The Influence of Communication Competence on Software Development Management Practices

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***Abstract*—This study investigates communication competences of Thai IT software developers whose works relate to software development practices. The results show that, two communication competence groups, Cognitive Complexity and Giving Task Information have relation to almost every practice, except metric practice. The other three groups, Low Individualism and Emotional Control, Oral and Written Reporting, and Receiving Utilizing Information also influence on some of the practices. The research results suggest both software industry and academic to concern human factors. However, these findings are limited to Thai IT Professionals.**

***Index Terms*—communication competence, project management practices, software development**

I. Introduction

Today, software is a vital factor for survive and success of organization. Timeliness and high quality software can support performing of organizations. Development of software then needs to handle with effective project management in order to increase the opportunity of successful of software. The proceeding of software project management practices are needed in order to lead to the success of the product [1]. According to the survey conducted by Standish Group [2], many software development organizations aware the importance of adopting management practices to improve the development processes. To manage the software development, communication is needed for smooth operation of various development tasks [2]-[7]. In the other word, a key threat of information systems project is improper communication. Therefore, communication competences of software developers are required. But, the required communication competences depend on specific attributes of each social group [8]. The software development career involves different functions from others so that the software developers should involve different communication competences.

In this study, we are interested to find out which communication competence of Thai IT Professionals influence on software development management practices. To answer this research question, we employ the software development management practices from Leung [1] as the dependent variables and the communication competences stated by Sriussadaporn-Chareongnam and Jablin [8] as independent variables.

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II. Theoretical Background

A. Software Development Management Practices (SDMP)

TABLE I. Common Software Development Management Practices

	Organizational Structure and Management Practices
1)	Have a software project management for each project.
2)	Have a software quality assurance plan.
3)	Establish a change control function for each project.
4)	Ensure user/customer input at all stages of the project.
5)	Ensure critical non-software resources available according to plan.
6)	Usage of prototyping methods in checking the requirements of the software.
	Standards and Procedures
7)	Formal assessment of risk, benefits, and viability of projects prior to contractual commitment.
8)	Application of common coding standards to each project.
9)	Formal procedures for estimation of effort, schedule and cost.
10)	Test planning prior to programming.
11)	Periodic reviews of status of each project by management.
12)	Formal procedures for passing over deliverables from one group to another.
13)	Independent testing conducted by users or Software Quality Assurance team.
	Metrics
14)	Record and feedback of estimated versus actual efforts into estimation process.
15)	Log post-implementation problems and track the effectiveness of solution.
16)	Existence of records from which all current versions and variants of systems can be quickly and accurately reconstructed.
	Control of Software Development Process
17)	Production of estimates, schedules, and changes only by the project managers who directly control the project resources.
18)	Have procedures for controlling changes to requirements, design and documentation, and code and specifications.
19)	Obtain signoff from all parties before changing project plans.
20)	Ensure testing/verification of every function.

There are many researches related to software development practices. Many of them studied only some particular practices such as software maintenance,

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schedule estimation, techniques, and tools [9]-[12]. However, there were a few researches that studied cover various aspects of SDMP. Dutta, Lee and Wassenhove [13] conducted a survey on software management practices in European communities. In the survey instrument, they divided software development practices into 5 areas which are organizational and management, standards and procedures, metrics, control of development process, and tools and technology. The questions of the survey were influenced by the previous researches, such as Capability Maturity Model (CMM), Europe's Bootstrap Model and Process Improvement and Capability dEterminator (SPICE) [13]. The researchers found that adoption levels are higher in some areas, such as organization and management, and control of development process. In contrast, the practices of metric, and tool and technology are less adopted by the European countries. In 2001/2002, Leung adopted the findings of Dutta, Lee and Wassenhove as a starting point for studying the situation of SDMP in China and Hong Kong. He selected only those practices with average adoption rate over 50% and arrived at 20 practices for his study as presented in Table I.

Verner and Cerpa [14] explored project management practices in order to provide a basic set of factors influenced the success of projects. They developed a questionnaire to collect data from Australian software developers. There were five aspects of project management: project manager, requirement analysis, cost/schedule estimation, risk assessment and post-mortems. The questions of this research consisted of 37 statements presented only, 9 questions correlated to the success of the project.

