

Full Length Research Paper

Software release planning challenges in software development: An empirical study

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Software development is a complicated process and requires careful planning to produce high quality software. In large software development projects, release planning may involve a lot of unique challenges. Due to time, budget and some other constraints, potentially there are many problems that may possibly occur. Subsequently, project managers have been trying to identify and understand release planning, challenges and possible resolutions which might help them in developing more effective and successful software products. This paper presents the findings from an empirical study which investigates release planning challenges. It takes a qualitative approach using interviews and observations with practitioners and project managers at five large software banking projects in Informatics Services Corporation (ISC) in Iran. The main objective of this study is to explore and increase the understanding of software release planning challenges in several software companies in a developing country. A number of challenges were elaborated and discussed in this study within the domain of software banking projects. These major challenges are classified into two main categories: the human-originated including people cooperation, disciplines and abilities; and the system-oriented including systematic approaches, resource constraints, complexity, and interdependency among the systems.

Key words: Challenges, qualitative research, release planning, software developments.

INTRODUCTION

Release planning is considered a company-wide optimization problem involving many stakeholders in whom the goal is to maximize utilization of the often limited resources, of a company and turn them into business benefit (Ruhe and Saliu, 2005). Release planning can also be perceived as a decision for selecting important and necessary features for a new product. Since implementation of all the features is impossible in one release, therefore, we need to know which features should be implemented in the subsequent release and which one can be further postponed. If there is no proper or sufficient planning for a new release, 'critical' features might be delayed into the release late in the cycle which might subsequently provide effect to the overall release

schedule. The potential effect might result in unsatisfied customers, time and budget overruns, and a loss in market share (Penny, 2002). Delivering software in an incremental fashion suggests increased customer satisfaction and reduces many of the risks associated with delivering large software projects (Ruhe and Ngo, 2004).

Release planning for a new release of software includes assigning important requirements by investigating time, resources, budget and constraints. Software release planning is a complex task; because many different factors must be considered in order to have good quality software, and project managers always face many problems for a new release. According to Ruhe and Saliu (2005), the complexity of release planning is partly due to the incompleteness and uncertainty of the information that characterizes the problems. They have discussed product release planning

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and have used the word “endless” to describe the challenges in any software development. This means that in every software development project these challenges exist and there should be some ways to manage and mitigate these problems. Without a proper software release planning, software projects are prone to fail because of the problems forced by new features that are not really necessary and urgent in a new release. Generating a new release is difficult to plan and becomes even more difficult with an increase in demand. Sometimes, a new release may have less efficiency compared to the previous releases because of misunderstanding of challenges in the process of coming up with a new release. This study explains the findings of an industrial qualitative study in Iran, focusing on current practice and challenges of software release planning in five large software banking projects.

LITERATURE REVIEW

In large software companies, besides focusing on the main stages of software developments such as requirements definition, analysis, design, implementation and testing, a plan for a new release is needed to make sure that the produced software is able to cope with new demands and is able to evolve gradually with the increased understanding of the developers and the users. The ability to be agile and aggressive in the development team is becoming necessary to ensure that the product is able to meet the ever-changing needs of stakeholders. However, to perform release planning process is not simple. The tools and methods that are used to support release planning are very intricate and complex. Since we do not have sufficient understanding or even fundamental mechanisms that cover most of the problems that may occur in this process, there is a necessity for a study in this area to be performed. Empirical studies are a key way to get information and move towards well-known decision (Perry et al., 2000). Surveys, experiments, case studies, are examples of empirical methods that are used to investigate software development processes. Empirical study is the attempt to learn something useful by comparing theory to reality and to improve our theories as a result (Perry et al., 2000).

According to Ruhe (2005), a release plan is influenced by several factors such as the types of requirements, implementation strategies, and urgency for the client, value for the developing company, risk management and personal decisions. Investigation and evaluation of these factors and proposed algorithms which can help us in decision making is very important. There are also tools implementing these algorithms, a comparison of these methods can be found in Saliu and Ruhe, 2005. These

methods are based on a number of variables to be estimated by experts. In its most basic form *customer value* and *cost* are estimated (Jung, 1998), while other work considers more parameters (Ruhe and Saliu, 2005). There are varying definitions in the literature on what constitutes the release planning problem. Ruhe and Saliu (2005) have provided a set of key aspects for release planning methods to be able to compare and understand them. Their paper describes ten technical and non-technical aspects that are significant to provide an impact on release planning process. These aspects are useful guideline for us to evaluate our challenges as well as to identify ways to overcome them. There are also various methodologies which aimed at detecting release planning problems from the industry and academic research which were categorized in Ruhe and Saliu, 2005. Saliu and Ruhe (2005) discussed current challenges in release planning, main characteristics of a release plan and present a form description of a release planning process.

According to Carlshamre (2002), there is always a possibility that problems occur for a next release which are not predicted and are different in each software development project. Carlshamre (2002) has classified release planning as a “wicked problem”. The concept of a wicked planning problem was first introduced by Rittel and Webber (1984). Wicked problems are difficult to clearly define and there is often no clear-cut solution to wicked problems. For this reason, only a systematic approach can be used and we need human ability and experience of professional practitioners in the world of software as well. Ruhe and Saliu have discussed release planning from two different dimensions which are art and science (Ruhe and Saliu, 2005). The art of release planning refers to human and his capabilities; and the science refers to the algorithms and methods. Based on their understanding, Ruhe and Saliu have designed, implemented and evaluated a support tool for release planning as a means of developing a rich understanding of the task.

