

Implementing product focused Process improvement through The Post Iteration and Process Improvement Workshop

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Abstract: SPI plays a significant role in improving software development performance in a software developing companies. Developing SPI approaches which are contextually easier to integrate with different development environments has been an issue for the research in the area. The SPI framework developed define, the detailed implementation procedures of SPI activities in line with the product development process through the post iteration and process improvement workshop (PIPIW) process steps and SPI tracking model. The framework consists of integrated capability improvement process flow which is developed through the integration of CMMI continuous representation and process components of institutionalization.

The developed process steps developed in the PIPIW is evaluated in a case study sited in a software development setting to examine its applicability for SPI implementation at small development settings. Results of the case study prevailed that, the framework is implementable in line with the development activities. In addition the advantages implementing the framework proven to organize and continually improve the practices used for the development activity. The case study in general prevailed practical evaluation of the framework to demonstrate how it address the perceived requirements.

Keywords: Post iteration and process improvement, SPI, software process, agile methods

1. INTRODUCTION

It is generally accepted that SPI is the crucial factor for the quality of the software product developed in software companies. Continuous improvement of the software process is considered as a means to guide software developing companies towards a standard practices to have a software process with better capability. Standard capability models are created, as a result significant improvement on the quality of the software products, through the introduction of new techniques and new tools, is achieved [1]. Software process capability describes the range of expected results that can be achieved by following a software process. The software process capability of an organization provides one means of predicting the most likely outcomes to be expected from the next software project the organization undertakes [2].

The implementation of SPI programs differs according to the priority of parameters considered for a particular context. Studying the initiatives and their success stories is a valuable input to study and evaluate alternative approach in developing cost effective, simple and context aware SPI framework. Different SPI implementation strategies with their underlined approaches presented in SPI researches. Their focus mainly was the context those companies exist. The software process improvement framework developed at national level is one of the many. The frameworks developed have different features, but basically followed similar procedure. The software improvement framework developed to be followed by Brazilian companies called MPS model [3] is one example. In this framework, implementing software process improvement initiatives in small and medium companies present SPI framework with extended stages than it was in CMMI [4]. The MPS Model is composed of three components. These are the MPS Reference Model; the MPS Assessment Method; and the

MPS Business Model, to guide the process improvement. Mo prosoft [5] is another approach developed in Mexico basically for small and medium software enterprises in Mexico, and later recommended to be used in Latin American software development companies as a national standard. According to the approach, a company should define its process based on the structure of the software organization. It is further recommend that, an organization can attain better success if it define and set up its own process implementation.

Developing SPI model for small and medium companies is the other dimension researched by many scholars and practitioners. One of them is PRISMS [6] which is also an approach to process improvement based on CMMI. It follows an approach to adapt CMMI based SPI implementation, using goal question metrics (GQM), to align process improvement with business values. The other SPI framework is OWPL [7], which is a gradual approach for software process improvement in SMEs. It is based on SPICE and organized with a three stage improvement framework. On the first stage (Stage 1) is called Micro-assessment, where micro-evaluation is done through simplified assessment questionnaire. In the second stage (Stage 2: OWPL evaluation) detail evaluation analysis is achieved which covers 10 process areas followed by the final step (stage 3), which is SPICE assessment. Another approach for SPI implementation in small companies is “Improvement Framework Utilizing Light Weight Assessment and Improvement Planning (iFLAP)” [8]. The approach is focused on selection of any particular KPA(s) and implement the process improvement through selection of professionals for SPI implementation. It start with assessment of the status of capability, then plan improvement program.

In general two important similarities can be extracted from the approaches taken. The first one is selecting and following well

known SPI framework to organize the SPI implementation activities. The other important similarity and recommendation on SPI implementation is, adapting the process to the context of software developing organization. In line with this, SPI activities in small and medium companies recommended to follow development activities. On the other hand, the recently introduced agile methodologies brought a product focused iterative development approach. This opportunity brought a possible path for success in software development in such companies, though long term process improvement is yet to be answered in these methods.