Even though Verner and Cerpa [14] provided a set of software development practices, the practices focused on only five areas of project management. These practices are different from the study of Dutta, Lee and Wassenhove [13], and Leung [1] which covered more aspects of the management practices. Furthermore, the Dutta, Lee and Wassenhove's survey questionnaire was conducted in wide range of countries in Europe. Hence, we adopt the set of SDM practices modified by Leung [1] as the independent variable in our research.

B. Communication Competency

In the communication competence study, there were a number of studies about the communication competences with the difference notions [15]. Most of researches defined the communication competence as knowledge of communicator's language and/or communication skills in various situations [15]-[18].

Communication knowledge referred to know how to comprehend that person, that context, and generative rules for managing the situation [19]. In this competence, the study of Spitzberg [19] covered task-relevant to procedure knowledge, strategies of knowledge acquisition, and knowledge dispositions. Sypher [20] suggested that communication occurs from human performance and the process by social action. As a result, social cognitive framework should be used in the study of this communication competence. His study involved perspective-taking, cognitive differentiation, self-monitoring, and listening.

Another competence is communication skills which embrace the actual performance of behaviors [15]. There were many studies conducted relate to communication skills [21]. The most cited skills are listening and written communication, oral presentation, persuading, interpersonal skills, and informational interviewing. Recently, Payne [15] identified eight skill sets which are common in the literature. These are listening, empathy, attentiveness, usage or articulation, altercentrism, interaction management, and adaptability.

In the Thai context, culture plays an importance role in communication. Most Thai people are Buddhists. Buddha's teaching influences the way Thai people communicate each other. It also involves in Thai culture. Therefore, communication competences for Thai may differ from the Western people. The study in Thai communication competences was conducted by Sriussadaporn-Charoenngam and Jablin [8]. In their research, culture aspects were included. They found that communication competences of Thai organizations could be defined by strategic communication, tactical communication and behavioral traits. These competences were categorized in to 17 groups as showed in Table II.

TABLE II. CLASSIFICATION OF COMMUNICATION COMPETENCES

Communication knowledge
1) Low individualism and emotional control
2) High power distance
3) High uncertainty avoidance
4) Low masculinity
Communication skills
5) Giving feedback
6) Feedback reception
7) Oral and written reporting
8) Information sharing
9) Receiving and utilizing information
10) Seeking information
11) Giving task information
12) Reducing task uncertainty
13) Advising
14) Persuading
15) Networking
Behavioral traits
16) Empathy
17) Cognitive complexity

III. METHODOLOGY

The target population of this research was Thai IT professionals who were working related to some processes of software development in software companies. Unfortunately, there is no any record of what the exact number of population is. Hence, the needed sample size was calculated according to sampling method provided by W.G. Cochran Infinite Population (1953). In this case, the sample size is 384 with 95% confident rate, 50% sampling percentile, and 5% tolerance.

To collect data from the sample, we selected the companies which registered their businesses in software

counseling and procuring category which arranged by the department of Business Development, Ministry of Commerce, Thailand in 2011. Referred to this registration, there were 3,426 companies around the country. The classification of these companies by regions is shown in Table III.

TABLE III. NUMBER OF SOFTWARE COUNSELING CLASSIFIED BY REGIONS OF THAILAND.

Regions	Number of organizations	%
Central	2,838	82.84
Northern	180	5.25
Northeast	76	2.22
East	146	4.26
West East	16	0.47
Southern	170	4.96
Total	3,426	100

According to data presented in Table III, the largest proportion of IT businesses situates in the central of Thailand. This proportion is more than 80%. This means that the organizations in the central region should cover all types of IT businesses. As a result, we decided to collect data from the IT professionals who are employed by these organizations. Although, the sample size was identified, we could not random our respondents from the population because the participation is required. Therefore, we picked up the registered companies and ask for their cooperation. If they were willing to participate, we asked for the number of IT workers. From the total 400 questionnaires sent out, we got back 147 copies (38.28% of the sample size) from 39 cooperation companies.

With respect to the objective of this research, the questionnaire was employed to obtain opinions from the respondents. The questionnaire was separated into three sections. The first section composed of eight items related to respondent information. The second section consisted of 80 items of communication behaviors or skills associated with respondent communication competent. Respondents were asked to rate their communicative behaviors or skills. The last section contained all 20 items about SDMP.