Ruhe and Ngo (2007) proposed a systematic approach for solving the wicked problem of software release planning and a new method (EVOLVE+) for decision support for software release planning. To facilitate release planning process, Wohlin and Aurum have recognized the importance of 13 criteria used in deciding when to include a software requirement in a release (Wohlin and Aurum, 2005). They show the motivation for the criteria and have shown that there are indeed some criteria that are more important than others in the decision-making process when deciding which requirements to include in a specific project or release. Their work concludes that business and management criteria are ranked higher than system criteria and that this is not

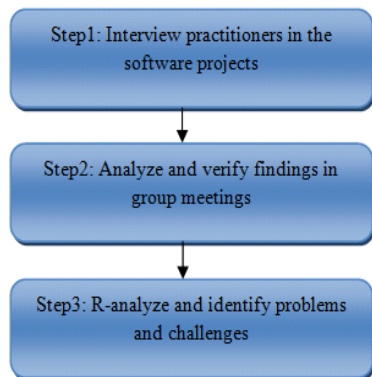


Figure 1. The research procedure.

an indication of this area being less important, rather than there is a need for better tools and methods for addressing these issues. In another related research, the importance of software architecture in release planning process was investigated and release planning process was discussed (Lindgren et al., 2008).

Based on the work in this area, our research aim to focus on deeper understanding of the release planning process. The main objective of this paper is to explore the release planning problems and challenges in software banking projects specifically in Iran. The findings might be useful for others to make comparison and analysis with the current understanding of release planning process.

RESEARCH DESIGN

Due to the fact that there are many problems and challenges in developing a new release in software projects, this research has focused on challenges associated with five large banking projects. Investigation of these challenges needs a proper and comprehensive study in software projects. A qualitative case study is performed to understand and identify challenges in software banking projects. Qualitative research methods are useful when the purpose is to explore an area of interest, to obtain an overview of a complex area, and to discover diversities and varieties rather than similarities (Robson, 2002). Qualitative data sources include observation and participant observation (fieldwork), interviews and questionnaires, documents and texts, and the researcher's impressions and reactions (Myers, 2009). It is also preferable to use a qualitative approach when the aim is to improve the understanding of a phenomenon in which little is known. This is due to the fact that the case study focuses on gaining in-depth information (Hoepfl, 1997). The quality of a qualitative study relies on the quality of the investigator (Robson, 2002). For this study, we interviewed 27 experienced software developers, analysts and designers and 5 project managers. Release challenges and problems with current release cycles, have been identified. This study consists of three steps which are described in Figure 1.

Step1: Interview practitioners in the software projects

In the first step, semi-structured interview (Robson, 2002) and direct observation for data collection with project team members that include

introductory and technical questions were performed. This was done through discussion among the interviewer and the interviewees. For each project, at least five persons attended the interview, and the number varies in each project. The interviews varied between 70 to 80 min in length. All their ideas were transcribed and later sent to them by e-mail to be approved and verified. Summary of interview questions are available in Appendix A; Table 1.

Step 2: Analyze and verify in group meetings

The second step was investigating and analyzing data collected from step1 in three long meetings with four project managers. Each meeting lasted between 120 to 180 min. In fact, the purpose of these meetings was to collect additional information, as well as to verify and confirm the information gained from the practitioners in the first step.

Another objective was to obtain feedback from project managers' views. In this step, project managers' experiences were also of great value to us.

Step 3: Re-analyze and identify the challenges

In this final step, we have a comprehensive view of all projects and their characteristics. We re-analyzed all data that we received in two previous steps and identified the challenges. We found 12 challenges that were faced by new release process which were very important to all interviewees. All the staff agreed that these challenges exist in their projects. Summary of the conducted interviews is shown in Table 1.

Software projects

This research was conducted in five software banking projects in Informatics Services Corporation (ISC) Company in Iran (<http://www.isc.iranet.net/MainE.asp>). ISC was established in 1993 and a new phase of renovation and modernization of different sections in the banking system started in this company. Old deficient structure of banking system was transformed to an efficient new one by using the executive and technical power of ISC. Here we provide an overview of the five projects that are still under development, and so far have produced a few releases.

Project 1: Damoon

The PGS (Payment Gateway Solution) system is for both internet shops and offline shops. In case of internet shop, it allows to set up a work place for credit card payments operator. When used in offline store it would be a good replacement of a regular POS machine for more modern payment terminal. The main functionalities of the systems are:

1. Credit card transactions with manual data input using the keyboard.
2. Credit card transactions using the second magnetic strip (provided that the PC has a reader connected to it).
3. Getting cardholder information from PGS SYSTEM server provided that the cardholder is registered with PGS SYSTEM or purchased earlier paying through PGS SYSTEM.
4. Processing transactions data locally without requesting from the PGS SYSTEM servers.

Project 2: Saba

Internet banking systems (Saba) is a web based banking application developed by ISC, on an Intranet/Internet environment. An intranet/

Table 1. Summary of the conducted interviews.

Project name	Interviews	Interview type	Additional information
Damoon	Project Manager	Meeting	-
Damoon	System analyst, Developer	Individual	Sending e-mail to get approvals
Saba	Project Manager	Meeting	-
Saba	System analyst, Developer	Individual	Sending e-mail to get approvals
PKI /CA	Project Manager	Meeting	-
PKI /CA	System analyst Developer, Security Manager	Individual	Sending e-mail to get approvals
EXIMBILLS	Project Manager	Meeting	-
EXIMBILLS	System analyst, Developer, designer	Individual	Sending e-mail to get approvals
Islamic loan systems	Project Manager	Meeting	-
Islamic loan systems	System analyst, Developer	Individual	Sending e-mail to get approvals

internet banking application could be part of an e-banking application. In e-banking application the users can perform their banking needs through different kind of channels, such as Mobile, ATM, POS, etc. internet banking systems. Currently, it can interact to any retail banking systems and deliver appropriate transactions.

