Real Life Experience Using CMMI L2 Processes and XP Practices

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Abstract

In December 2003, BIMAR has initiated an SPI project to reach CMMI L2 in 2004 using XP practices. Nitelik Danışmanlık Ltd. has planned and conducting the project. This paper aimed at describing the pilot project in which three CMMI L2 processes, namely Requirements Management, Project Planning, Configuration Management, together with three XP practices, namely, customer as a member of team (card system), pair programming, first test then coding. The pilot project concluded very successful. The CMMI processes and XP practices were working very well and in harmony.

1 Introduction

In 2002 BIMAR has initiated a Change Program aiming at enhancing the customer satisfaction. A part of the Change Program was improving the software development processes. SPI program has been launched in 2003. CMMI has been chosen as the maturity model for the software processes to be improved. XP has also been chosen as the software lifecycle model to be used together with CMMI. [4] In this sense, it is the first experience in Turkey for using CMMI processes and XP practices together.

In this paper, we would like to share our experience about piloting CMMI L2 processes together with XP practices. The processes piloted in the study are Requirements Management, Project Planning, and Configuration Management. XP practices piloted are Planning the game (cards), pair programming, first test then coding, customer as a team member.

For each process piloted we have given the following information: purpose of the process , metaphor used in designing the process, main activities identified for the process, and strategic decisions about the process.

For the XP practices, following topics will be given: Observation made about using the cards In XP for planning the game, experiences about pair programming, and first test then coding implementation. [1]

2 CMMI Processes Piloted

2.1 Requirements Management

2.1.1 Purpose [5]

- Make the customers' needs to be taken correctly, accurately and exactly.
- To take managerial commitments from both BİMAR and the customer..
- To keep track of these commitments and therefore, to provide their return to the customer, on time with minimum errors.

2.1.2 Metaphor

While designing the metaphor, we imagined a restaurant that works on a special-order basis. We performed an environment that lets each customer describe and tell the cooks whatever meal he/she enjoys to eat.

For the waiter, we created a role which; kindly meets the customer at the front, gets the details of the orders, gives information about the status of the kitchen, without any negative effect to other customers, prohibits any external disturbs while the meal is prepared by the cooks and the customer, and finally lets the customer to leave the restaurant with good mood and positive emotions. Our customer not only could bring his suggestions while cooking the meal cooperatively, but also would have no hesitation about the time being spent and the type of ingredients that is being used.
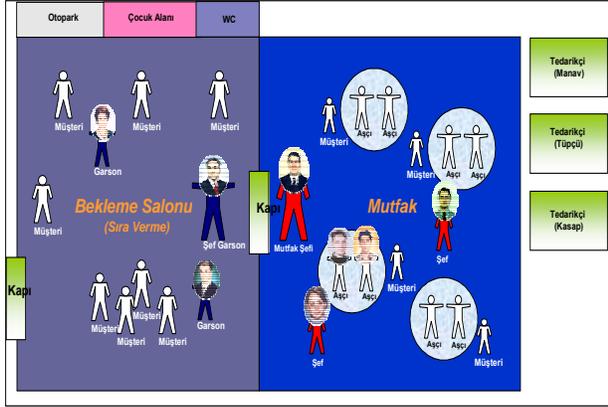
Figure 1 – Metaphor

As a result of this methodology, our goal becomes, to have the customer eat his/her actual, desired meal, and to have the staff work in a more comfortable and more productive environment.

6 major steps have overcome after the metaphor task,

- Take order
- Proactive Approach
- Forward (Scale, Communicate) the Order
- Keep Track of the order
- Sophisticated (Qualified) Approach
- Close the order

Figure 2 – Main Steps for Requirements Management

We combined the 'Communicate the order' step into the obtain the order step, thereby performed 4 major steps. See Figure 2.

- Taking the order
- Keeping track of the accepted order
- Close the order.

The below two steps are thought to be included in all the steps, because they are important in the whole story for enhancing service quality and customer satisfaction.

- Proactive Approach
- Sophisticated Approach

2.1.3 Main Activities

Take the Order;

Figure 3 – Taking the order

- In this step, first of all we check whether the customer has the authority to make an order. Then, we help him/her to meet with the correct person to contact in Bimar.
- After this appointment, the customer needs are obtained by qualified software personnel by using Customer Cards and verification (Test Scenario) cards. .
- The estimated time magnitudes that are given by the Software Forecast Team (The Bimar software experts, who help the customers to fill the Customer cards and actually identify the estimated completion time value of them) are used in order to form a price proposal and eventually let a final offer to come into life.
- When the proposal of the software Project is accepted, a rendezvous date (Project Start Date) is asked to the Project office.