Agile methods have demonstrated a different focus on the direction of software development to be more product focused. However, they have some drawbacks and limitations on their applicability related to nature of project and development environment. The focus of agile methods is on the project only and no formal strategy for long term process improvement is presented [9], [10]. In addition, development activity being mostly dependent on tacit knowledge owned by developers could be a risk if skilled developers leave the organization [11]. Agile practices like XP are sensitive to full understanding and participation of development process. Little documentation is also considered as one limitation of agile practices to trace the development process for developers joining the team and to retain the experience which can be an asset for the organization's future growth [11].

The overall objective of Agile and CMMI approach is ensuring development of a good quality software but from different perspective. The agile methods focus on the "how" aspect of implementing software capitalizing on the people and product development. The CMMI framework in general define requirements a matured software process should have. Focusing on these two important, but considered incompatible characteristic is considered a better approach in recent SPI researches. Such approach can be beneficial for software companies with low maturity level to benefit from their process improvement at the same time keep the pace on the business by responding to customers demand.

In this paper the process improvement guidelines defined by the Post Iteration and Process Improvement Workshop process step is presented in detail. The guideline is part of the component of an integrated SPI framework of agile and CMMI developed earlier [12]. The paper is organized

2. RELATED WORKS

Experience in combining the two practices has shown that CMMI and scrum complement each other by creating synergies. Scrum defines how products are developed which can fill the gap on CMMI where definition of what development method to be used is missing [13]. CMMI, on the other hand, provides guideline and practices to deploy, sustain and continuously improve scrum in organizations [14]. In another study, the combination of CMMI level-5 processes and scrum have also been found complementary [15]. The CMMI framework can specify a clear vision of what processes should be considered for performance improvement and the scrum ensures efficient and flexible implementation of processes. Implementing agile methods can reduce the cost of training and no documentation demand will exist at early stages of software development. Hence, companies can give more focus on software development without losing sight on process improvement [16].

Combining the two approaches has taken the attention of researchers recently. Accordingly, research findings related with combining some agile methodologies with the KPAs in

the CMMI framework have demonstrated the two approaches can work together and can also be even better if they are implemented thoughtfully than they are individually [9, 11, 12, 19]. In line with this, the attempts made and the results obtained have shown tangible evidence of achievements in software development and SPI through combining CMMI and agile methods.

Experience reports from Wake [54] shown that, agile practices are accelerators of SPI with a benefit of providing quality product with time and improve the capability of the organization. Performance improvement has been achieved in both smaller and large projects as a result of using scrum with CMMI. The combination of Agile practices and CMMI is explained as a means to "Amplify Learning and Deliver Fast"[54]. The following summary of related works demonstrate the approaches considered, methodologies used, and findings reported by the researches.

- Application of XP and CMMI v1.2 for SPI implementation for small development firms is presented by M. Yousef et al [17]. According to the research, it is possible to cover twenty (twelve largely and eight partial) out of twenty two KPAs through XP. Unlike other researches [34, 97], the researchers argued coverage of most of the KPAs through XP, though no objective evidence is presented. The description of relationship between CMMI and XP only present at the KPA level and detailed analysis of the specific practices is recommended for future research. The model developed for process improvement is focused on development approaches to follow XP method from agile approach. According to the proposed framework, additional features can be added to XP to fulfill requirement of unaddressed CMMI KPAs. The features to be added can be from the traditional methods according to the research. The process improvement guideline is not presented, rather the XP method is selected to fulfill the development approach.
- Introducing CMMI following the agile methods improve stability of the organization's process while keeping the desired agility in product development [18]. Three companies with different development approach and implemented CMMI and certified to some level. The approach first examine the existing development approach and accordingly tailor the development through introduction of scrum practices. The detailed guideline and common approach for implementation of CMMI and agile method is not the focus. Rather the approach focused on defining a framework where different development entities can introduce scrum to their development culture.
- K. Miler and J.Lukasiewicz [19], developed a reference model called a "CMMI-Scrum (C-S)" model. The model used for mapping specific goals of the second and the third level of maturity in the CMMI staged representation of the CMMI (V 1.2) model onto the activities described by the Scrum methodology. The study consider Scrum to cover some practices of level 2 and 3 of staged representation of CMMI and claim 40% coverage of specific practices. The objective of the approach is to manage the compromise between scrum agility

and CMMI maturity through selection of practices and introducing new ones. The research did not demonstrate the process whereby specific practices or maturity levels improve their capability. The approach is limited to application of scrum in a CMMI environment and identify problems associated in a project than an organized capability improvement plan.