As stated in the previous sections, this research adopts the research models from Leung [1] and Sriussadaporn-Charoenngam and Jablin [8]. The questions from both findings were translated into Thai and verified by 3 English experts. Two of them are Thai people who directly studied department of Language and Communication. Another one is a foreigner who is English native speaker, born in Thailand and studied Thai language for many years. Items of both communication and management practices asked the respondents to indicate their opinion on five-point, Likert-type scales (5 = strongly agree, 1 = strongly disagree).

To ensure that the Thai questionnaire is reliable, thirty software developers were asked to finish the pretest. One question in the communication section was revoked because of negative question commented by the respondents of the pretest. Overview, the cronbach's coefficient alpha of the communication competences is .934. However some items of three communication competences (Giving Task Information, Reducing Task Uncertainty and Advising) were dropped to improve their reliability. After dropping items we mentioned above, over all inter-rater reliability increased. In case of SDMP, the overall coefficient alpha was .942. Table IV illustrates the reliability of the communication competences and SDMP.

TABLE IV. CRONBACH'S COEFFICIENT ALPHA OF THE COMMUNICATION COMPETENCES AND SDMP

Variables	Cronbach's alpha
Communication Competences	
Low individualism and emotional control	.765
High power distance	.727
High uncertainty avoidance	.823
Low masculinity	.575
Empathy	.786
Cognitive complexity	.817
Giving Feedback	.746
Feedback reception	.711
Oral and written reporting	.654
Information sharing	.694
Receiving and utilizing information	.552
Seeking information	.935
Giving task information	.533
Reducing task uncertainty	.583
Advising	.935
Persuading	.618
Networking	.932
SDMP.	
Organization Structure and Management Practices	.764
Standards and Procedures	.858
Metrics	.810
Control of Software Process Management	.816

Because we are interested to discover which communication competence influences on the SDMP, stepwise regression analysis is employed to answer this question. According to the criteria for utilizing regression analysis, multicollinearity tests were performed. The variance inflation factor (VIF) and the condition index (CI) are the statistics generally used to test the collinearity. VIF is an index of the effect of other predictor variables on a regression coefficient. If the regression model contains a high VIF, it means that there is a high degree of collinearity or multicollinearity [22]. Generally, the accepted VIF is not greater than 10.0. In this study, VIFs ranged from 1.063-1.566 which well below the threshold value.

Additionally, CI is also employed to measure the presence of collinearity. If the value of CI is larger than 30 and the proportion of variance for each regression coefficient is .90 or above for two or more coefficients, these indicate a problem of collinearity [22]. In case of our study, all CIs are less than the threshold value. Together, these two collinearity diagnostics indicate no problem associated with multicollinearity in the research data.

IV. FINDINGS

A. Demographic Data

Table V illustrates the demographic data of individuals. The responses show that the most respondents are male

(72.1%) and age between 25-29 years. They graduated bachelor degree and currently work as programmer or developer. They have worked in their currently position about 1-5 years. Most of them have worked in the currently company and have experienced related to software project for more than 1 and less than 5 years.

TABLE V. GENERAL INFORMATION OF RESPONDENTS

Variables	Total (N = 147)	
	Count	%
Sex		
Male	106	72.1
Female	41	27.9
Age		
20-24 years	26	17.7
25-29	59	40.1
30-34	42	28.6
35-39	14	9.5
40-49	6	4.1
Education Level		
Below bachelor degree	9	6.1
Bachelor degree	142	96.6
Master degree	43	29.3
Doctor of philosophy degree	1	.7
Work Position		
Project manager	17	11.6
System analyst	20	13.6
System analyst assistant	2	1.4
Graphic designer	11	7.5
Programmer/ Developer	57	38.8
Database Administrator	1	.7
Network Administrator	4	2.7
System Tester	7	4.8
IT Support	14	9.5
Others	14	9.5
Work position period		
Under 1 year	30	20.4
1-5 years	82	55.8
6-10 years	28	19.0
11-15 years	4	2.7
16-20 years	2	1.4
More than 21 years	1	.7
Year of work in Organization		
Under 1 year	43	29.3
1-5 years	75	51.1
6-10 years	23	15.6
11-15 years	4	2.7
16-20 years	2	1.4
Number of years related to Software Project		
Under 1 year	27	18.4
1-5 years	64	43.5
6-10 years	35	23.8
11-15 years	17	11.6
16-20 years	3	2.0
More than 21 years	1	.7

With respect to the communication competences and SDPM, the results in Table VI show that the respondents rate their opinions as moderate agreement to SDMP. The average scores of all SDMP are not too different. They got scores around three. Generally, the respondents think they have reasonable communication abilities. The highest average score of the communication competence is giving task information while as networking is the lowest mean score.