Project 3: PKI (public key infrastructure)

At present, many ongoing processes are transaction-oriented. Transactions in the broadest sense of the word cover the elementary messaging for processes like Internet banking, B2B and B2C exchanges, online notary services, e-invoices, online tax declarations etc. All of these business processes can be handled faster and more cost effective electronically. For security and privacy reasons but also because of government regulations, it has becomes increasingly important to guarantee the authenticity and integrity of these transactions by means of digital signatures. Doing transactions electronically can be a huge cost saver compared to traditional paper based procedures. It can also yield better and faster results and thus lead to higher customer satisfaction. Several industry and government initiatives stimulate businesses to increase the level of automation in their internal and external processes. Well-known examples are Bolero.net for global trading; and Identrus and Swift TrustAct for global e-commerce.

On the government front, the European Council has prepared a new directive on VAT and invoicing that enables companies to replace paper based invoicing with exclusive electronic invoicing even for cross border transactions. Electronic signatures are explicitly mentioned as one of the means to implement such a system. Although less fancy than other applications e-invoicing is easier to implement and yields an immediate and predictable return on investment.

Project 4: EXIMBILLS

Trade Finance Systems (EXIMBILLS) is an integrated system that audits and automates the complete cycle of trade finance transactions, in real time and in accordance with SWIFT and UCP standards. This allows for a rapid yet comprehensive installation for banks wishing to implement on a strict time scale. The system is able to save bank's time and money by straight processing to automate the creating of records from incoming SWIFT messages, passing accounting entries, producing customer advices, and making payments with little or no user intervention.

Project 5: Islamic loan systems

Islamic banking is now well into its stride and there is no longer any doubt that it has earned a respected place in the world of banking. Some leading international organizations, including the International Monetary Fund, have carried out extensive research in order to understand and evaluate the characteristics of this newly established banking practice. Islamic banking, which bases itself on the principle of fair profit sharing and claims to be the most stable method of banking, provides a range of deposit and loan products to its customers.

Although, there are similarities between Islamic banking practices and the traditional western banking methods, the principles lying behind Islamic products as well as the technicalities involved in the day to day business are entirely different. This stems from the fact that Islamic banks do not regard their customers purely as their creditors or debtors. An Islamic bank customer participates in all investment activities of the bank and shares the profits as well as the business risks involved. A certificate of deposit is a document of participation and investment and not purely a debt-reclaim document. A loan granted to a customer is regarded as an investment, which involves risk, and not a debt burden on the customer.

The Islamic loan products cover a range of customer financial requirements including consumer loans, commercial loans, mortgages, corporate loans and investments. They are divided into some major categories, which may differ from bank to bank although the main principles and procedures remain unchanged. The main categories, referred to as 'Aghd', are "Ghard-Ol-Hassane", "Mozaribbe", "Morabehe", "Joale", "Moshareka", "Ijare", and "Salaf". The widespread use of Islamic Banking both in Islamic and non-Islamic countries has created demand for computer based systems supporting Islamic banking procedures. The traditional retail banking systems, which mainly cover the western banking products, do not encompass the requirements of an Islamic bank. The deficiencies of the existing software systems have forced Islamic banks to invest heavily on improving the traditional systems. However, this has not proved successful mainly due to the nature of the Islamic loan products.

On the other hand modern international banks with local presence in Islamic countries have recently shown an interest in Islamic transactions and products. However, their limited knowledge of Islamic banking has hindered a powerful competition with local banks. The software projects and their application areas are introduces in Table 2.

Challenges identification

In this study the objective is to find and understand problems and

Table 2. Projects and applications their areas.

Project name	Number of project members	Application domain	Number of releases until now	End users	Long-term planning
Damoon	8	Internet payment systems	2	Banks and financial institute	Yes
Saba	15	Internet banking systems	6	Banks and financial institute	yes
PKI /CA	12	Public Key Infrastructure	2	Central bank	yes
EXIMBILLS	18	Trade Finance Systems	2	Banks and financial institute	yes
ILS	26	Retail banking systems	9	Banks and financial institute and central bank	yes

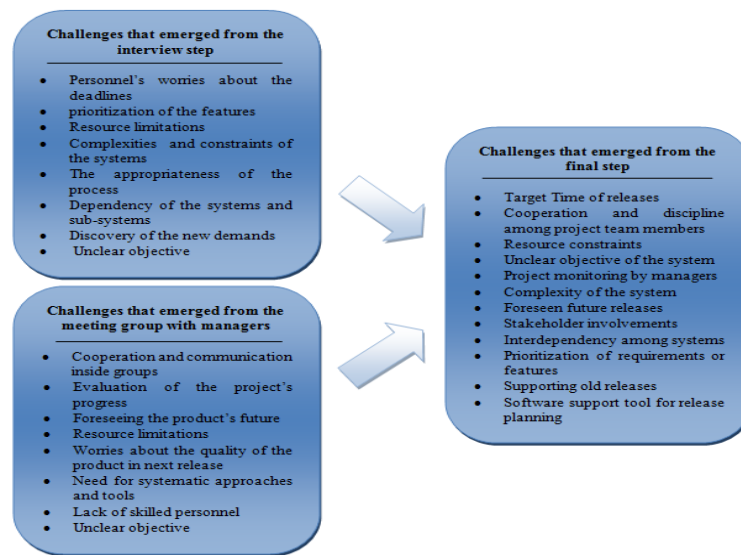


Figure 2. Challenges during the discussion, interview and meeting.

challenges that the team members and the project managers usually face in the process of release planning. As it was mentioned earlier, this study includes three steps. In the first step, we had several face-to-face interviews and discussions with the team members e.g. developers and analyzers; those who were inside the system and those who were in close contact with the system. In this step we interviewed 27 interviewees and issues about development process and possible problems faced in release planning were discussed. Then, interview transcripts were refined and e-mailed to all the interviewees to be verified. During the interviews, two researchers were involved to ensure that the researchers are able to verify their collected information.

