

## Knowledge Work Process: Software Developer's in Small Medium Enterprise

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### Abstract

*Managing knowledge work in the workplace is inherently important and accessible to the organizations for the long terms growth and performance. Software developer is a key successor for the organization success and knowledge work is viewed as the highest complexity of work characteristics. The intentions of software developers to improve the knowledge work process are remain unconsciousness. This paper will address the issue of knowledge work process and try to propose a method how to improve knowledge work process based on distinct methods and approaches. A literature review was used in order to distinguish the methods and will use data collected 300 respondents from Small Medium Enterprise (SMEs) in Malaysia and validate the methods by using structural equation modelling. Our results provide evidence on the importance of certain method to improve knowledge work on the software developers and business success, and have implications for both research and practice in the field of SMEs.*

**Keywords:** *knowledge work, Knowledge work process, knowledge worker, software developer's and small medium enterprise (SMEs)*

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### 1. Introduction

Managing knowledge in the advanced of technology has made greater sense entirely to the process and productivity of knowledge work. According to [1] the most important contribution management needs to make in the 21<sup>st</sup> century is similarly to increase the productivity of knowledge work and the knowledge worker and the most valuable assets of a 21<sup>st</sup> century whether business or non-business, will be its knowledge workers and their productivity.

The term knowledge work deal with the people who used formal knowledge as a major part of their job. By definition knowledge works is related to the any activities that require special knowledge or skill or creates new knowledge [2]. It involved a creative work solving unstructured problems that require exploration and creation of knowledge [3]. Reference [2] define it as "a set of activities using individual and external knowledge to produce outputs characterized by information content." Knowledge work precise more on the stronger communication needs, assign multiple role to the person rather than with the single job position and increase the importance of team work. It also comprises transactions, interactions and decision making that require the continuous revising and improving of the resource knowledge. It means all the activities related to the knowledge work stress the changes in the process and practice compare to traditional works [4].

It's never doubt that software developer as a knowledge worker will bring a fundamental change in the structure and process of knowledge work in the ICT infrastructure [3]. The structure and process of knowledge work adversely contrast to physical work which emphasize on the applying existing knowledge or create new knowledge of software developer's base on the work environment. It means the software developer who expertise in the particular area need to use their cognitive skill with engaging in the complexity of processes in the software development [2].

The process approach allows an end-to-end view of how best to structure, sequence, and measure work activities to reach targeted outcomes. However the nature of the process of knowledge work is difficult to describe [5]. The inputs and outputs of knowledge work ideas, interruptions, inspirations, and so on are often less tangible and discrete. There are no predetermined task sequences that, if executed, guarantee the desired outcome. Knowledge workers may operate by an intuitive feel for how to accomplish their work or through

accumulated experience. Although many of the researchers give more attention towards of the process in the knowledge work such [5] explain the reengineering and laissez faire methods emphasize the improvement of the process of knowledge work, [4] state the potential analysis of knowledge work aim to enhance the ability of handling knowledge and [3] state the process in the modeling of knowledge work infrastructure but lack of detail analysis related to the software developers. The classical model tries to adopt the input and output system for the creation of the intellectual assets, but still not configure with the structure and process analysis of knowledge work.

In the case of software developer, there is a widely used approach to measure knowledge work process orientation. Software Engineering Institute Capability Maturity Model (CMM), has introduced a method that allows the analysis of the different levels of process maturity has seen the two groups in a company that is in CMM Level 5, the highest level of process maturity, and the other two groups in the same company in Level 3. They found that, for the most part, mature processes experienced by many developers that enable and empower rather than coercion and isolation [6]. It means software developers experienced the increased processing orientation as positive [7].

Definition of SMEs has also changed. North American Industry Classification System uses measures such as: the number of employees and total revenue, depending on the industry. The European Union (EU) has created a uniform definition: independent companies with less than 250 employees and have either a turnover of less than 40 million euros or total assets of less than 27 million euro [8]. Most of the software developers work at the SMEs company [8]. But lack of the require knowledge and skill caused by less of financial or access to funding and working capital to create greater risk in SMEs [9]. Their lack of awareness of the importance of adopting best business practices and quality management systems, such as financial management and customer focused activities, in order to improve a company's productivity and profitability. Furthermore most of the projects were related to the failure of SMEs Company's associated with incorrect specification of requirements [10]. In the meantime the software organizations cannot properly manage their software process and the same mistake repeated after decade [10]. They lack awareness of the importance of adopting business best practices and quality management systems, such as financial management and customer focused activities, in order to enhance the firms' productivity and profitability [11].

### 1.1. The Proposed Method and Approach

In this part of research, we have identified and make a comparison based on method or approach to improve the knowledge work process. This method is adapted from knowledge intensity model [4] and work segments [7] which assess the relevance of knowledge work in a major work process and product or services. The higher of knowledge intensity, meaning the higher of the effectiveness of handling the knowledge and becomes an important factor of the knowledge work process.

