Status of Requirements Management in Six Chinese Software Companies

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Abstract—*Little is known about Chinese software development. In this paper, we report on the status of requirements management within six Chinese companies. We investigate the pre-implementation phases on business and engineering levels and documentation utilized within the whole development process.*

Index Terms—**business and engineering levels, pre-implementation phases, product vision planning, product planning, release planning, documentation.**

I. INTRODUCTION

Today, we have a fairly good insight into the status of software development in the industrialized countries. Still however, we know little, if almost nothing, about its status in the developing countries. One of these countries is China.

About 10 years ago, Chinese software industry was a small and undeveloped sector [7]. It was, and probably still is, an extremely young and fragmented industry consisting of both small firms and foreign corporations. Due to its relatively young age, we know very little about its status of developing software.

When visiting Fudan University, we had the opportunity to study six Chinese software organizations [3]. Hence, in this paper, we report on their status. We mainly put focus on the requirements management in the pre-implementation phases on business and engineering levels and documentation utilized within the whole development process.

The remainder of this paper is as follows. Section 2 reports on our research method. Section 3 presents the context of this study. Section 4 presents the status within the Chinese organizations and Section 5 makes final remarks.

II. RESEARCH METHOD

When visiting Fudan University as a guest professor in fall 2007, we took the opportunity to study the requirements management practice within some Chinese organizations [3]. For this purpose, we used students attending our course on advanced software engineering. The students were provided with 30 questions and expected answers to them.

The questionnaire used is presented in Table 1. It consisted of four different parts. *Part 1* inquired about the organization and its background. *Part 2* dealt with the documentation practice on the *Business* level whereas *Part 3* did the same on the *Engineering* level. Finally, *Part 4* investigated the

details of documenting requirements and their management within the whole development process as prescribed by our template presented in Table 2 [2]. The template is called *Software Requirements Management Template* (SRMT).

Our questionnaire was open-ended and semi-structured. Its purpose was to give freedom to the respondents to answer in their own terms [9]. The data collection method was convenience sampling [6]. This means that we did not control the choice of the organizations involved in our study. It was students who did it, and they chose the companies that were

TABLE 1. OUR QUESTIONNAIRE

PART 1: Introductory
Q A.1: What is your name?
Q A.2: What is your email?
Q A.3: What is your telephone number?
Q A.3: What is the name of your company?
Q A.4: What is the number of employees?
Q A.5: What is your role in the company?
Q A: 6: What type of products or services does your company develop/provide?
Q A.7: What is generally the size of your projects?
Q A.8: What software development process model(s) do you use?

PART 2: Documentation Qs – Business level
Q B.1: Does your organization conduct planning on the business level?
Q B.2: What role is involved in this planning?
Q B.3: How often is this planning conducted?
Q B.4: Does your organization write a document similar to the Operational Concept?
Q B.5: What is this document called?
Q B.6: What is the purpose of this document?
Q B.7: Who uses this document and for what purpose?

PART 3: Documentation Qs – Engineering level
Q C.1: Does your organization conduct Product Planning?
Q C.2: What is the goal of the Product Planning activity?
Q C.3: What roles are involved in Product Planning?
Q C.4: How often is the Product Planning conducted?
Q C.5: What is the output (document) of the Product Planning?
Q C.6: Who uses this output (document) and for what purpose?
Q C.7: Does your organization conduct Release Planning?
Q C.8: What roles are involved in Product Planning?
Q C.9: How often is the Release Planning conducted?
Q C.10: What is the output (document) of the Release Planning?
Q C.11: Who uses this output (document) and for what purpose?
Q C.12: Which of the following options apply:
  • Product Planning comes before Release Planning
  • Release Planning comes before Product Planning
  • Product Planning is part of Release Planning
  • Release Planning is part of Product Planning
Q C.13: Is the output (document) of the Product Planning the same as the output of the Release Planning?