- In another research, M. Pikkarainen, and A. Mäntyniemi [20] presented application of CMMI framework for assessment of agile software development. The research defined relationship between agile practices and CMMI specific goals as a main component. Its main focus is, on assessment aspect, and no clear set of activities with defined target for process improvement is presented. The approach define a model and associated description of the guidelines for process assessment. The requirement to be attained by each agile practice in relation with process capability is not included. The approach of application of CMMI for assessing companies implementing agile practices is discussed, while aiming introducing agile practices to the existing practice, based on project related experience results.
- Application of scrum practices to the CMMI practices implemented environment to introduce agility to a plan driven environment is an approach demonstrated by Ana Sofia, C. Marçal, et al.[21]. The approach taken was focused on aligning practices from scrum to CMMI project management process areas with assessment of their relationships and differences. The main contribution of this research is on the project management process areas on CMMI and scrum practices. The process areas other than project management were not considered. The research concluded that, an improvement on the relationship level between CMMI project management process areas and scrum can be attained through tailoring scrum practices.
- M. Fritzsche and P. Keil [22], presented analysis of all CMMI capability levels with practices from XP and scrum. The detailed analysis presented the compatibility, collaboration and conflict between KPAs from CMMI level 2 to level 5 and practices from XP and scrum. The research concluded that the agile method (XP and scrum) support CMMI level 2 and 3 KPAs. To fully utilize the combination of the relationship between these two sets of practices, a practice catalogue of agile practices is proposed to be studied and developed. The research further recommended analysis of other agile methods regarding their relationship with CMMI. The paper didn't define a guideline or approach recommended to be followed in combining the two approaches or how to implement SPI through combination of practices from the two approaches.

Since the idea is introduced recently, and is coming out of the idea that “agile and CMMI are completely incompatible set of practices”, it needs a thorough investigation in all dimensions to enrich the results achieved so far. The approaches taken mostly are fragmented approach by picking practices from both approaches and considering their complementation to benefit from.

One of the areas which worth considering is aligning the process improvement activities with the development methods of agile. Agile methods execute development through iterations to be completed within 1 to 4 weeks. Extending the iteration workshop to include process improvement activities is considered the possible approach to guide agile methodologies fulfill CMMI requirement of process capability. Based on the activities of the iteration review meetings, process improvement steps can be included to review the experiences and document them through agile based practices templates and procedures. This approach is used to integrate the two paradigms as a unified framework to be used as an alternative path for companies starting product focused SPI implementation.

3. THE POST ITERATION AND PROCESS IMPROVEMENT WORKSHOP (PIPIW)

Please In agile development, at the end of every iteration, a review session is implemented to evaluate the team's performance [23]. According to Cockburn's reflection work shop [23] and PIW by Salo [24].et al. provide project teams a way to examine and accordingly shape the practices while running projects. Moreover, it makes easy to get a quick feedback on the improved practices. The steps used in the post-iteration workshop by Salo et al. is and reflection work shop from Cock burn[] is used as a baseline and contextually extended to incorporate process improvement practices defined in the previous section to define post iteration and process improvement workshop (PIPIW). It starts with the development team discussing the positive and negative experiences of the previous iteration. Based on the identified positive experiences and improvement directions the team identify the practices for the next iteration.

