development area.

II PROBLEM STATEMENT
All such projects for software development processes are facing a risk. Human factors are recognized as a major factor cause the risk. Human factors comprise skill of workers, planning, risk management and teamwork’s. Factors like the lack of due diligence at the requirement phase and an important factor the level of skill in design and poor management judgments in selecting software engineers with the right skill sets (McManus & Wood-Harper, 2007). In that way is very difficult to create the process and data model outputs with their reality and practical knowledge of the business process. Weidong, Jixue, & Hawryszkiewycz (2007) mentioned that in order to achieve an outcome, most such processes require participants to have sufficient information and possess a high level of skill and expertise, and also require them to mutually collaborate and cooperate as well.

The survey, conducted by the Standish Group (2007) found that human factors play a significant role in the weakest of projects. This seemed to be a direct relationship between human factors and failure of the projects. A quarter of the benefits of IT projects are being lost by organizations across the globe because of management failures during a project’s life cycle (KPMG, 2010). Whittaker (2011); Verner & Cerpa, (2005) most common reason for project failure was poor project planning in two distinct areas. First, risks were not addressed as part of the project planning process.

While communication between teams and end users was still perceived as an issue within some projects. Weidong, Jixue & Hawryszkiewycz (2007) pointed out that the knowledge work productivity is one of the key factors that determine enterprise success. Many software projects are behind schedule and over budget, and do not always work as intended. Partly, these failures are due to issues with coordination, communication and knowledge (Tawee, Delaney, Arvanitis, & Lei, 2009). Costly IT failures are a grimly unsurprising part of 21st-Century life. But what’s revealing is not so much what went wrong this time, but why the same mistakes continue to be repeated decade after decade (Drew Robb, 2014). Based on the literature review, we found that performance of knowledge worker becomes a major issue for the development of the software projects. These issues’ has attracted more attention from the international community.

III LITERATURE REVIEW

A Knowledge Work
Knowledge work activities are determined by knowledge worker. Any activity either requires specialized knowledge or skills, or creates new knowledge is related to the knowledge work (Ware and Grantham, 2007). It focuses primarily on activities such as creating or applying information or knowledge to create value (Ware and Grantham, 2007). Thomas (2011) stated knowledge work is all work whose output is mainly intangible, whose input is not clearly definable, and that allows a high degree of individual discretion in the task. According to the definition some of the tasks for the knowledge work are: planning, acquiring, searching, analysing, organizing, programming, distributing, marketing, deciding, and numerous other tasks that require transformation of information from one form to another in order to produce the final “product”. Mostly important knowledge work is usually not an individual task, but is performed in cooperation and collaboration with others working in teams on complex tasks, which individuals cannot perform alone (Han & Williams, 2008; Pyöriä, 2005). Teams are viewed as a knowledge, integrating mechanism and it is through teamwork, individuals’ knowledge can be shared and mobile with the team (Erhardt, 2011). Improving knowledge works, related to the productivity is a vital challenge for the sustainable development and it can be optimized primarily involves the knowledge work (Davis and Naumman, 1999). Drucker, (1999). However, Davenport and Prusak, (2000) stress the importance of quality as a factor determining the knowledge work productivity. This also can be an important part in software development for improving the knowledge work productivity (Lepasaar & Miikinen, 2002).

B Knowledge Worker
Knowledge workers are those employees who have responsibility for exploring and generating ideas and concepts rather than concentrating solely on implementing or managing existing processes or operations within the organization. The knowledge worker is someone who is involved in the any activities related to the knowledge work (Drucker 1999; Mohanta, Kannan and Thooyamani, 2010). It means it has high degrees of expertise, education, or experience and the primary purpose of their jobs involve the creation, distribution or application of
knowledge. Subsequently knowledge work activities are related to the brain activities. It means skill; knowledge and information will be delivered during their work or activities.