According to this method the level of knowledge intensity determines the route to the knowledge work process. In cases of low knowledge intensity is related to the work efficiency and focus directly how to use resources efficiently (e.g. Shop floor production of bolts). But relatively the higher level of knowledge intensity means the process of knowledge work is complicated and use full of knowledge as central resources and will determine the level of standard handling the information, communication and decision making (e.g. an investment bank, school, research lab and software developers).

The second method is trying to impose, precisely in the process and knowledge activity. There are some key differences in process orientations among different types of knowledge work and workers. Based on the matrix shown in figure 2 there are four key types of knowledge work based on the degree of expertise and the level of coordination in the work [7]. The first approach focuses on the work of the transaction, which is usually more malleable in terms of process than others, because the work that is usually recurrent and knowledge-based workers formalities and procedures process. This means less knowledge of the activities undertaken and process flows into some form of computer-based applications. The systems measure the process and usually brings the work and all information and knowledge required to perform it to the worker.

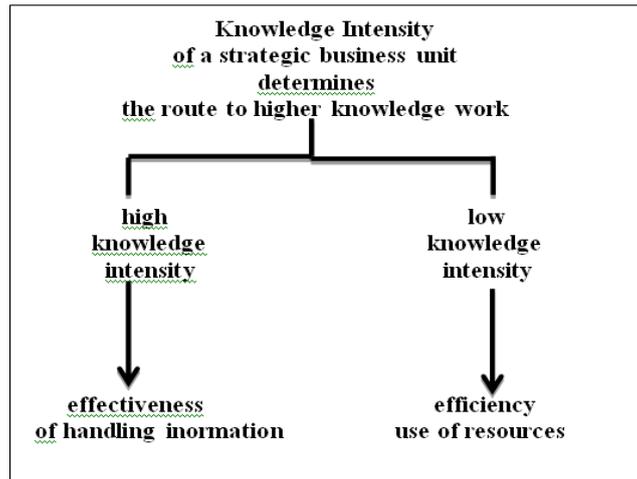


Figure 1. Potential Analysis for Knowledge work Process

Integration work is often quite structured, even higher levels of cooperation often lead to a more complex process. Employee-oriented integrated quite possible to adopt the intervention process. It is possible to articulate the process to be followed in the document, and employees usually have enough time and discretion to negotiate with the document. An important part of the process, but does not describe the practice, but must follow standard operating procedures within the organization.

Expert work can be made more process oriented, but they're experts often hold the process imposed. Usually, someone should give them the ability to overcome or step out of the process. These workers have a high degree of autonomy and discretion in their work, but most of the work applied technology to key aspects of the process. Most knowledge workers involved in the intervention process of knowledge creation in the intervention process. The last of the approach is collaborative work. It presents a challenge for process oriented managers and these workers typically have a more iterative, collaborative approach to work for which patterns are more difficult to discern. In this approach work structure can be denied and likely they always provide an intervention approaches to meet their task. Knowledge distribution and application is prominently work is this approach.

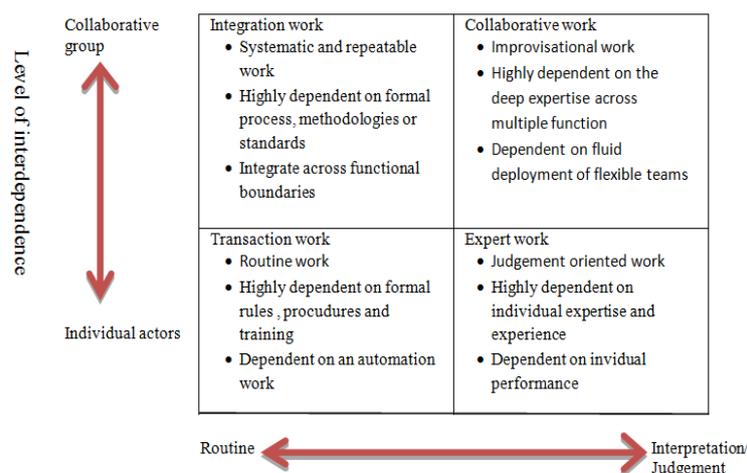


Figure 2. Approach to Knowledge work process

The most important for the software developer such as programmer is to think the process in terms of knowledge activities involved. It means the process can be deferred by whether the software developers can create knowledge, distribute or apply it. The process of knowledge creation is embedded in every single step of process in software development. The evaluation is needed to view a knowledge creation in the each stage of processes. But in the software development software developers sometimes need to apply the knowledge more than created it. It's very important for programmer to apply the existing knowledge to the program application which certainly exist. It seems like software developers become as integral which adopted process intervention, but highly structured work. But in another situation they need to collaborate with their peers across multiple function to complete the task.

### 3. Process Improvement Method for Knowledge Work in SMEs

Software developers have been described as highly skilled and creative employees [12] A knowledge work process much concentrate on thinking activities, collaborative and interactive which makes it difficult to structure. Even though the process is complicated, but in certain circumstances we can still view a knowledge work process based on the approach and method given above. In this part we try to make an overview and suggestion how to improve knowledge work process in SMEs company.

All the software developers have different skill and knowledge or knowledge work and we have describe there are some differences in term of process orientation. Based on the matrix showed in Figure 3 we can make a conclusion, software developers involve in the integration an collaborative work focusing on high knowledge intensity work. It means software developers are more on processes oriented, but still highly collaborated.