In this research the PIPIW include process improvement steps and guidelines from the integrated capability improvement framework and SPI tracking model defined and explained earlier in our earlier phase of research [12]. The post-iteration workshop technique is used for this research to review activities of the previous iteration of the project and provide a mechanism for the team members to identify positive and negative aspects or difficulties to be improved in the next iteration. The result of practices selected for the next iteration is considered as improvement suggestions in each iteration which in turn can be measured and tracked through the frameworks and associated practices included. The sequence of activities is shown in Figure 1.0 and the detailed description of each indicating their role in the PIPIW.

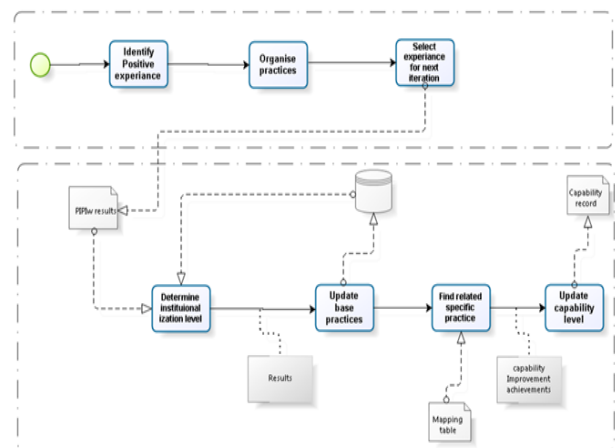


Figure 1.0 Post iteration and process improvement workshop process steps.

Identify and organize positive experiences:

In this step, the development team task is to identify the practices with positive outcomes. The fundamental activities are based on the practices of agile methods (XP and Scrum). The project participants determine the procedures used and templates generated in that specific iteration and explanation of the approach on how positively affect the iteration. This followed by organization of the positive practices according to the nature of the practice or process area where the practice belong. The practice related procedures and templates need to be organized with their associated description. Group discussion is held within the group members reviewing and creating common consensus on the practices identified and organized. In line with this, the group discussion can also review the negative experiences, then the next iteration planning can avoid those practices from happening.

Define activities for next iteration: Based on the collected positive experiences identified in the iteration undertaken by the team and the discussion made, the group members define the activities for the upcoming iteration. The list of practices are recorded on a story board for each iteration to enable comparisons to be made in each iteration to trace the improvement achieved. The different teams can see the practices selected and refined in the iterations carried out by the team.

Similarity Analysis: In this step the agile practices used in each iteration including the updates made is assessed its variation with the previously defined templates and procedures. The previous the process improvement group collect the predefined set of activities defined by the development groups and evaluates their level of similarity. The base practices compiled in the company is used as a bench mark for the analysis and will get updates at the end of each iteration. The resulting output is used to determine the status of institutionalization of those practices in that particular setting. Templates and procedures of each agile practice is measured how they are institutionalized in relation with their respective practices. The level of institutionalization of the practices is defined according to the requirements specified at each level of institutionalization process steps.

Mapping table reference: In this step the task is representing the process improvement in terms of specific practices of CMMI KPAs. Identification of the specific practices is based on the mapping relationship of specific practices of CMMI and agile practices. This is used to identify specific practice of CMMI addressed by the agile practices identified in the previous steps. In doing so, an agile practice can be mapped to different specific practices and a single specific practice can be addressed by more than one agile practice. In cases where more than one agile practice represent a specific practice in a KPA, all the agile practices expected to meet the institutionalization level requirement to improve the capability level of the corresponding specific practice up to a level to be indicated as capability level

Update SPI tracking model: Basically, SPI tracking model is used to follow up and display the improvement progress of KPAs through its specific practices. In the previous steps, the agile practices are evaluated based on their level of institutionalization and identified with which specific practices they can be mapped referring to the mapping table. In the SPI tracking model, the capability level of specific

practices is updated based on their level of institutionalization. The complete capability level of the KPA is represented through the specific practice. This can show where the gap for improvement is; and to consider them in the upcoming capacitation plan of the organization.