In the second step, interviews were conducted in three meetings with five project managers in which the researchers verified the data collected from the first step and tried to identify release planning challenges related to the outside environment of the system. Besides, discussion on the requirements for the durability and sustainability of the systems was also done. In this step, experiences of the managers and their concerns about the future of the systems were identified and illustrated in Figure 2.

The final step was about re-analysing and investigating the findings of the two previous steps to identify the challenges shown in Figure 2. For the identification process, all related transcripts for each step were compiled and arranged in a readable format as seen in aforementioned table. Having an accurate project deadline means schedules can be

planned. One of the most important factors both for the team members and the managers was discussion on the deadlines for the future releases because it cannot be decided easily and estimated with accuracy and this estimation can trigger problems for the personnel. Sometimes, the managers were very strict in deciding on the deadlines because of the pressures from the organizations. They consider that the time of a new release is of importance because of the tough competition and the high demands of the stakeholders. Proper communication and coordination among the members is significant in successful software development process. In the meetings with managers, they mentioned that communication and coordination are among the most important elements for the success of the product.

Chatzoglou (1997) discusses that a lack of resources, that is, people involved, time and money as the requirements of the activity. Lack of resources including human or financial was also discussed in meetings, but the discussions were more on the human resources. The survey by Hall et al. (2002) also confirms that lack of skilled personnel is one of the organizational problems in the process of software development. Lack of experienced and know-how personnel has a great impact on the release time in the future and sometimes it has been observed that because of this problem the new release may be delayed for a few months. Ruhe and Saliu (2005) mentioned that complexity is one of the difficulties in release planning. Complexity and constraints of the system are of the factors seen in every software

development project and members know that there is no systematic approach to solve it. In this study, during the discussion with the members, creative and experimental approaches were suggested as the possible ways to tackle these problems. Most of the managers agreed that they couldn't avoid the inherent complexity of the software system and the complexity can result in delays of the future releases. Another challenge is in terms of the interdependence of the systems and the related sub-systems in a web-based project, especially the banking projects. This is one of the main topics discussed in the interviews and meetings since a few of these systems are almost ready to be utilized but are delayed to be installed due to their non-adaptability with the related systems.

Identification and discovery of significant new features for a system which will be the base for new releases was also one of the major challenges to the team members and managers. There is always this question that how we can spot important features and prioritize them for future releases. Managers defined systematic approaches and tools as the basic way to cater this question. In all projects, some were worried about changes in strategies and lack of clarity in the goals. Sometimes, the pressure on staff for generating a new release was regulated due to the importance of the project, and sometimes the same project was halted for a long time. Many of these strategic changes were devised by the top level managers based on certain organizational policies which the team members were not aware of and may result in problems for the new release. Saliu and Ruhe, (2005) mentioned that stakeholder involvement as one of the key aspects for release planning. Although there are many stakeholders who are interested in the content of the release, the definition of stakeholder is different for different organizations. These types of different definitions will be further discussed in the next section. Most of the time, the manager is the main one in charge and has the full responsibility to think about the future of the products. They are concerned that the new release should have better quality and performance. Therefore, they need to foresee the future of the product and decide whether the new release can cover all the inefficiencies of previous releases. In our meetings with the managers, they mentioned that they usually paid special attention to the process of the development of the project. For most of the managers, they already had regular weekly and monthly meetings to evaluate the tasks of the personnel so that they able to keep track of the project's progress and should be the first one to know if anything goes wrong with the project. Figure 2 shows the topics discussed in each step.

FINDINGS

A satisfactory release for software can be attributed to the well organized and planned process. Software quality can be achieved through identification of real software defects and adding suitable features for the new release. This section presented the challenges found during re-analysis in step 3. The twelve challenges presented in the following section are the findings from the discussions and the analyses made in the study. Projects and all their characteristics are available in Appendix A, Table 2.

Target time of releases

One of the most important questions that project

managers are challenged with in release planning is when to release the next software version. The time taken from when the software is conceptualized until it is being available for new version is important to be planned to ensure that the software is not outmoded in more than one release. This time refers to the time needed for a new release of product or project and setting this period of time effectively is a particularly crucial ingredient in successful release plan. The challenge is to determine an acceptable time of release for a project. All the interviewees were mainly concerned on time scheduling and one of the developers mentioned that he always faced problem on the amount of time allocated to him to finish his work. The setting of time for release planning can be of fixed intervals or flexible ones. For some projects, this time is fixed and pre-determined and in others, it is flexible or based on new demands or the condition of the project.

In Damoon project, the time for release is fixed and is determined twice a year. Based on the new requirements of the users, they provide a new release. In Saba, the release time is considered crucial and it is identified to be three times a year. Three new releases have been provided annually and until now they have had a total of 6 releases based on their customers' requests. The release time for PKI/CA is fixed and is once a year. Its project manager intends to concentrate more on security aspects for each new release, because security is one of the most important considerations in this type of projects. In EXIMBILLS, the time of new release is flexible and depends on many factors. Creating a new release for EXIMBILLS is based on new functions and new requirements of banks and Swift organization. There are many functions planned in this system that must be implemented in the future. In the ILS, a new release is flexible due to the changes in rules and regulations. For this project, they have already made 9 releases. To set the target time of releases is so much dependent on many realistic factors of the projects. Hence, the manager has to be aware and sensible to the project they are handling.

