A Case Study on Implement Software Development Using Hybrid ISX

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Abstract **- To succeed in software project management, practitioners should consider the systemic software development methods which are consistent with the factors that influence successful software development projects. These factors include projects, organizations, team leaders, customers, personnel and process methods. Although, SCRUM, XP and Quality Management System Standard ISO 9001 are a few of the popular methods today, there is no one particular method that is consistent with all factors and covers all sides. Therefore, this paper presents the development of a software framework with a hybrid method approach comprising of ISO 9001, SCRUM and XP (Hybrid ISX). The developed software framework consists of five parts; 1) the discovery, 2) sprint planning, 3) sprint, 4) release and process improvement, and 5) monitoring. This particular framework was tested by two companies, and the results showed that the quality of the software delivered to customers increased significantly. Not only the preparation of projects, but also project estimated duration and project completion showed signs of improvement. Moreover, a review by staff after using the software confirmed they had a deeper understanding and more knowledge of each process.**

Keywords **- Software Development, ISO 9001, SCRUM, XP**

I. INTRODUCTION

Agile, the software development procedure is now known as one of the most popular software development methods today because of its efficiency and fast software transfer compared to original software development such as [1] SCRUM and XP (Extreme Programing). These 2 popular methods of software development have been integrated with agile because they add the strength of SCRUM project management combined with the software development procedure of XP [2]. However, by applying a document control system together with the Agile software development, an increased efficiency of sophisticated software maintenance could be achieved [3]. Apart from the good process of software development, the system would require supportive factors which are organizations, leaders, processes, teams, personal, project and customer which leads to a success in software development projects [4]. The study of [5] shows that integrating ISO 9001 standards, SCRUM and XP together contributed to supportive factors for a successful software development.

This paper presents the development of a software framework with a hybrid method approach comprising of ISO 9001, SCRUM and XP (Hybrid ISX) which is a new method for software development. This hybrid method should be able to solve software development failure in a prescribed time frame.

II. HYBRID ISX

According to gathered documents and related researches, software development framework is applied by ISO 9001, SCRUM and XP (Hybrid ISX) which is composed of 5 procedures. Those procedures are discovery, sprint planning, sprint, release, and monitoring respectively. Each procedure consists of 5 parts, factors, people (product owner, scrum master, scrum team, and auditor), tools, practices, and evaluation. (Showing in fig. 1).

III. RESEARCH METHODOLODY

A group of samples were selected using purposive sampling. The two samples were ware software houses in Thailand, certified by ISO 9001 because each case study had sophisticated and various body of knowledge which are enough to identify whether a Hybrid ISX is appropriate to their house [6]. The information was gathered from a managing director, software development manager, software development team and software users or customers. Hybrid ISX will be applied to these 2 companies and the software will be delivered to each company 3 times. This study will be conducted by gathering information from the followings methods.

• The questionnaire on "Supportive factors of success in Software development" consists of these measurements, organization, leader, process, team, personal, project and customer. The questionnaire will be handed in by all participants after completing hybrid ISX training and again after the software has been delivered 3 times.

• The evaluation of the Hybrid ISX recognition using the Technology Acceptance Model (TAM) [7] which is accepted by 5 software professions, had IOC equal to 0.87. In other words, the information and objectives of the questionnaire are in concordance. This evaluation will be conducted after transferring software 3 times.

• In depth interview by using a purposive sampling method – The participants of each company will be interviewed according to a draft set of questions.

IV. RESULT AND DISCUSSION

This research was conducted by employing 2 samples, which are represented by company A and company B. Company A is a software house company which develops software packages, consisting of 50 employees. The software development projects of company A are mostly about software improvement and increasing the capability of programming to respond to market demands. A few project developments from company A may include extra campaigns apart from normal software packages. Moreover, this evaluation has 9 participants from a managing director, software development manager, software development team and software users or customers. Another sample is company B. Company B is a big company consisting of 200 employees and many sub-companies. It has an established software development department to develop software for its own sub-companies including the other company departments. The software development projects of company B are mostly about developing new programming or new reports to respond to sub-companies and other department demands. This evaluation had 12 participants from a managing director, software development manager, software development team and software users or customers. Thus, this research was composed of 21 participants in total.

The comparison result of supportive factors of success in software development of these 2 companies, before and after applying Hybrid ISX showed that before, the level of all 7 dimensions of supportive factors of success was low but after applying, the level of success was higher. The average value of 3.7 is an indication of an excellent level, especially the supportive factors of success in the software development processes. Both companies had high improvements after applying the Hybrid ISX. One can clearly see that the process of managing customer's requirement consists of quality control and

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customer's confirmation. In addition, a standardized, clear and verifiable method to develop software are also highly important for better performance. Moreover, tools, methods, instruction, and strictly performance also lead to a success in software development. The study shows that the reason why this average value increased comes from a clear process of software development. Moreover, other departments that work together in software development must also clearly understand the process which suits their work [8]. Even if a software development department is not familiar with the procedure at the beginning, the whole department tends to get better by following this processes. In other words, it takes a while for all departments to develop themselves to a new procedure [9].