The framework for small and medium companies preferred to be more product focused than aiming on organizational process. According to [25], software development business can have more success through continuous improvement, and the packaging of experience for reuse. Hence, the guidelines and architecture of the SPI framework shall be articulated based on this notion. As described by [26], product focused approach to software process improvement emphasizes on defining tools and guidelines for product quality driven process improvement.

The framework basically planned to address the issue of SPI implementation difficulties. In software engineering a number of SPI models and implementation guidelines developed and used for decades. In line with this the implementation success stories and difficulties reported. In addition success factors for SPI implementation prevail considerations to be made in SPI implementation. Understanding the models and their fundamental principle is important to select and define the components.

4. RESEARCH DESIGN

In this section, the research method selected and used, including the research setting is discussed. Based on the target of this research data analysis and evaluation procedures discussed according to the research context.

4.1 Research Method

Case study method is selected to be used for the study based on reasons related to the research context. According to Runeson [27] software engineering researches recommended to follow case study methods to research contexts where the study subject cannot be studied in isolation. In software process improvement when studying a change as a result of introducing an approach case study is the case study is the suitable approach to follow [27]. As pointed out by Runeson [28] “case study research lends itself naturally to software process improvement (SPI) because of the focus of case studies on individual sites within their natural context”. It is also explained by Yin [29] that, case study is a suitable approach to investigate a contemporary phenomenon in a real-life context. Besides, it is a good approach to answer questions related with how and why which are related with operational links to be traced over time [29]. The components with associated guideline of the framework will be used at different levels to collect case study data and guide the analysis procedure. The case study will be executed in a software development environment where the researchers’ role was as participant observer and in some occasions lead meetings in a group discussion.

The case study is targeted to evaluate the PIPIW process steps applicability for SPI implementation, within software development projects. The case for the research is selected according to the definition of case in case study research “contemporary phenomenon in its real-life context” as it is explained by yin [29]. Hence, a software development project can be considered as a study case. The main purpose of the case study is to evaluate the integrated SPI framework in terms of its applicability to improve capability of CMMI KPAs. In this regard, software development environment is the context where the SPI implementation is to be executed.

The study follows case study steps iteratively based on the guides in case study research described by Benbasat as preparing data collection, collecting evidence, analyzing case study evidence, and presenting case studies [30].

4.2 Data Collection

According to Benbasat[30], good quality case study research considers three basic principles, namely use of multiple sources of evidence, creating a case study database, and maintaining chain of evidence. It is generally recommended to use six data sources in conducting case study research which are documentation, archival records, interviews, direct observations, participant observations, and physical artifacts [30]. This research used structured and semi structured individual and group interviews from case project teams' software development documentations, direct observations, and seminars according to the scenario to be investigated.

According to Yin [31] focused group discussion, software development document analysis, individual practitioners interview can be used to keep the data triangulation requirement. According to [27] the use of multiple sources of data in case study research provides a better perspective of the study and increases the credibility of the research. As recommended by Runeson [28] for case study research in software engineering, triangulated data collection methods used in this research. These are documents from project related meeting minutes, records of sprint reviews, and technical documents and the resulting reflection on each of them used. For the interview, discussions is organized with in small groups of software developers and individual developers. For the observation part, process of review meetings, where meeting attendants interact with each other, and thus generate information about the studied object, is used.

4.3 Research Setting

The company where the case study is situated is a software development unit placed under academic institution. The development unit is a separate section founded specifically for application development to internal and external customers. The application development unit has autonomous business orientation in terms of engaging with any software development projects. The financial related tasks are under the hosting institution and clear agreement is established to manage the income associated with software development projects. At the time of the case study the software development department has 10 developers with variety of job positions (a team leader, programmers, system analyst, software architect, security expert). In terms of roles in a specific project all experts take different roles according to the nature of the project to be developed.