Cooperation and discipline among project team members

During the group meetings, one of the shared concerns that project managers had, was the lack of proper cooperation and discipline among different members of a project team. Some of the developers show little interest in making a new release. The developers may not feel the direct needs for a new release because they are not the main users. Most managers agree that if their team members or the developers are not able to work together

and harmonically, they may have difficulties in meeting deadlines. Many problems may potentially arise due to the team disability to work together. Therefore, trying to improve on the cooperation and discipline of the team will be one of the important and crucial challenges in release planning as well.

In Damoon project, the developers did not get on very well together because of insufficient information about the requirements. Hence, to improve the situation more regular meetings with project managers were conducted to obtain more information about these requirements. Due to this, a better relationship amongst them is able to be built as the project progresses. In Saba project, the cooperation among developers is well maintained due to the clarity in the definition of requirements. During the interview meeting, the project manager of Saba told us that Saba is one of the successful projects at ISC and he is satisfied with all the members work and behaviour. He attributed the project success i to the cooperation and the discipline of the project team members. In this project, the number of releases is 6 as it is shown in Appendix A: Table 2. In PKI/CA, the cooperation and discipline of developers' team is satisfactory. This might be due to the fact that project is new and the team is following the managers' instructions accordingly. In EXIMBILLS, enthusiasm among the members was not satisfactory and the work flow was very slow due to the lack of qualified staff which led to employment of new members. As the literature indicates, new members take time to get used to company's procedures and methodology. This slows down the software development process as a whole. ILS project is having a similar problem as in EXIMBILLS but for a different reason. In ILS, the problem was that changes during the construction phase were time consuming. It was a large project with a large number of staff and cooperation among all of the members is not that well. The management is taking extra effort to ensure that the project team members are able to work cooperatively together. At this point in time, ILS project is still struggling with the problems and still looking for ways to increase cooperation among its team members.

Resource constraints

One of the main issues that all of the interviewees complained with their projects, was the problem of resource constraints. If the needed resources were available in abundance, then the project duration could be shortened to achieve a new release. On the other hand, if the needed resources are severely limited, the project is more likely to be delayed. When a new requirement or feature is decided and planned for a next

release, many constraints like time and effort must be faced and planned. Resource constraints are clearly a key aspect of release planning (Ruhe and Saliu, 2005), since without considering resource constraints the consequence would be an unrealistic release. In all these projects, there were no serious financial constraints, because most of the customers were banks and government institutes but sometimes payments to the client companies were delayed due to some avoidable circumstances. Damoon and Saba projects face expertise constraints. The projects have difficulties trying to find required expertise in the area. Project managers believed that they were "always behind technology in these two projects". In EXIMBILLS, there was always the risk of being behind the new version of the system software, because EXIMBILLS is a new trade finance system for Iranian banks and it is not yet fully understandable in their requirements and directions.

In the PKI/CA project, its project manager perceives that the project's security aspects are hard to attained and achieved. Thus, its project manager is always willing to increase his investments to improve the overall security aspects of the system. Unavailability of the new technology was one of their problems in this area as well. In ILS because of the complexity of the systems, every change needed a lot of budget and time, either from financial or human resources aspects. The project manager scared of new changes and sometimes tries to keep the old system. Developers always feel that they are working in an old technology environment and they wish either to change these old technologies or leave the project.

Unclear objective of the system

The objectives as stated in (Saliu and Ruhe, 2005) describe the desired properties for a product, or stated differently, the goals of the product. Sometimes these objectives are related to a project strategy, features, content, quality, aims and satisfaction. In many large software projects, the ambiguity in the objectives can lead to many problems in generating releases. Unclear project goals and objectives, and frequent change of the objectives during the project are key factors in failures for release planning. In Saba, the managers, initially were not sure of how secure their system would be. The reason was that the system is supposed to be the first Internet banking solution which was going to be used in Iran and there happen to be many new changes which are unpredictable and unplanned for at the starting of the project. The bank which will be using the system is actually the largest bank with over 40 million customers. So, many uncertainties and worries arise around the

project that leads to a poor progress. Like Saba, Damoon faced some changes in objectives which were not planned before. In Trade Finance (EXIMBILLS), all operations in Iran were manually performed before implementing this system. Therefore, they always fear of the risk of customer dissatisfaction or reactions to the system. At this point, the project is expected to face many changing objectives which might be driven by the customers' response to the system.

The stakeholders of ILS project have so much concern on its return on investment (ROI). At the same time, the project has many requirements which are changing regularly and the rules and regulations set by CBI (Central bank of Iran) were constantly being modified. Therefore, the project management has to endlessly put lots of man/days effort to ensure the project is able to meet the demands. ILS project eventually managed to break even financially this year. In PKI/CA, the security risks was always the main issue in the system, as the project management is not very sure how complete the project's security requirements are set up. In general, it can be observed from the projects that frequent changes and unclear policies and strategies of the system can cause hindrance and difficulties in the process of the development of future releases.

Project monitoring by managers

One of the main concerns of the managers in all these projects is monitoring the progress of the projects. It is crucial for project managers to have an accurate progress report to enable release planning to be successful. Almost all the project managers believe that project monitoring would have a significant effect on the quality of the new releases. The important element is that the ability to identify or recognize a problem in software development process. Once a problem is detected and the problem may be tackled and it can be no longer present for a new release. If the monitoring is done properly and thoroughly, achievement of the final goal would be much easier. In all projects, after constructing a Gantt chart, the project managers is responsible to update the tasks and if any of the tasks were behind schedule, then the required resources were needed to overcome the shortfall.