Keeping Track Of Accepted Order;

Figure 4 – Keeping track of accepted order

- We divide this step into two time intervals;
  First level is following and managing the states between the acceptance and the rendezvous date. Second level is between rendezvous date, which means the start of the Project studies of the Project Office and the termination of the Project again by the Project office.

- In the life cycle of the Software Project, the issues about the scope and cost are handled by the Customer Relations Representative, however, the issues about

Time and Quality are handled by the Project Leader.

Closing Of The Order;

Figure 5 – Closing the order

This step starts working, whenever an information comes from the Project Office that the studies are completed and Project can now be closed.

- The attributes of the customer about this Project are taken by a Project inquiry questionnaire form.
- As the technical closure is made, the Project resources become available.
- Financial track includes invoicing of the products and control of the payment.

2.2 Project Planning
2.2.1 Purpose

The purpose of project planning process can be described as the following recursive steps: [2]

- ➢ Do the most valuable(the most important, urgent etc...) thing
- ➢ Coordinate the related parties
- ➢ If any change occur, go to the first step

2.2.2 Metaphor

The Japanese Restaurant is used as the metaphor, while designing the process. There is the hall at the entrance of the restaurant in which customers wait until get to the dining room.. In the dining room, there are the tables at which food is cooked by the two cooks in accordance with the customer's desire.

Waiters takes the orders from customers at the saloon and forward to the chief. The chief lines the orders up and get the customers to the empty tables in the dining room. Food is cooked under customer's very eye and until the customer say "It's ok", cooking process continues. At the end, the customer and his/her family can eat the meal.

In this example, actually the chief is the project manager and the cooks are the programmers. The chief gets the right customer and the right cooks together, plans the works, follows the matter and solves the problems.

2.2.3 Main Activities

Project activities were performed, according to the process, whose main steps are project planning, project tracking, closure.

At the beginning of the project, iteration based planning was tested. This was the first meeting with cards. The customer cards were grouped to constitute the working program parts. One part, would be completed in one iteration(4-6 weeks). Then, the technical cards were filled.

The customer cards were divided two day lasted technical cards and then the project plan was done. We saw that, the cards would make the project planning much easier. In addition to this, to keep track of the project tasks, divided into small parts, would be getting easier. At the end of the 2 day, the average duration of the technical card completion, the status of the card would be apparent, the problems which negatively effect the time schedule could be realized early and solved before too late.

Because the programmers worked as pair, the real task durations were shorter than planned. High quality programs were produced and the customer was very satisfied with the outputs.

The work environment is very important for the productivity of the programmers. Because of this, the environment should be planned at the beginning of the project. The pair programmers should work together at one conformable table without disturbed by any other thing such as telephone, other people etc....

During the project, if the pair programmer and the customer meets every day and work together for several hours, that project will be successful. As a result of such a communication, changes in the requirements can be easily accepted and acted quickly against the change request.

The most powerful way of sharing the information is the face-to-face discussion. During the project, regular status meeting was hold to make the information distribution homogeneous and to develop the solutions

as a team for the problems. As a result of the good team work the project was successfully completed.

2.2.4   Strategic Decisions

1. In order to make the program management successfully, during the projects, their time schedules should be fixed and should not deviate from the schedules.
2. In order to create customer satisfaction and Bimar prestige, allocate the less resources for bug fixing: Quality shouldn't be sacrificed.
3. Invoicing should be made when the working parts of the program is completed and not delivered at the end of the whole project. So, the offer should include the flexible cost.
4. This process will be used only for the software development projects in Bimar.
5. According to the project's size and urgency, different approaches will be adopted to the project. For example, for an urgent and middle sized project, the approach will be 'start immediately and document later'.
6. The project will be planned iteratively.
7. The project will be planned by using the cards. [2]
8. The customer cards will be created as manageable, independent, small parts. For example, a pair programmer will be able to complete the card max. in 2-3 weeks. [2]
9. The team works in only one project at a time and to concentrate on this they shouldn't work for another project.
10. XP suggests the specialization in the business area and don't suggest the technical specialization. [3]

2.2.5   What the pilot project means for Bimar

In the Bimar project team, there were the team members which act in the project as the customer. While, the project was executed with the old methods with the real customer, the new process was tested with the "imitation customer". Before applying the process to the real customer, This test provided the chance to make the necessary improvements in the process

"In theory, there is no difference between theory and practice but in practice, there is!". The opportunity that comparing the designed process and the realized process, provided the process design teams to see the differences between them.