TABLE VI. DESCRIPTIVE STATISTICS OF COMMUNICATION COMPETENCES AND SDMP

	Mean	Std. Deviation
Software Development Management Practices		
Standards and Procedures	3.8047	.68880
Control of Software Process Management	3.7670	.71353
Organization Structure and Management Practices	3.7222	.66448
Metrics	3.6168	.81122
Communication competencies		
Giving task information	4.0782	.63219
High power distance	3.9847	.53172
Advising	3.7959	.73035
Cognitive complexity	3.7789	.55041
Seeking information	3.7211	.83580
Receiving and utilizing information	3.5692	.61712
Information sharing	3.4201	.55297
Empathy	3.4041	.51947
Persuading	3.3197	.76960
High uncertainty avoidance	3.2503	.43301
Low individualism and emotional control	3.2016	.43980
Oral and written reporting	3.1723	.64973
Giving feedback	3.1440	.57393
Feedback reception	3.0272	.57868
Low masculinity	2.9252	.61414
Reducing task uncertainty	2.2993	.94300
Networking	2.2903	.65696

B. The Influence of Communication Competence on Software Management Practices

The results of stepwise regression analysis showed in Table VII reveal that the SDMP are influenced by 5 communication competences. These are cognitive complexity, giving task information, receiving utilizing information, oral and written reporting, and low individualism and emotional control. Almost every dimension of software development management practices is promoted by cognitive complexity and giving task information. While cognitive complexity does not effect on the organizational structure and management practices, giving task information does not involve in the metrics practice. In addition, low individualism and emotional control influences on only standards and procedures, and metrics whereas oral and written reporting also affect organizational structure and management practices, and control of software development process.

With regards to the findings from this research, we can conclude that giving task information and cognitive complexity are the common communication competences. According to the study of Sriussadaporn-Charoenngam and Jablin [8], giving task information emphasizes on explaining clearing task procedures and allowing team members to question while as cognitive complexity concentrate on capability of proposing creative ideas, describing what is going on, and analyzing and envisaging situations. These common communication competences correspond to the focus of SDMP because the software development projects are complex and require information exchange. This kind of projects is normally limited with a time frame [23]. Therefore, ability to describe tasks to perform to members can

promote fast performance and corporation. Moreover, outputs from each task should be accurate which leads to high quality and reduce reworks [24]. Similarly, cognitive complexity is also required as a competence for SDMP as it should help the project to overcome problems which may occur during the processes of software development.

TABLE VII. INFLUENCE OF COMMUNICATION COMPETENCIES ON THE SOFTWARE DEVELOPMENT MANAGEMENT PRACTICES

Dependent Variables	Independent Variables	B	Std. Error	Beta	t	Sig.	tolerance	VIF
Organizational structure and management	Constant	.969	.361		2.684	.008		
	Giving Task Information	.302	.081	.288	3.715	.000	.824	1.214
	Receiving and Utilizing Information	.247	.085	.230	2.918	.004	.795	1.257
	Oral and Written Reporting	.201	.080	.197	2.509	.013	.804	1.243
	R = .543	adjusted R^2 = .280		R^2 = .295	F = 19.900	p < .005		
Standards and procedures	Constant	.427	.452		.945	.346		
	Giving Task Information	.315	.094	.289	3.363	.001	.656	1.524
	Cognitive Complexity	.321	.109	.257	2.950	.004	.639	1.566
	Low Individualism and Emotional Control	.275	.113	.175	2.442	.016	.938	1.066
	R = .555	adjusted R^2 = .293		R^2 = .308	F = 21.173	p < .005		
Metrics	Constant	.374	.543		.689	.492		
	Cognitive Complexity	.521	.113	.354	4.628	.000	.940	1.063
	Low Individualism and Emotional Control	.397	.141	.215	2.819	.006	.940	1.063
	R = .457	adjusted R^2 = .198		R^2 = .209	F = 18.998	p < .005		
Control of Software Development Process	Constant	.779	.390		1.997	.048		
	Cognitive Complexity	.298	.116	.230	2.571	.011	.613	1.632
	Oral and Written Reporting	.239	.085	.217	2.811	.006	.822	1.216
	Giving Task Information	.271	.099	.240	2.747	.007	.644	1.553
	R = .546	adjusted R^2 = .283		R^2 = .298	F = 20.222	p < .005		