Part 4: Requirements
Q D.1: Does your organization document requirements?
Q D.2: For each attribute could you please state whether you record it:
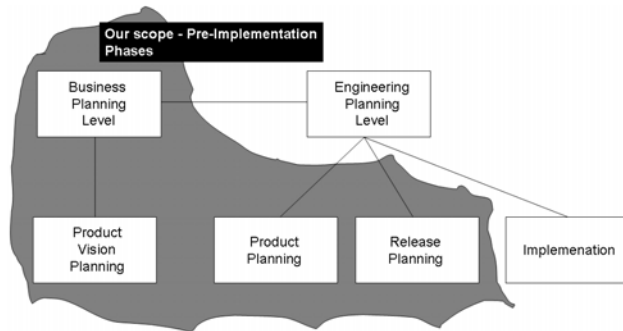
Fig. 1. Process phases

most conveniently available. The only requirement was that the organizations should develop software systems.

III. CONTEXT

In this section, we present the context relevant for this study. We first present a development cycle presented from the business and engineering perspectives in Section 3.1. We then describe the *SRMT* template in Section 3.2.

A. Process

One way of illustrating a software development cycle is by structuring it according to business and engineering levels. As shown in Fig. 1, this cycle consists of the *Pre-Implementation* and *Implementation* phases [5].

Regarding the *Pre-Implementation* process phase, it is executed on both *Business* and *Engineering* levels. It covers the activities during which one makes various preparations for the next-coming implementation. These are *Product Vision Planning, Product Planning* and *Release Planning.*

In the *Product Vision Planning* phase, one evolves an overall business vision into a more detailed product vision. At this phase, one focuses on product goals, overall business and product structure, development environment, and return on investment. The results of this phase are documented in a *Product Vision Document*, usually called *Operational Concept* [2].

In the subsequent phases, *Product Planning* and *Release Planning*, one first outlines a high-level product roadmap. Such a roadmap is usually called *Product Plan. Operational Concept* may play its role as well. One then designates and plans releases and documents them in a *Release Plan*.

Regarding the *Implementation* process phase, it is executed on the *Engineering* level. It covers phases and activities during which the actual projects take place. Here, one uses (1) *Product Plan* as a basis for relating the implementation results to the overall product structure, (2) *Release Plan* for planning and defining the scope of the implementation process, and (3) a change management tool for recording information about the requirements and their realization during the implementation phase. Usually, such a tool implements the fields that we have defined in the *SRMT* template.

B. Template

The *SRMT* consists of eight clusters of information, each dedicated to a particular requirement aspect and/or phase. As listed in Table 2, each cluster covers a set of attributes bearing on highly cohesive information. Below, we briefly describe the clusters.

- **General Requirement Description** describes basic requirements information needed for identifying, understanding, and classifying requirements.
- **Requirement Evaluation Data** describes the data essential for evaluating and prioritizing the requirements [4].
- **Other Description Data** provides the context of the requirements and their management process.
- **Requirement Reporting Data** records when and by whom the requirements have been identified and to whom they have been assigned.
- **Requirement Management Data** communicates information about the requirements management process.
- **Requirement Management Progress** tracks the implementation status essential for monitoring and controlling requirements.

TABLE 2. SOFTWARE REQUIREMENTS MANAGEMENT TEMPLATE [4]

General Requirement Description:
Requirement ID **(4)**, Requirement Title **(5)**, Requirement Description **(6)**, Requirement Type **(4)**, Internal/External Req. **(5)**, Rationale **(4)**, Event/Use Case ID **(3)**, Related to Requirement(s) **(5)**, Non-functional requirements **(1)**, Constraints (Solution **(4)**, Technical **(5)**, Budget **(2)**, Resource **(4)**) Conflicting Requirements **(3)**, Intended User **(5)**, Specific user who stated the requirements **(5)**, Customer Satisfaction **(4)**, Customer Dissatisfaction **(3)**, Reference documents **(5)**.