The monitoring process in Damoon and Saba was taking place on regular weekly basis, with the exception that in Saba the resources can be modified according to project needs. In PKI/CA that process was regularly on monthly basis, and it was taking place every two weeks. In EXIMBILLS, since it is a new system and the system's main structure is not defined yet, there is no fixed schedule for the monitoring or reporting process. In ILS,

the monitoring process was regular and it is performed once a month. In short, project managers monitor the work progress in order to evaluate the flow of the project under development, with the aim of improving future project functionalities. The managers emphasized that project monitoring is a challenge and the monitoring process has helped them tremendously to plan easier for the next release.

Complexity of the system

One of the important elements that can delay or cause problems in large projects for delivering a new release is the complexity of the system. This complexity can be innate and is usually seen in all large software projects. Most project complexity cannot be possibly eliminated completely and can only be reduced. Sometimes, technical constraints can also cause complexity. Technical constraints refer to any of a number of technical issues and obstacles that will impact the new release. For example, a company might be trying to connect many banking branches to a central location via links and this can produce complexity to the system. Size of the project is another concept that affects the complexity in each system, because some projects may have hundreds to thousands of features.

In the Saba project, the complexity of the system increased due to the need to connect the application server to the mainframe running on COBOL/CICS/IMS environment. Project managers strive hard to decrease this complexity by using the IBM CICS Transaction Gateway (CTG). This connection problem was also observable in Damoon. In Trade Finance, no big complex issue was in the system as the platform was on PC environment and the connectivity to mainframe was always on batch mode and via file transfer (FTP), but the swift messages in EXIMBILLS were not received on time. The complexity in the ILS was in its data base. They had two choices: one was to use the existing IMS and the second was to use a better and new engine such as Oracle, DB2 or Informix. Eventually, they decided to use the DB2. In PKI /CA, the complexity was the construction of the security room for their system as the room must had been designed in a particular setting and arrangement with specialized software and hardware platform with high level security in mind. As it was a new platform they always felt the risk of things not going according to plan. PKI /CA is one of the largest projects in Iran with a lot of requirements and new demand features, and this cause the project's complexity. This complexity is expected to delay the new release for a few months and even year. For this reason, an innovative solution to decrease these complexities is required.

Foreseen future releases

Most software projects in long-term development process require new features or requirements that cannot be implemented in one release and they must be considered for several future releases. In this case, pro-activity is needed to ensure a successful release planning in the future and it is advisable to have a plan for later releases. It has been observed that planning for only one release (that is, next one) is usually not enough (Carlshamre, 2002). Sometimes, stakeholders' features may not be considered in the next release and a planned schedule is not available. This may result in dissatisfaction, so it is advisable to plan in advance for two or more releases to provide clearer picture to the stakeholders. Hence, necessity of current release management that is able to predict the issues and requirements in following releases arise. For example, there can be customer requests that can have impact during a release project, such as, the need to add more features or functionalities required by a specific customer. In all projects, planning for the future is considered difficult for project managers due to many uncertainties in the industries and the banking projects are greatly affected by customer and banking demands.

One of the professional developers' mentioned the uncertainties by saying that their prediction is subject to change every day. For Damoon project, the plan for one release ahead is always on calendar and the stakeholder knows about the details of the next release. For the personal Internet banking solution, Saba has also one release ahead and similarly the stakeholders know the details of the coming release. In PKI/CA, as the project only has one release a year, the details are usually set by CBI and that is a well known fact to all. Due to the flexibility and the newness of the releases in EXIMBILLS, no exact calendar is set and the project rolls out the releases whenever the timing is considered right. This situation is true for ILS too because of its flexible nature. However, most managers agree that it is much easier to plan for releases if the schedule is set ahead of time or there is a set direction towards producing several releases within the specified time.

Stakeholder involvements

A stakeholder is a person or group of people that may significantly influence the success of a project. It is clear that the stakeholders are interested in having their ideas being considered in the contents of a release. Thus, the presence of the stakeholders and trying to attend to requirements is effective in a new release. For all these projects there are three types of stakeholders involved.

The Steering Committee meeting involves three people from the customers' side and three from developer's side. The meetings take place once a month and the strategic planning and resource planning for the projects are usually discussed there. The Operational meetings usually take place once every week and in these meetings they discuss how to finalize the new requirements and how to reach the deadlines. The Technical meetings usually happen whenever is needed and sometimes twice a day. In these meetings, they discuss the technical details of the requirements with the customers and business analysts which are usually from the customers' side. As illustrated in Appendix, the main customers for these projects are banks and governmental organization.

Damon Project is an Internet shopping project with Saderat, Melli and Mine and Industry banks as the major clients. These banks use the users and customers' view points to improve the system. Saba project, an Internet Banking project in terms of banking transactions that are performed via a secured Internet application, is running in Melli, Export and Development, Mine and Industry, and Saderat banks. Central bank of Iran with the most foreign transactions in the country uses PKI/CA to do so. EXIMBILLS which is foreign currency software is used by Saderat and Melli banks for their international transactions and trades. It can be said that all the foreign currency transactions in the country are done by these two banks and this system exclusively. Melli, Export and Development, Mine and Industry, and Saderat banks use ILS for their financial requirements.