Nevertheless, the organizational structure and management practice is not be influenced by cognitive complexity. This may be because this management practice involves activities related to establishing organization of the project and planning which possibly will not require this ability. The activities of this practice could require receiving and utilizing information, and oral and written reporting competences in order to set the proper project plan. During planning process, stakeholders should be involved to provide information as it is valuable for the project manager to modify the plan. Moreover, to improve cooperation among project stakeholders, the written plan is necessary [25].

Surprising, receiving and utilizing information, and giving task information are not involved in the metrics practice although they relate to record and provide data occurring during the preceding of the project. When we consider the influenced communication competences for this practice, we found cognitive complexity and low individual and emotional control. Cognitive complexity already reflects receiving and utilizing information. Lack of this competence, it may be difficult to have the cognitive complexity competence. Metrics practice can tell us what went wrong in the project. Hence, metrics should be established and focuses on collecting data in order to tracking and finding the variance of software development processes, which can help project managers to perform their tasks. Therefore, cognitive complexity also affects on this practice. On the other hand, low individualism associates with Thai culture. This type of culture allows Thai IT professionals to express and perform in order to harmonize with others [26]. This leads to positive impact on the project because they have to do good jobs.

In case of the standards and procedures management practice, almost the same communication competences

appear in the metrics practice. Having giving task information involved in the standards and procedures practice may be due to the nature of this practice which needs undoubtedly information to follow the standards.

With regarding to the control of software development process, not only the common communication competences but also oral and written reporting influences the practice. The practice gives attention in controlling resources, changing to requirements and documentation, obtaining sign off, and testing and verifying functions. All of these practices normally require this good competence to present and prepare documents to all parties.

Although adequate networking competence is required for expanding their own knowledge [27], Thai IT professionals rate for this competence quite low. This may be due to occupational culture that IT professionals prefer interacting with people in their groups rather than others [28].

V. Conclusion

The success of the software projects not only depend on technologies, but also the ability to communicate. This research attempted to answer, "Which do communication competences of Thai IT professionals influence the SDMP? The results from the research allow us to summarize that there are two common communication competences which are giving task information and cognitive complexity and other three competences which include receiving and utilizing information, oral and written reporting, and low individualism and emotional control.

These findings suggest us that if Thai software development organizations want to improve the success of projects, communication among team members could encourage their employees to develop the ability to generate new solutions, analyze and forecast circumstances and ability to explain information of works, including oral and written. As a result, in some instances, Thai IT companies should set the minimum communication competences for IT personnel. This recommendation also forwards to education. Thai universities should modify their IT curriculums. They should not contain only technical courses but also soft skills, especially communication competences. The competences listed above should be considered. Otherwise, graduated students may face difficulty when they go to the Thai IT industry. Moreover, communicative facilities are also essential, especially, when distance is involved.

This research has several limitations. Firstly, as this study is the exploratory research, the findings are derived in forms of statistics. Lacks of qualitative data results in inadequate rich information to explain situations. Secondly, the samples of this research are IT professionals working in IT outsourcing companies in Thailand. Consequently, using the results should take caution even to other IT organizations in Thailand because the organization settings in non-outsourcing businesses are different. Thirdly, SDMP were borrowed from the study of [1] which may not really match to the practices of Thai IT professionals. Finally, even though we employed the communication competences studied in Thai context, confirmation of these competences should be conducted. In the future, researchers should strive to obtain qualitative data. In-depth interviews would be helpful in further explaining why and how the communication competences influence the SDMP. Extending samples to other organizations would create perfectly conceptualization. In addition, survey of the status of SDMP for Thai organizations should be conducted. If there is Thai SDMP, replicated studies should be performed.

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