C Knowledge Work Productivity
Productivity of knowledge work is mainly concerned quality aspect rather than quantity. Knowledge work productivity means the quality of work(Drucker, 1999). On the other hand, knowledge work productivity, is considered an integral part of the quality management process in order to achieve performance excellence. Consequently the quality improvement of knowledge works is necessarily important in order to improve the quality of the process. The challenge of performance improvement has been intensified with the struggle to manage quality in the workplace. Increased competition, international trade, and globalization have led multinational companies to focus on the concept of quality in the past few decades. Organizations have traditionally adopted quality management and performance improvement tools as a result of their need to reform in order to meet or exceed customer expectations (Flynn, Schroeder and Sakakibara, 1994). According to Juran ,(2004) and Akdere, (2009) quality management however is an integrated approach to achieving and sustaining high quality output, focusing on the maintenance and continuous improvement of processes and defect prevention at all levels and in all functions of the organization.

D Knowledge Worker Performance
Erne (2011) has stated that knowledge worker performances on knowledge work productivity are indicating expert performance across various industries. This refers to the specific parameters such as quantity and or quality of day-to-day work results, quality of interaction with different stakeholders, innovation behaviour with respect to business and or professional innovations, compliance with professional and or organizational standards. Davis and Naumman, (1999) has mentioned knowledge worker performance is depends on skills of knowledge workers.. It can achieve by performing knowledge worker with more expertise and creativity as well as by achieving more complete and timely results. These improvements are manifest in information technologies’ that either expand the scope, depth and completeness of activities or provides for the application of new methods that were previously not feasible. Technology plays an important role in the knowledge work environment today (Davis and Naumman, 1999). Davenport and Prusak (1998) discussed that technology has utilized widely and intensively to manage the data and information which is important part of the entire quality management cycle in an organization. Furthermore, appropriate of knowledge work information and technologies will determine the individual ability and skill in productivity of knowledge work (Davis and Naumman, 1999). To further increase productivity, information technology has become the core means for understanding the structure and function of knowledge work (Davis and Naumman, 1999). Much of the previous work is related to knowledge work tools and technologies. Hayman and Elliman (2000) proposed a design principle for the knowledge worker-computer interaction interface, claiming that consideration must be given to the way humans receive and process information. Yang (2011) pointed out that in order to further increase productivity; information technology has become the core means for understanding the structure and function of knowledge work. Another example, Frohlich and Plate (2000) developed a new input device that allows knowledge workers to intuitively specify three-dimensional coordination in graphics applications so as to enhance the work efficiency. Yi & Shu (2010) has put forward the concepts of human-information interaction efficiency during the knowledge work process, put forward that when human, information and tasks matched with each other, the human-information system (H-IS) interaction efficiency could be enhanced.

In the management context (Harris, 2010) has stated that one of the key factors for effective team of knowledge workers is an effective team decision making. Effective decision making is especially important for teams of knowledge workers considering that decision is often the product of these teams. The major benefits of effective team decision making are reduction of time needed to make decisions and improved decision quality. Spath, Davidson and Zachry (2004) stated that communication is an important part of the knowledge worker as a genre in the organization. They introduced a modelling method and software for visualizing, analysing, and enacting knowledge work productivity. Communication Event Models (CEM) are used to visualize the projects built from a record of all the communication events that members of a given project team participate in. McManus & Wood-Harper, (2007) state that communication is one of the important factors influences the ability of team members and stakeholders. Some require an innovative approach by introducing the procedure and standard of the tasks (Changjun and Zhenyi, 2006). The
organization depends on the knowledge works and creativity of knowledge workers. The impact of knowledge of process innovation was highlighted as the power of intellectual capital of knowledge workers is their ability to produce ideas that give a certain value (Rishikesha, K. T., & Ganesh, P. N., 2002). In software process development potentially allows Indian software developers to unleash their creativity and fulfill the potential for which they are internationally known. Within the organization the top management is urged to create an organizational climate in which honest failures are tolerated, creativity is rewarded and inter-functional and inter-divisional barriers are lowered (Rishikesha, K. T., & Ganesh, P. N. (2002). Furthermore, at the present the businesses have faced limited of effective way to support knowledge work in term of innovation, which results in a disappointing situation that the employee works enthusiasm and creativity are diminishing, particularly in knowledge, innovation team with high potential productivity (Li Xin, Shang Qin, & Dong Tian, 2007). It stated in literature that knowledge work productivity are related to the knowledge worker performance can be classified to the skill, technology, efficiency, collaboration and creativity of knowledge workers. These factors must be improved in order to enhance the productivity of knowledge work.