In fact, there are generally three levels of stakeholders who are important to be considered as inputs to the future releases. The first ones are developers and creators of the system. The second ones are banks and their experts whose opinions are very important. The third level is the customers and users of the banking services. Customers of each bank are shown in Table 2 of Appendix A. Hence, it is critical to ensure there are sufficient involvements of stakeholders in the project development. The involvement will not only ensure the valid requirements have been understood but also to enable better planning for the progress of the project and more specifically to better plan for future releases.

Interdependency among systems

Many web applications are interdependent to each other. When looking after older applications or creating new ones, it seems very difficult to synchronize the system which relies on other systems. For example, a finance system depends on the wage and salary system, etc. Therefore, one of the important and considerable issues

in a new release is to fully investigate and understand the relationships among systems and the related sub-systems. Most of these systems and sub-systems have to work integratively within the new release.

In Damoon and Saba, the interdependency among system is high due to on line/real time connections and interfaces to other systems such as card and core banking system. So, the understanding of these relationships and their mapping to the new release is of high importance. In PKI/CA, the dependency degree is low due to its being a closed system. In fact, these systems are somehow independent and their transactions are not related to other systems. In EXIMBILLS, the dependency is medium. Only one interface is in existence and that is to General Ledger (GL) system. Dependency in ILS is high because the existing interface is with five other systems which cover customer financial requirements including consumer loans, commercial loans, mortgages, corporate loans and investments. Therefore, we can conclude that most large software projects which are related to other systems and sub-systems require full synchronization and adoption to the systems for generating a new release. This is actually a great challenge to project managers in terms of systems understanding and cooperation of various entities of the system. To produce a new release in this context usually requires not only various cooperation from the technical groups and managerial people of the system but also to get full support from the users of the system.

Prioritization of requirements or features

Prioritizing requirements can be seen as the process of deriving an order relation on a given set of requirements, with the ultimate goal of obtaining a shared rationale for partitioning them into subsequent product releases (Avesani and Susi, 2004). A project manager has to balance the project scope against the constraints of the schedule, budget, resources, and goals. One balancing strategy is prioritization to drop or postpone low priority requirements to a later release when there are new, higher priority requirements. Therefore, it is very important to decide what the prioritization is based on. Different prioritization techniques can be used in different projects depends on different parameters.

In release planning tools, there have been a few techniques used for prioritizing the requirements. Some comparisons are made in (Karlsson et al., 1998). Requirement prioritization is used in software release planning for assigning which candidate requirements of a software project should be included in a certain release. When customer expectations are high, time is short, and budget is limited, you want to make sure the product only

contains the most necessary features. So, it is important for managers to prioritize what to include in a next release. The team must collaborate on requirements prioritization. Damoon, Saba, EXIMBILLS and ILS are Customer centric. They allow the customers to dictate the priorities for the projects' requirements. These projects have many customers or end users for their banking operations, so the customers' demands are high and the necessity of prioritization is considered important. PKI/CA project is more government centric. The government always has the upper hand in dictating the priorities. This system is crucial for Central bank of Iran and hence they have the first word in setting the priority. The project manager mention to us that usually during the meeting with the, central bank, the bank will instruct them on what to do and the development team has to follow the order obediently.

Supporting old releases

One of the issues that always worry project managers is the capability of a new release to support older releases. Most of the time, it is expected that a new release is expanded to cover all of the previous releases. However there are occasions that the new releases are less efficient than the older ones and the users might later on find out and demand to use the old releases. Therefore, managers are always striving to have the best possible features in the last release. Usually, a new release is produced when there many requests or requirements made by customers on the product. As the result, the teams may suggest to bundle the appropriate features together and then construct a new release to be deployed. On the other hand, according to the project managers, whenever there is a new release many possibilities might occur even though many testing and quality assurance procedures have been performed. The most concerned issue is to ensure that a new release must always support old releases.

Software support tool for release planning

Release planning is a complex process which needs intensive human expertise and knowledge. It includes many demanding tasks like resource estimation and setting objectives in release plan generation and decision making. These tasks altogether call for an intelligent tool support that would be of great value to a project manager who is going to make release decisions. Most project managers agree that the whole process of preparing, constructing, resource allocating and so on are very formidable tasks that need to be well planned to be

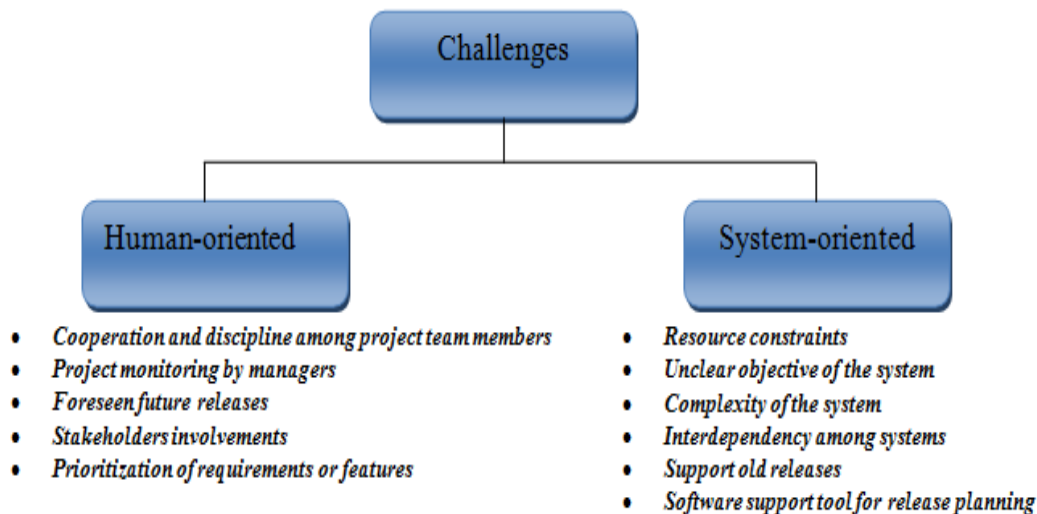


Figure 3. Categorization of the challenges.

executed. Most of the time, they do not have a proper tool in order to assist them in these difficult operations. Most managers are looking for some support tools to assist them in this process. Many of them believe that software tools might give them extra advantages to possibly create a more effective plan for their releases.