TABLE I
THE EVALUATION OF SUPPORTIVE FACTORS OF SUCCESS, BEFORE AND AFTER HYBRID ISX APPLICATION

Supportive factors of success in software development	Average Score Company A		Average Score Company B	
	Before	After	Before	After
Organization	1.98	3.74	2.28	3.53
Leader	2.22	3.61	2.34	3.71
Process	2.06	4.25	2.34	4.10
Team	2.14	3.64	2.48	3.46
Personal	2.33	3.70	2.39	3.72
Project	1.96	3.52	2.36	3.39
Customer	2.63	3.07	2.36	3.72
Average	**2.11**	**3.70**	**2.32**	**3.71**

The evaluation of Hybrid ISX recognition from all participants in the software development from both companies showed that Self Reliance on Hybrid ISX application average equaled 3.89 which means the ability to study and self-recognition are at a high level. Recognition of advantage from the Hybrid ISX application average was 4.51 which means it is the right method of implication and would be beneficial in the future. The average of simplicity of the Hybrid ISX application was equal to 4.26 which means it is flexible and helps to improve the process at a very high level of recognition. Moreover, the determination of the Hybrid ISX application lead to a high level of attitude equaling an average value of 4.37, this is equal to a very high level of recognition. Last but not least, the result on determination, this was also

at a high level with an average of 3.84. The above means that all participants were willing to apply the Hybrid ISX to their system in the future.

TABLE II
THE EVALUATION OF HYBRID ISX RECOGNITION

Evaluation List	Average	Level of Recognition
Self-Reliance on Hybrid ISX	3.89	Much
Recognition of advantage from Hybrid ISX	4.51	Most
Simplicity of Hybrid ISX	4.26	Much
Attitude on Hybrid ISX	4.37	Much
Determination on Hybrid ISX	3.84	Much

According to the evaluation of the Hybrid ISX Recognition, the recognition of advantage from Hybrid ISX gained the highest average value because most people related to the software development and had more of an understanding of software development processes. Moreover, the ISO 9001 standard has pointed out the objectives of work which must be measured by its department and other departments [10]. Moreover, the process specifies that quality improvements of each department must be continuously conducted after delivering the software. The result of improvements must also be concluded and reported to mangers and the executive team at the prescribed time. Most users agree that these methods could benefit their company in the future [11]. In addition, it was discovered that higher quality of process accuracy from the developer [12] leads to a higher reliability of software from the development department among staff [13].

According to the observations and interviews related to employees about the processes of development, the result showed that the customer satisfaction after software delivery was higher especially for continuous projects for both companies. According to the observations and interview related to employees about the process of development, the result showed that the customer satisfaction after software delivery was higher especially for continuous projects from both companies, this was because the scrum team was involved during the process of software

development by communicating and discussing with the customers. Aleksandar [14] had also mentioned this particular point to increase the customer satisfaction which stated it is necessary to make the project clear to both the team and the customers. Both companies did not use the pair programming method because of the same reason which was the cost of development being high while the speed of tasks were too low.

From monitoring the progress of software development of both companies, it was found that employees understood and followed the new implementation. They enthusiastically and continuously improve themselves with the new processes. According to the interview about the increasing amount of documents as stated in the ISO 9001 standard [15], they thought that this would not a problem for the software development team because they now understood clearly the standard required.

By strictly complying with the procedure, the software development team was able to follow the leader, paying attention to the development. The leader can then assign an internal audit team to be trained with the Hybrid ISX and internal control which follows the ISO 9001 regulations. These audits and reports are one of the factors which helped the team to follow the ISO 9001 standard properly [15].

V. CONCLUSION

According to the Hybrid ISX practice and the case study of company A and company B, the researcher of this paper found that the Hybrid ISX practice leads to a success when using the following 7 supportive factor dimensions; organization, leader, process, team, personal, project and customer, especially in Process dimension. The evaluation of the Hybrid ISX recognition result presented that customers were satisfied with the Hybrid ISX. They agreed that it would be beneficial in the future as its simplicity and flexibility could improve the process. For the future research, the Hybrid ISX with software houses that are not ISO 9001 certified will be investigated.

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)

[1] Thippayasaeng, P. (2009). "An efficacious comparison of software development technique by agile and non-agile". Department of Computer Science and Information Technology, Naresuan Universit, Phitsanulok.