Requirements Evaluation Data
Business Value **(3)**, Other value **(2)**, Requirements Priority (Rank) **(5)**, Acceptance Criterion/Criteria **(2)**, Fit Criterion **(1)**

Other Description Data
System Data (System ID **(2)**, Sub-System ID **(2)**, Component ID) **(2)**, Adjacent/interfacing Systems ID **(2)**, Environment **(4)**, Assumptions **(2)**,

Requirements Reporting Data
Requirements Reporting Date **(4)**, Originated by **(3)**, Reported by **(3)**, Requirements Owner **(5)**

Requirements Management Data
Preliminary Implementation Plan **(4)**, Planned and Actual Activities(s) (*Activity Description* **(3)**, *Activity Start Date* **(3)**, *Activity End Date* **(3)**, *Expected/Actual Result of Activity Taken* **(3)**, *Activity Conducted By* **(3)**, *Activity Approved By* **(1)**, *Effort Spent On Activity* **(2)**, *Cost of Action* **(4)**,)

Requirements Management Progress Data
Requirement Management Status **(4)**, Requirement Mngmt Status Date **(3)**, Requirement Age **(2)**, Requirement Changes **(4)**,

Requirements Completion Data
Actual Completion Date **(6)**, Planned Completion Date **(6)**, Relation To Tests **(5)**, Released In **(5)**, Requirements Completion Approved By **(4)**, Signed Off Date **(5)**, Signed Off By **(4)**, Estimated Total Effort **(5)**, Actual Total Effort **(5)**, Estimated Total Cost **(4)**, , Actual Total Cost **(4)**,

Post Implementation Data
Analysis of the Requirements Implementation Process **(3)**, Lessons learned **(4)**,

The numbers in the paranthesis next to the attributes represent the results

TABLE 3. PROFILES OF THE CHINESE COMPANIES STUDIED

	Company size (Nr of employees)	Product type	Role interviewed	Team size	Project duration	Method
Org 1	20000 worldwide	Business solutions	Developer	5-10 developers	3-10 months	Plan-driven
Org 2	170	GPS Navigation	Project Leader	6 developers	1 month	Plan-driven
Org 3	10	Web services	Developer	4-5 developers	1 month	Agile document a lot
Org 4	10000	eCommerce platform	QA Manager	1-20	1-6 months	Both plan-driven and agile
Org 5	•14 on permanent basis •60 on temporal basis	Scientific application	Project Manager	8	6-18 months	Agile-like
Org 6	20-30	Information Retrieval	Developer	20-30	NA	Plan-driven

- **Requirement Completion Data** covers information about the planned and actual activities of the implementation process [8].
- **Post Implementation Data** holds information on the post-mortem process analysis.

IV. STATUS

In this section, we present the status as elicited within the Chinese organizations studied. We first present their profiles in Section 3.1. We then describe their status on both the *Business* and the *Engineering* levels in Sections 3.2-3, respectively. Finally, in Section 3.4, we go into the details of the documenting practice.

A. Profile of the Organizations Studied

All the organizations studied develop software. As shown in Table 3, half of them are small companies. Two of the other half are major international organizations who have established their activities in China. The products they develop range from business solutions to web services to scientific applications. Their projects vary in team size and duration as well. Half of them practiced heavyweight development and the other half the agile-like one.

Due to the sensitivity of the results presented herein, we do not disclose the names of the companies studied. Instead, we number them and use these numbers as their fictive names.

B. Business Level

As presented in Table 4, all the Chinese organizations studied conduct long-term planning. Only two organizations, the international ones (Org 1 and *Org 4*), document the results of this phase. Two of the remaining four organizations conduct business planning on only an oral basis.

Regarding the documentation, only two organizations, *Org 1* and *Org 4*, produce documents corresponding to the *Operational Concept*. These documents are called *Product Specification and Business Requirements Document*. They are used for planning business, its strategies and resources. The three remaining organizations do not create any document of this kind. In the fourth organization, *Org 3*, this fact was unknown by the interviewee. This is because he represented the engineering level.