During the project, primitive quality assurance, measurement and analysis reports were prepared and process improvement was exercised. This exercises created the ideas to make the process more convenient. For example, to make the process more practical, standard content templates(communication plan etc…) were created.

During the process design, the good team work and taking into consideration every idea are the critical success factors. The process was designed by the team containing the people from different departments. After the design period, the spreading period starts. The project team members who acted in the process design, acted actively to execute the process during the project. As a result, process spreading activities is predicted to be effective.

All the process design and spreading activities shows that Bimar takes big steps along the learning organization's way. At this age, the organizations who act quickly against the changes will be successful. We are proud of working in such a company which learn to live in the changing environment.

2.3   Configuration Management

The Configuration Management System is a system that provides and maintains the consistency and integrity by using the identification, control, status assessment and audit activities for work products that form the values of an organization.

The Configuration Management System is designed for purpose of protecting the data that is the most valuable asset of an organization. The existence and usability of the Configuration Management System in an organization ensures to access the most reliable data in a speedy and easier manner within the limits of authorization.

2.3.1   Purpose

The purpose in establishment of the Configuration Management System is to identify the work products to be kept in this system, to follow up the modifications on work products and to provide and

maintain their consistency and integrity by making control on them.

For this purpose, the special Goals and practices of CMMI level 2 are as follows; [5]
Special Goal 1. Establish Baselines
    Specific Practice 1.1 Identify Configuration Items
    Specific Practice 1.2 Establish a Configuration Management System
    Specific Practice 1.3 Create or Release Baselines
Specific Goal 2. Track and Control Changes
    Specific Practice 2.1 Track Change Requests
    Specific Practice 2.2 Control Configuration Items
Specific Goal 3. Establish Integrity
    Specific Practice 3.1 Establish Configuration Management Records
    Specific Practice 3.2 Perform Configuration Audits

After the Configuration Management System was established in the company, a Configuration Management Plan has been prepared for the internal pilot project with which the functionality of the system to be tested. In the plan, the work products to be included in the system, authorization on the work products and relations between them are defined. During the project period, in conformity with the prepared plan, the consistency and integrity of the Configuration Management System for the project has been ensured , by following up the modification on work products and the version management.

During the performance period of the internal pilot project, the joint operation of the configuration management process and other processes have been observe, the resulting suggestions been assessed at the status meetings and improvements been made for the process.

2.3.2   Metaphor

In the process design and internal pilot project studies, the bank has been used as a metaphor.
The purpose, working method and customer satisfaction understanding of the bank and the configuration management system are almost similar.

To use a metaphor during the process design and internal pilot project studies, has made the idea sharing of the team members more productive.

2.3.3   Main Activities

In the design studies of the Configuration Management process , it has been determined that there is a need for the roles such as General Configuration Manager and Project Configuration Responsible ,and some persons have been appointed for such roles in the internal pilot project. While applying the configuration management process in the internal pilot project, three main steps that were established in the process design studies have been operated.

Three main steps for the configuration management system are as follows;

1. Project-Starting : The top management has the authority to start a project in the Configuration Management System. A Project Configuration Responsible is appointed for the project. The Project Configuration Responsible, together with the Project Manager or Project Customer Relations Representative, prepare a Project Configuration Management Plan. The prepared configuration management plan is sent t with the demand form to the General Configuration Manager by the person who demands to start the project.
The General Configuration Manager operates the Project-Starting step.

2. Project-Operating : In the Project Configuration Management ,a demand form is completed to perform a procedure on the work products . For the related demand, the Project-Operating step is operated by the Project Configuration Responsible. Within the performance , the following procedures are included.
> To check in the work product
> To check out work product
> To delete the work product
> To create a baseline
> To withdraw the baseline
> To update the data on work product

3. Project-Ending: In the Project Configuration Management, the Project manager or in case he /she is not appointed , the Customer Relations Representative has the authority to make the project ending demand.
With the demand of project ending, the Project Configuration Responsible operates the Project-Ending step.

Certainly, during the application period of the Configuration Management System, some difficulties have been experienced to eliminate them, some improvement have been made.

The purpose in the internal pilot project is to identify and eliminate the deficiencies for all the processes and by assessing the suggestions and approaches to the process, to make improvements.

During the performance period of the internal pilot project, it has been determined at the beginning that the persons included in the project did not know the Project Configuration Management and its significance and besides, its application was like a big load. Additionally, other processes did not trigger the application of the Project Configuration Management. In order to clarify this point, an informative guide has been prepared to emphasize the significance of the Project Configuration Management and make its application easier.