[2] VersionOne. (2012). "State of Agile Survey 2011". <www.versionOne.com>. Accessed 20 March 2012.

[3] Klakhang, C. (2009). "Comparative analysis of software productivity and maintainability in Agile (Extreme programming) and Non-Agile (Waterfall-based) development". Department of Computer Science, Thammasat University, Bangkok.

[4] Penchamrush, S., Utakrit, N., and Porrawatprevakorn, N. (2014). "Factors Related to the Successfulness of Software Development". Srinakharinwirot Science Journal, Vol. 30, No. 1, June 2014.

[5] Penchamrush, S., Utakrit, N., and Porrawatprevakorn, N. (2015). "Hybrid Scrum XP and ISO 9001 for Improve Software Development Process". The 7th International Conference on Information Technology and Electrical Engineering (ICITEE2015), King Mongkut's Institute of Technology Ladkrabang.

[6] Unterkalmsteiner, M., Gorschek, T., Moinul, A.K.M.I., Cho, K.C., Rahadian, B.P., and Robert, F. (2012). "Evaluation and Measurement of Software Process Improvement - A Systematic Literature Review". IEEE Trans. Softw. Eng. 38, 2, pp. 398-424.

[7] Davis, F.D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology". MIS Quarterly 13.

[8]   Chandra, S., Kumar, V., and Kumar, U. (2009). "The Journal of Systems and Software Identifying Some Important Success Factors In Adopting Agile Software Development Practices". The Journal of Systems & Software, Vol. 82. No. 11.

[9]   Cho, J. (2008). "Issues and Challenges of Agile Software Development with SCRUM". Colorado State University, Pueblo.

[10] Allen, P., Ramachandran, M., and Abushama, H. (2003). "PRISMS: an approach to software process improvement for small to medium enterprises". Paper read at Quality Software, 2013 Proceedings Third International Conference on, 6-7 Nov 2003.

[11] Chow, T. and Cao, D.B. (2008). "A survey study of critical success factors in agile software projects". J. Syst. Softw. Vol. 81 No. 6. pp. 961-971.

[12] Coram, M. and Bohner, S. (2005). "The impact of agile methods on software project management". Paper read at Engineering of Computer-Based Systems, 2005 ECBS '05. 12th IEEE International Conference and Workshops on the, 4-7 April 2005.

[13] Mansor, Z., Yahya, S., and Arshad, N. H. (2011). "Success Determinants in Agile Software Development Methodology". Procedia Engineering.

[14] Aleksandar, T. (2008). "Extreme Programming for Better Results on Software Development Projects". PM World Today, Vol. X, Issue VI. June 2008.

[15] Heeager, L.T. and Nielsen, P.A. (2009). "Agile software development and its compatibility with a document-driven approach? A case study". Australasian conference on information systems, Melbourne, Australia. pp. 205.