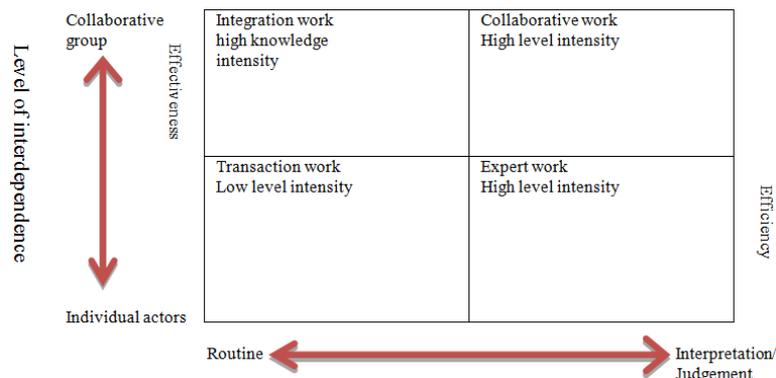


Figure 3. Combination approach of knowledge work

Software developers have to work with a participative and adopt any process changes if also have been party to design the system [7]. In a particular view participative change also typically yields more incremental change results and continuous in order to make improvements over time. An example of this type method would be agile development models which adopt and adapted for the development process of small companies. It's less focused on the specific steps to be followed in a process, but more oriented to composition of team work and highly iterative workflow [13]. Pair programming is such a practice that holds promise for overcoming some of the challenges. In pair programming two software developers such programmers working side-by-side on one computer collaborating on the same design, algorithm, coding or testing. This will create a new environment with the need to promote knowledge sharing and collaborative knowledge discovery across multiple function.

### 3. Research Method

The intention of identifying of knowledge works is to build a method for describing ways to evolving process steps of a knowledge work process so that managers or knowledge workers

can be dynamically organized and coordinate this method to support various process activities and guide to the process, in an individual basis, 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 work process model proposed by [4] and [7]. Based on this review the factors in knowledge work process are identified. In this research, we are focusing on the effectiveness and efficiency of the method. 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 300 as register in SME Company (SEM). The data will be analyzed using Structural Equation Modeling by using Partial Least Square Technique (PLS).

The third phase is modeled 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.

### 3.1. Data Collection

We conducted a cross-sectional study of SMEs in the software area in Peninsular Malaysia. Since our research gives more attention to the software developers under SMEs, a good practical reason in the choice of the Software Company, the researcher followed the EU definition of SMEs, excluding companies with less than four employees. A random sample of the SMEs, the software developer was created from company databases in Malaysia. These will phone and asked if they would confirm that their company used web pages, e-mail, or online systems for research purpose; if so, they were then invited to take part in the survey. In each SMEs company, the developers will survey by using an online survey by using questionnaires. All respondents hopefully will give contribution to this research. Each company had at least a web presence where individual customers or companies could find information about products and services.

### 3.2. Data Analysis

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. Partial least squares analysis (PLS) was chosen as the most appropriate tools in SEM to analyze our model. PLS is a confirmatory, second-generation multivariate analysis technique that is well suited for complex predictive models.

PLS has several advantages that make it well suited for our research the ability to handle reflective and formative indicators and robustness with respect to departure from multivariate normality as well as the ability to handle the multicollinearity found in some competency variables of our model. Furthermore, as with multiple regressions, PLS focuses on the model's ability to predict rather than just explaining the variability of the dependent variable, making it most useful in situations where the theory is still being developed [6]. In PLS the predictive ability of constructs is optimized and the performance of the individual scale items is reported. In reporting the results of these analyses, we start with the measurement models.

Formative items represent measures that affect the construct under study. Changes in the construct are therefore not expected to cause any changes in the indicators. As a result, items within a formative scale are not expected to correlate. Tests of convergent and discriminant validity based on the inter correlations between items are therefore not relevant for evaluating the psychometric properties of formative items. Instead, item weights are used to indicate how relevant each item is in measuring its latent construct.

The reflective items are believed to be caused by the latent constructs they are intended to measure. The Intercorrelations between the items are therefore expected. The psychometric properties of the reflective items were examined by analyzing their internal consistency in terms of their convergent and discriminant validity. Convergent validity was estimated based on the item loadings, and a loading of above 0.70 is recommended as this

indicated that at least half of the variance in each item could be accounted for by the latent construct.

#### 4. Conclusion

Firms must better manage two of their most precious asset knowledge and the people who create and possess it. Firms attempting to make their knowledge work processes more efficient and effective face a choice. They can adopt transaction approaches for knowledge work improvement that have been employed for the administrative and operational work. Or they can employ more collaborative approaches that rely on pair programming to design and evaluate their own activities. In most cases, however, we believe that organizations will benefit by choosing an intermediate participative course between the two extremes. Using the strategies we have discussed, companies can select methods and tactics that reflect the type of knowledge work, they are addressing, their organizational culture, and the business requirements for the change project. Of course, improvements to knowledge work are only one effort in a broad portfolio of improvement and change initiatives that managers must integrate.

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