Again, in the studies carried out during the application period of the pilot project, a theater idea was suggested , all the processes came together to work together with this regard, and an educative scenario about the functionality of processes and their relations was prepared in BİMAR. The persons included in the process transformed the scenario to a play and it was showed to all the BİMAR employees. Thanks to this play, all the designed processes , including the Project Configuration Management process, became more understandable for the audiences and process project teams.

Another issue was that, when any work product is wanted to be taken from the Configuration Management system just for purpose of reading (not to want to make any modification but just to review), whether it is necessary to complete a form for such a procedure. As such questions were asked very frequently, by improving the application process of the system, the reading authorization has been given to everybody who works for the project and so this problem has been eliminated.

Again, by considering the suggestions to simplify the Configuration Management System Demand Form that must be completed for each demand in the Configuration Management System, it has been decided to make improvements on the demand form.

2.3.4 Strategic Decisions

The strategic decisions that were taken during the process design and internal pilot project studies and approved by the top management are as follows;

➢ A tool must be used for the sound operation and functionality of the Configuration Management System. However, to determine the expectations and selection criteria related to the tool to be used, firstly a system has been designed and decided to operate manually. For this reason, during the internal pilot project studies and project studies for a while, a file server to store the work products and MS Excel to store the movements and relations of the work products within the system will be used. On the File server, there exist confidential and private areas related to the project.

Confidential area: It is an area separated for the baselines and ended projects that only the General Configuration Manager is authorized to access.

Private area : It is an area separated for the ongoing projects that only the Project Configuration Responsible is authorized to access.

➢ As no tool has been used for the Configuration Management System yet and its manual follow up is difficult , the work products out of project and source codes will not be included in the Configuration Management System.
➢ To follow up the work products of the confidential area in the Configuration Management System, there must be a Company General Configuration Management Plan.
➢ For each project to be taken into Configuration Management System, there must be a Project Configuration Management Plan.
➢ There must be General Configuration Manager and Project Configuration Responsible roles in the company.

General Configuration Manager: he is responsible for the confidential area in the Configuration Management System. He caries out and follows up the procedures of the project starting, project ending and to create a baseline steps in the confidential area .He is responsible for following up the company General Configuration Management Plan.

Project Configuration Responsible: In the Configuration Management System , he is the full authorized person in the special area for the project he

is responsible for . He is responsible for the operation of all the process steps in the related project and following up the project configuration management plan.

3   XP Practices Piloted

4.1 Cards

Cards are tools that the customers can write their requirements in detail and that are used to determine the projet duration and cost. Customer cards should be written by business specialists that have the enough authority and business knowledge. These business specialists are to be assigned by their managers and they will work as a team member. They should work with the team preferably 5 days a week, and not less than 2 days.

Each card written by the customer should include maximum 2 weeks of work. The cards that are longer than 2 weeks should be and rewritten . [1]

Validation card is written by the customer, after the customer card, in order to define how to check the output. Validation card includes the acceptance criteria for the relevant customer card.

The cards should be prioritized according to ist urgency and possible earned value, by the customer. The card chosen are implemented by iterations and delivered to the customer. During the project, the customer may realize that some of the cards are not important for him and may cancel them.

The advantages of a making project using cards are below;

- Schedule plan and scope are trackked up to date.
- Customer should only need to pay for the finished parts (cards)
- Makes the prioritization of the requirements easier.

In our pilot project our new way of working was first presented to the customer. The customer was positive about the card system. He told that a project we did for them in the past would be more successful if we had used this system.

A business specialist was assigned for the project by the customer. The business specialist, working together with the Software Estimation Team, wrote the requirements on cards. After the project started, he worked together with he project manager to prioritize the cards and plan the following iteration. The customer could track the status of the project easily as the periodic status reports were written in terms of cards. The customer satisfaction was increased as he worked with the team and could see the results as soon as the work was done. And also he could make

changes in his requirements and added new ones while working with the team.

At the end of each iteration the programs for the chosen cards were delivered to the customer.

Our pilot project was finished in 3 iterations. We found out that the customer was pleased with our new way of working by the results of the customer satisfaction survey we made.