Table 1. Knowledge Worker Performance Factors.

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<th>Authors</th>
<th>Factors Contribute to the knowledge worker</th>
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<td>Han &amp; Williams, (2008); Pyöriä, (2005)</td>
<td>Collaboration</td>
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Based on above theoretical analysis, we composed a proposed model for describing the relationship between knowledge worker performance factors and knowledge work productivity was established. Figure 1 depicted of the overall proposed model.

IV A PROPOSED CONCEPTUAL MODEL

This study proposes a conceptual framework that is formed by five factors, namely skill and technology, efficiency, collaboration and creativity of knowledge worker as shown in figure 1. Skill and technology is one of the major factors that need to be considered and part of the measurement towards quality improvement in knowledge work productivity. Technology will enhance the effectiveness and efficiency of knowledge work. Innovation in knowledge work fundamentally based on new technology. Efficiency means "doing the thing right and it mainly concern for the efficient ways to manage the resources, eliminate waste and reduce cost. Management has recognized this factor as important part in business process and takes initial step for further improvement in the management task, resources and technology. Collaboration is the basis for bringing together the knowledge, experience and skills of multiple team members to contribute to the development of a new product more effectively than individual team members performing their narrow tasks in support of product development. Collaboration requires effective team work. Team members must trust and respect one another. There must be open communication and a willingness to accept input from others. In a dynamic business environment, knowledge work teams become more and more popular within high-tech organizations. Performance means the accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed. In a contract, performance is deemed to be the fulfilment of an obligation, in a manner that releases the performer from all liabilities under the contract. Performance measurement in knowledge work context does not per se differ from using performance measurement in a more traditional setting, but success factors in knowledge work are more resource orientated. The measures considering the results, external key stakeholders or processes are somewhat similar. In the knowledge work context, the role of knowledge worker is the main asset to emphasize. Knowledge worker equals the competencies, i.e. knowledge and skills. Lastly, the creation of better or more effective products, processes, services, technologies, or ideas that are accepted by markets, governments, and society. It also reflects the creative and novel fashion on a process which regards to the improvement effectiveness and efficiency or marketability.
V METHODOLOGY

The intention to identify a knowledge workers performance factors and to build a proposed model for describing a relationship evolve process steps of a knowledge work productivity in software development so that managers or knowledge workers can be dynamically organized and coordinate this factors to support various process activities and guide to the process. Morover to advance process steps towards process completion with higher efficiency and quality. Hence, it must provide ways to describe various process activities.

The methodology involves four phases’ namely theoretical studies, empirical study, framework evaluation and validation and a comparative study. In theoretical study, a literature review is conducted to understand the knowledge worker performance factors and productivity model proposed by Erne (2011). Based on this review knowledge worker performance factors are identify and proposed a conceptual model. The second phase is an empirical study that focuses on collecting data from software developers in SME by distributing a set of questionnaires. The sample of this study is 270 as register in SME company. The data will be analyzed using Structural Equation Modelling (SEM). SEM is chosen as statistical technique because it allows the analysis of all the factors simultaneously. The outcome is significant direct effects of quality factors towards knowledge work productivity. The third phase is modelled evaluation and validation. In this phase, the model will be evaluated and validated using a case study and expert review. The fourth phase is a comparative study with other works or methods to evaluate the knowledge work productivity. The study took place over a period of four months and fourteen semi-structured interviews, participation in five meetings, and several direct observations were carried out. In order to clarify themes and conceptions the material has been discussed with the knowledge workers in several informal meetings and thus ascertains reliability.

V CONCLUSION

This paper is based on the assumption that knowledge work productivity is a vital part of organization achievement. Specifically, our work aims to examine the relationship between knowledge workers and KWP in SDP. The model shall provide support for management practice and overcome the challenges in organizational knowledge work productivity. Therefore it is a hope that this model can be implemented in other working environment to overcome human failure from KWP aspect. A further study of the various factors related to the knowledge workers will be conducted to understand the various impact of the knowledge workers performance to the developers and the organization.

REFERENCES