The development team started implementing the project following practices from scrum and XP of agile methods with available standard templates used. The source of most of the practices related templates and procedures is from "agilealliance" package. In line with this, the team started organizing the base practices based on scientific definition and procedures of standard methodologies. The base practices are not a complete copy of the standard methodologies but they are selected practices to be used at the beginning of the first iteration. Team members privileged to suggest a template or procedure, for any practice from these methods, based on the practices from the standard methodologies. The improved practices are planned to be updated at the end of each iteration based on the achieved results of the PIPIW.

Based on the procedures of PIPIW, the development team aligned the development task and implementation of SPI activities using the framework. At the end of each iteration the base practices database is updated with any improved template or procedure. The development activity is the primary focus of the team, and it is directed through the daily meeting of sprints. This has contributed to keep focus on the product as a primary job for the practitioners. According to the SPI framework, process improvement is executed at the end of each iteration. Each PIPIW propose practice related procedures or templates for the next iteration or improvement suggestions on the existing ones. The recommendation is based on the experience based practices and enhancements found positively affect the development activities in the completed iteration.

5. DATA ANALYSIS AND FRAMEWORK EVALUATION

Data collection and data analysis in case study research follow an iterative process. In this regard, development of theoretical propositions to guide data collection and analysis is recommended [31]. The analysis and evaluation of the framework is based on the guideline defined in each components of the integrated framework developed. In this research, the data collection and analysis basically focused on the collected results of the development process and process improvement activities with associated templates and procedures. In addition, personal reflections and group discussions have been held based on the interview plan prepared. The interviews and group discussions used to prevail the practitioners view on the application of the SPI framework in line with the development activity. The data collected through interview and group discussions is analyzed following the procedures of qualitative data analysis.

5.1 Discussion of Study Results

The case study results presented are from the compiled result of the case study in application of the integrated framework of agile and CMMI for process improvement. In this part of the thesis, the application of the framework and the results of process improvement is presented after the first project is completed in six iterations. The reported case study result is focused on what has been done in each phases of the PIPIW and the results discovered. In addition, the improvement achieved in due course of implementation of the framework in parallel with the software product development is recorded throughout the case study. The compiled results of the case study is presented in the following section. The output of each iteration is presented by compiling the iterations with similar characteristic than discussing results from each iteration one by one.

First Iteration: - The team started the development task with practices and available templates and general procedures of the standard methodologies considered relevant at the beginning. In the first PIPIW, which is held at the end of the first iteration, some templates and procedures have been found to be relevant to be considered as good experience. The team collected those practices and proposed them to be followed in the upcoming similar tasks. Some of the procedures and templates have been included as part of the initial base practices. But, most of the proposed procedures and templates of the practices implemented, were not considered as part of the base practices. This is done following the decision from group members due to the fact that the development group just started organizing its experience. The development group was set free to consider them for the second iteration or start

developing new templates or procedures for the practices. Following the first iteration, the team organized the practices with related procedures and templates in the base practice table. The table is prepared to show updated status of team document management file to demonstrate how templates and procedures of agile practices are initially started to be organized and updated in the process. Later in the process, such data is planned to get updated at the end of each PIPIW and organized in the database of the PMS. Resources related with development activities are planned to be accessed from the PMS once the software is completed.

Iteration (2 - 6): - Starting from the second iteration, the team started the development by selecting the practices, associated procedures, and templates from the base practice database. In the process of the development, the group used and accordingly made modifications on the procedures and templates. At the end of each iteration, the development group executed the PIPIW according to the predefined procedure. In each PIPIW, templates and procedures of the practices used and proved helpful in the development activities were proposed. The proposed templates and procedures with their associated practices used in the development activities of the next iteration, and modified to incorporate additional features. Every enhancement was done on the templates and procedures, which initially selected by the team from the base practices. The detailed activities and reflections on the achieved results is presented focusing on the main activities performed. The discussion, regarding each process step of the PIPIW summarized for five iterations, is presented in the subsequent paragraphs.