Card examples:

Figure 6 – Customer Card

Figure 7 – Validation Card

Figure 8 – Technical Card

3.1   Pair Programming

The pair programmer means that two programmers sit on the same table and look at the same screen and write code by rotation. As

one of them writes the code, the other traces the code at the same time. [1]

At first sight, it may seem to allocate two programmers for the same project, in practice it is very good idea. It was seen that at the pilot project that the team of two programmers writes code more quickly than the one programmer. Because the second eye traces the code, the problems are realized and solved early. In addition to this, controlling the code continuously reduces the bugs, as a result, the number of defects are inconsiderable. The time is saved and the products are in quality.

As the mathematical formula, it is expressed that the time to write code and fix the bugs by the two programmers separately is more than the time to write code by pair programmers.

At the beginning, there may be problems due to the difference in level of the knowledge of programmers but as the time passes it becomes unimportant. While implementing the XP practices, the difference in level between the programmers seems to be the disadvantage, as the time passes, it is seen that this difference is not very important and one programmer can catch up with the other. But obviously, if the knowledge of the programmers are in the same level, projects go faster. However there is an important advantage of this work style that the new programmers in the area learns very quickly by working together with the expert programmer and start to produce the code in the area. As a result the knowledge is shared and become homogeneous in the organization.

Of course, the psychological factors should be concerned also while the pair is gathered. If the pair programmers get along well together, the project goes well, work become pleasurable.

3.2   First Test then Coding

At the project, program codes was written by RPG on the IBM AS/400 system.
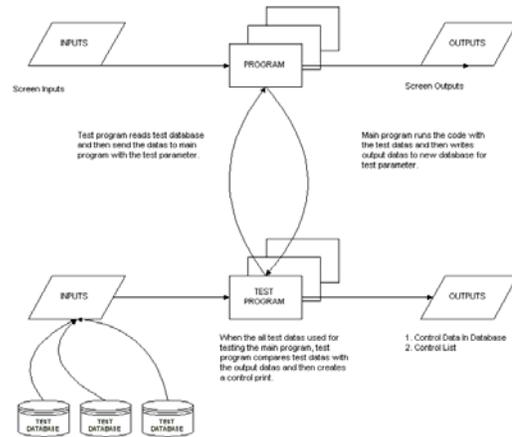

Figure 9: Test program is calling the main module provide it with the inputs and check outputs fit to expected outputs

Differently from the classical approaches, according to the XP practices, first the test code was written. [1]

To write the test code, firstly inputs and outputs were defined.(Figure 9)

While the test code was written by RPG programming language on the AS/400 system, the most difficult task was how to get the inputs. The cause of this is that, in RPG language, screens run integrated with the code and without conditions in the source code, program doesn't run in the test mode. This kind of changes in the main program was tried to minimize.

Depend on the function keys, for the data that will be listed on the screen from the any database, worked to get the inputs and test the outputs

The goal of the test method, to control the program by the another program. While writing the test code, at the beginning for the every test, some test data were defined as the constant. For example, to match the port number and the port names, they are defined as the constant data, and then port number is gotten from the database dynamically and verified. This method provides the long-lived test code, it can be used without any change in the future. Besides that, for every test, the physical file is created on the AS400 and the test data is entered to this file. Samely, the data at the end of the test is saved to the

another physical file. Then at the end of the test, the control list was built by comparing the outputs of the main program with the test data. The outputs means that the data which the user would like to obtain. This can cause some difficulties in file management, because the number of the files increases while testing the complex modules.

Every information entered by the user or on the lists should be controlled by the test program. In RPG like programs, to write the test code of the program, prepared to get lists, is more difficult than to write the test code for the screen controls. This difficulty increases as the lists get bigger and more complex.

In spite of these difficulties, this method provides quality software and as a result high customer satisfaction.

The other advantages of writing the test code are the followings;

1- While writing the test code, it is possible to look at the program from different respects and the defective points of the program can be noticed.
2- With the different data, all the program conditions are tested.
3- Programs can be tested every time when desired with pressing only one key.
4- The test is made by the program and this provides the objectivity in testing.
5- It can be observed that, how the last changes in the program effects the old program.

4   Conclusion

We found that XP practices are very well supporting CMMI processes: Requirements Management, and Project Planning, project planning process becomes very trivial when cards used in hardcopy as suggested in XP. However, using hardcopy cards have some disadvantages considering to Configuration Management.

The final word can be "While CMMI creates an organizational discipline XP ease the daily life by providing pragmatic end result oriented practices. CMMI and XP can be very well used together and their synergy is incredible"

	Cards	Pair Programming	First Test then Coding
Requirements Managements	++	N/A	+++
Project Planning	+++	++	++
Configuration Management	--	N/A	N/A

Table 1 – Relationship between some of CMMI process with some XP practices

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