The documents as produced in *Org 1* and *Org 4* are used by (1) business analysts for creating software requirements specifications, (2) architects for designing and reviewing the requirements, (3) senior developers for creating technical

TABLE 4. BUSINESS PLANNING LEVEL

	Long-term planning	Roles involved	Frequency	Operational Concept in place
Org 1 (international)	yes	Senior manager Project Leader	Every week It depends on the market demand and customers` request	yes, It is called Product Specification
Org 2	yes	CEO, department manager and other managers	NA	NA
Org 3	yes	Manager	On a demand basis	NR
Org 4 (international)	yes	Business Unit Team	Once a year	Yes (Business Requirement Document
Org 5	yes	Scientific manager	Once a year	No
Org 6	yes	Manager, Developer	Once a month	No

NR – not relevant   NA – not available

TABLE 5. PRODUCT PLANNING DATA

	Product planning	Roles involved	Frequency	Product Plan
Org 1 (international)	yes	Quality Manager Project Leader	Every day	yes
Org 2	yes	Product Manager Marketing Team Project Manager Project Leader	Once a month	Montly project plans
Org 3	yes	Product Manager	On a demand basis	yes
Org 4 (international)	Yes	Business Unit Team, Product Manager, Global Product Planner, Development Manager	Once a year	Yes (Product Roadmap)
Org 5	yes	Project Manager Senior developers	Every two months	Yes
Org 6	no	NR	NR	NR

NR – not relevant   NA – not available

solutions and for checking the feasibility of the requirements, (4) project leaders for creating plans, (5) quality managers for reviewing the requirements specification and ensuring the product quality.

Regarding the roles involved on the business level, they may be grouped under the name of senior and/or business management. They range from CEOs, senior management, project leaders to business unit teams. Finally, the frequency of business planning ranges from once a week to once a year.

A. Engineering Level

As shown in Table 5, five of the six organizations studied conduct product planning. Four of them create *Product Plans*. The fifth organization creates monthly project plans instead. Regarding the sixth organization, *Org 6,* it neither plans its products nor its releases. Hence, we exclude it from our analysis made below.

The roles within the remaining five organizations are mainly the engineering roles ranging from product managers, project managers to senior developers. However, in some

organizations, some of the business roles continue to be involved in this phase. They are business teams and marketing teams.

Product planning is conducted at different frequency rates starting with a daily frequency and ending with a yearly one. Its goal is to define the product and create a product plan to be used as a basis for future development. The plan is used by various teams, such as project leaders, quality managers, product managers, project managers, developers, and testers.

Considering the release planning phase, only half of the organizations studied, conduct it and create release plans. As can be seen in Table 6, some of the roles involved in product planning are involved in release planning as well. However, the role portfolio shifts somewhat from less business-like roles to the more engineering-like ones. The frequency of conducting release planning does not have as wide spread as in the former phases. It only ranges from once a week to every two weeks. Its result, the *Release Plan*, is used by various roles such as project managers, project leaders, and developers for planning and managing their work.

TABLE 6. RELEASE PLANNING DATA

	Release planning	Roles involved	Frequency	Release Plan
Org 1 (international)	yes	Quality Manager, Solution Mngt. Project Leader	Every week	Yes
Org 2	yes	IT Operation Manager Project Manager, QA	Once a week	Yes
Org 3	no	NR	NR	NR
Org 4 (international)	yes	Release Manager Development Manager	Every two weeks	Yes
Org 5	no	NR	NR	NR
Org 6	No	NR	NR	No

NR – not relevant   NA – not available

A. Documentation Practice

To our positive surprise, many of the fields inherent in the *SRMT* template are actively used and documented in the Chinese organizations studied. The evidence is provided in Table 2. The results for each attribute are marked with numbers written in the parenthesis next to the attributes. These numbers represent the combined results from the six companies studied.

Except for *Org 6*, all the organizations studied document most of the fields in our template. However, the most diligently documented clusters were *General Requirements Description, Requirements Reporting Data* and *Requirements Completion Data*. Regarding the remaining clusters, the documentation of their fields varied.

V. FINAL REMARKS

The status within many developing countries is like a black box. One knows little, if almost nothing, about their development processes. When visiting Fudan University in Shanghai in China, we took the opportunity to make this black box less black.

We succeeded to have insight into six Chinese organizations. Simultaneously, we made a similar study in Canada [1][2][5]. However, the Canadian study was not directly analogous. It only focused on the status in an agile development context.

Due to the fact that our data collection is based on the convenience sampling method, we cannot generalize our results. Still however, we may claim that these results indicate that the status of the Chinese software development looks satisfactory and that it is highly comparable with the status in the developed countries. More studies however need to be made to confirm this statement.

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