Identify and organize positive experiences: - In this step of the PIPIW, the team proposed practices for the next iteration. In due course of the development task, agile practices have been used according to their relevance for the task. Among the agile practices used, the team managed to develop procedure to be followed, and template to be used to execute the associated agile practice in the next iteration. Starting from the second iteration, the development team reviewed the procedures and templates used in the development activities of the respective iterations. At the end of this phase of the PIPIW, the selected practices selected from the base practice organized with newly created or improved practices and proposed templates. The files related with each practices is organized in a simple MS-word datasheet table. A table is prepared in the development site to keep updated status of team document management file to demonstrate how templates and procedures of agile practices are initially started to be organized and updated in the process. After completion of the last iteration, part of updated procedures and templates with related agile practices in the base practice table is shown in Tale 6.1 and table 6.2.

Table 6.1 Part of XP base practices after six iterations

XP		
Practice	Procedure	[Template]
User story	Link	Link
Metaphor	Link	Link
Coding standards	Link	Link
Continuous	Link	Link
Simple Design	Link	

Table 6.2 Part of scrum base practices after six iterations

Scrum		
Practice	Procedure	[Template]
Sprint Backlog	Link	Link
Product backlog	Link	Link
Sprint Review	Link	Link
Sprint Planning	Link	Link

Define activities for next iteration: - From the practices and associated procedures and templates used, the team (the researcher is participant observer and the team leader who is the department manager organize and led the PIPIW) selected and proposed those which were found helpful to use them in the next iteration. In the second and third iteration, the team proposed additional templates and improvements on the existing ones. As an output to this phase of the PIPIW, the development team defined practices with their template and procedures for the upcoming iteration. The definition is in terms of the improved and newly proposed procedures and templates to be used. At the end of the fifth iteration, procedures and templates (when applicable) is prepared, compiled and filed for almost all the practices used by the development team. Some of the agile practice in the two methods found to be difficult to address through templates and procedures. This is basically related with the limitation of integrating the requirement of those agile practices to the development culture. In the last two iterations, part of the base practices were updated through modifications on the existing procedures and updates on templates proposed by the development team.

The most important case study data is regarding the SPI activities performed based on the guideline defined in the components of the SPI framework. Accordingly the templates and procedures developed and updated in each iteration has been summarized in the discussion. The number of procedures and templates has been represented in the graph in Figure 6.4

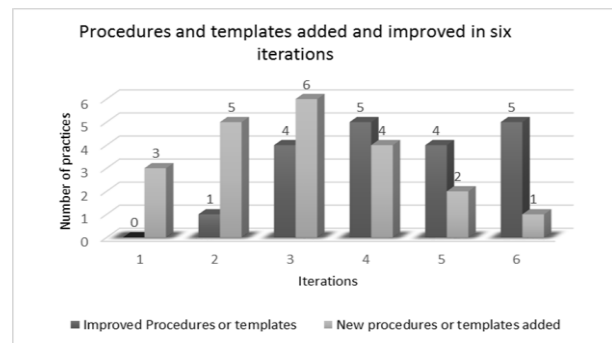


Figure 6.4 Improved and included practices and templates

The graph displays the compiled results of practice related procedures and templates introduced to the base practice database. It also shows improved procedures and templates at the end of each iteration. Templates and procedures were discovered starting from the first iteration and according to the team's PIPIW results some of them are recommended to be considered in the next iterations. The inclusion of new procedures and templates continued till the sixth iteration. The graph also display records regarding improvement on the

procedures and templates on the base practices throughout the six iterations.

Some interesting feature have been prevailed through group discussions and individual interview responses. The developers understanding of SPI implementation has been only outsider look and was considered beyond the reach of small development companies. After implementing the SPI framework the previous perception has been changed. The development team members have developed better understanding and benefits of SPI. In this regard, the SPI implementation being focused at small scale improvement has contributed team members and development unit manager see the benefit of it and encouraged to accept SPI implementation with minimum resistance.

6. CONCLUSION

The implementation of the SPI framework has been executed with minimum, and controlled effort and resource in conjunction with development activities. The implementation of each step in the process of the development activities with the SPI activities is discussed in detail. In each iteration the team has utilized any possible opportunity for improvement on the currently used practice templates and procedures.

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