[16] JingFeng, N., Zhiyu, C., and Gang, L. (2010). "PDCA process application in the continuous improvement of software quality". Paper read at Computer, Mechatronics, Control and Electronic Engineering (CMCE), 2010 International Conference on, 24-26 Aug 2010.
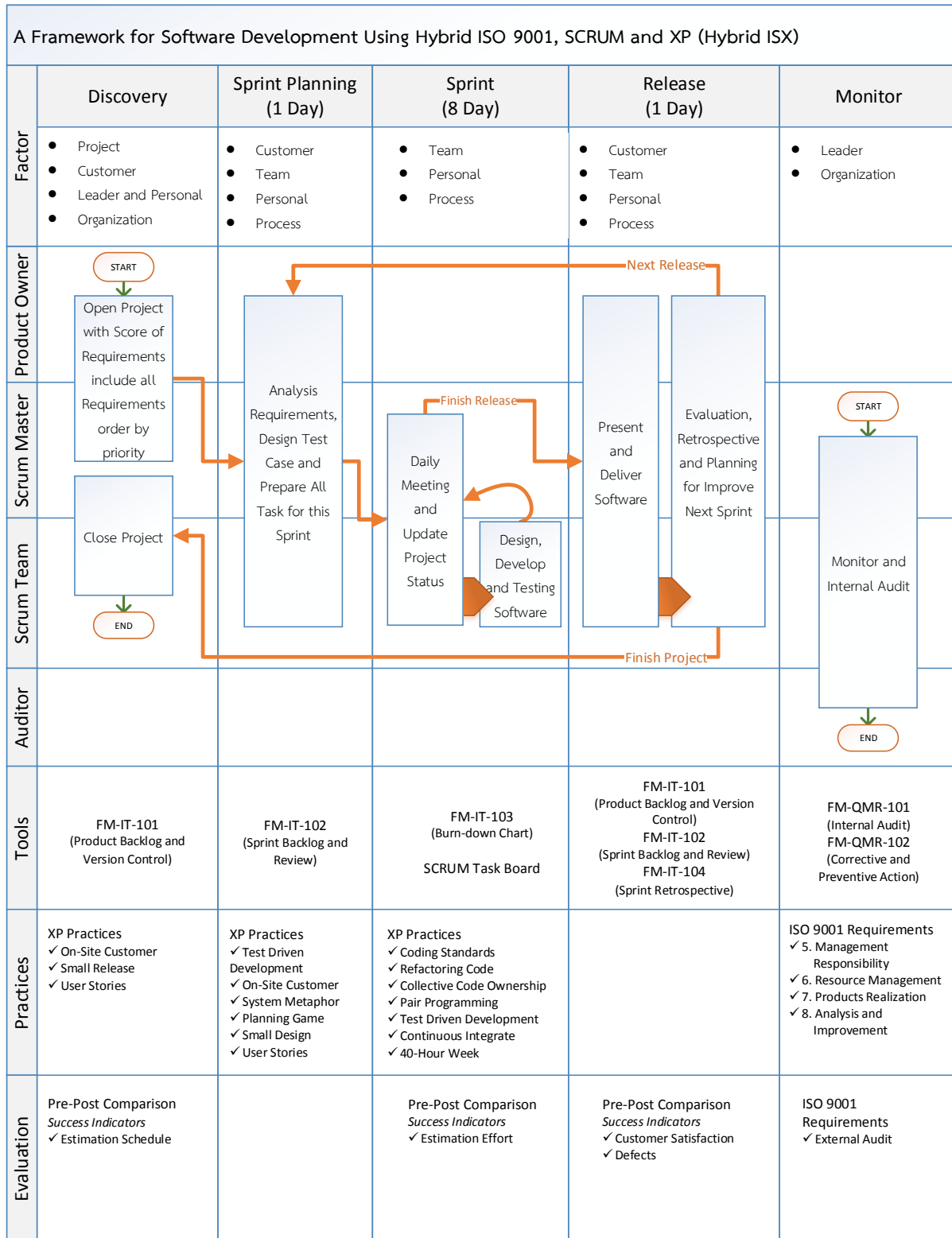
A Framework for Software Development Using Hybrid ISO 9001, SCRUM and XP (Hybrid ISX)

	Discovery	Sprint Planning (1 Day)	Sprint (8 Day)	Release (1 Day)	Monitor
Factor	• Project • Customer • Leader and Personal • Organization	• Customer • Team • Personal • Process	• Team • Personal • Process	• Customer • Team • Personal • Process	• Leader • Organization
Product Owner / Scrum Master / Scrum Team / Auditor	START → Open Project with Score of Requirements include all Requirements order by priority → Close Project → END	Analysis Requirements, Design Test Case and Prepare All Task for this Sprint	Daily Meeting and Update Project Status → Design, Develop and Testing Software (Finish Release)	Present and Deliver Software (Next Release)	Evaluation, Retrospective and Planning for Improve Next Sprint — START → Monitor and Internal Audit → END (Finish Project)
Tools	FM-IT-101 (Product Backlog and Version Control)	FM-IT-102 (Sprint Backlog and Review)	FM-IT-103 (Burn-down Chart) SCRUM Task Board	FM-IT-101 (Product Backlog and Version Control) FM-IT-102 (Sprint Backlog and Review) FM-IT-104 (Sprint Retrospective)	FM-QMR-101 (Internal Audit) FM-QMR-102 (Corrective and Preventive Action)
Practices	XP Practices ✓ On-Site Customer ✓ Small Release ✓ User Stories	XP Practices ✓ Test Driven Development ✓ On-Site Customer ✓ System Metaphor ✓ Planning Game ✓ Small Design ✓ User Stories	XP Practices ✓ Coding Standards ✓ Refactoring Code ✓ Collective Code Ownership ✓ Pair Programming ✓ Test Driven Development ✓ Continuous Integrate ✓ 40-Hour Week		ISO 9001 Requirements ✓ 5. Management Responsibility ✓ 6. Resource Management ✓ 7. Products Realization ✓ 8. Analysis and Improvement
Evaluation	Pre-Post Comparison *Success Indicators* ✓ Estimation Schedule		Pre-Post Comparison *Success Indicators* ✓ Estimation Effort	Pre-Post Comparison *Success Indicators* ✓ Customer Satisfaction ✓ Defects	ISO 9001 Requirements ✓ External Audit

Fig. 1 A Framework for Software Development Using Hybrid ISO 9001, SCRUM, and XP (Hybrid ISX)