DISCUSSION

This discussion is divided in two parts. The first part presents our experience and view from qualitative research in banking project and the second part discusses the threats to the validity of our research.

Experience gained from applying a qualitative approach

The qualitative research approach is usually used for the investigation of social phenomena, or in other words, situations in which people are involved and different kinds of processes take place (Hazzan and Dubinsky, 2007). In software engineering, that includes various domains for developing a software product, evaluation of every domain can give us some new insights and experiences. Thus, it is advisable to always go searching for new knowledge even though some of these findings cannot be generalized for all situations. In this study, software banking projects were investigated and a group of people were interviewed with regard to their experience; we performed rounds of interviews to provide us with different points of views and similarly to increase reliability and validity of the study. After performing the interviews and data collection, the data transcripts were

almost 60 pages. The 12 challenges which were identified are later categorized into two main categories as seen in Figure 3. The first category is referred as human-oriented challenges, which are related to stakeholders and customers duties and cooperation, and the way the tasks are done.

The second category is referred as system-oriented challenges, are related to problems and the issues of the developed system: limitations and complexities. The duration of the time for a new release that was introduced as the first challenge can be grouped into both of these categories

As we observed earlier, nearly all the challenges found in software development projects come under these two groups. In the first one, which is related to human, people and their attributes have a significant impact in software release planning. Some of the roles which are performed by human who involved in release planning like functional analyst, development lead, and quality assurance are very complex. Tasks in which they have to perform require innovation and previous project experience. As we acknowledge, innovation is a difficult ability to be measured and to be defined. Hence, these tasks which have to be performed in release planning are obviously difficult and might suggest to the research community to perform more studies to identify ways to facilitate these activities or tasks. From another aspect in the second group which is related to system, many challenges with regards to inherent qualities of the system and the environment are identified. Similarly, system and environments understanding requires more systematic approach and support tools to be used. These two categories of challenges might lead the practitioners and the research communities to explore more opportunities and ways in order to overcome these challenges

in the future with the aim to produce better quality product releases.

Validity of results

When a researcher performs a qualitative research, he or she must pay attention to the validity of the research. There are many different ways of establishing validity, including: interviewer corroboration, negative case analysis, and conformability. Most of these methods were described by Lincoln and Guba (1985). Validity of the result needs to be planned by introducing proper counter measures. We have followed the recommendations by Yin (2003) that he has chosen four possible ways for the validation. The first one is referred to as construct validity. In this case, this study used two main researchers for interviews and discussion in order to reduce misconception or misunderstanding of the information gained from the interviewees. One of the researchers is the first author and the second one a master student. After each interview, both researchers and interviewers sat down to discuss the data and information gained. Resolution in terms of terminologies or words used by the interviewees was discussed. Data were collectively gathered and organized by both researchers. Unclear data were also discussed and resolved before the next meeting with the interviewees. .

The second important measurement was trying to demonstrate the internal validity of the study. There is always a meeting with project managers been conducted to confirm information from step 1. In this second meeting, the interviewees (developers) were not invited. This is purposely plan to counter check the validity of the data gathered from the developers. In step 3, the researchers reanalyzed the data collected from step 1 and add in the data or information gathered from the project managers in step 2. The third validity measure is to show the reliability of this study. The first author actually is a full time employee in three of five projects from 2005 to 2007 at ISC. The author has the opportunities of recognizing the issues that have been raised by the project managers and the developers in the projects. The author was aware of the possible problems in many of the projects. All of these have in way or another helped to increase the external validity of the study results.

Conclusion

This study has presented 12 challenges in a release planning process from software banking project domain. Due to the fact that there are many different aspects to

be considered for a new release, this study is conducted with the aim to better understand and identify main challenges faced by people in the development teams. Some of the challenges can be considered the common problems faced by software development teams and some are quite rare. The study also exposes that there are cases in which, a new release is not always better in functionality than the older ones and may even have more problems than the previous release. This circumstance might indicate that there are certain unresolved issues in the release planning process. Even though, the findings of the study is not generalizable to all release planning processes which are taking places in other companies, the findings can at least provide us with the possible understanding that these problems might occur during the process. Essentially, this study is able identify 12 challenges and those challenges are categorized into human-oriented and system-oriented categories.

Although, these identified challenges have been observed in special domains (that is, banking), the present study can be investigated further by increasing the number of sample projects in order to spot more detailed challenges in other areas from both human and system point of views. This work can be a useful guide for release planning process in order to have an improved product and more satisfied customers.

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APPENDIX

Appendix A

Table 1. Summary of interview questions.

Part 1: Introductory questions

What is your name?
 What is your e-mail address?
 Give us a definition of your project?
 What is your role in the project?
 How many people attend this project?
 What generally is the size of your project?
 Are you satisfied with the project? If yes or no, why?

Part 2: Technical questions

Do your project managers conduct release planning?
 What is the current release cycle?
 What is your cooperation and interest in the project like?
 What challenges and problems do you face when you want to release a new version?
 How are the requirements generated? How are they tracked?
 What are the ambiguous problems in your project?
 When is the next release date? When was the last release date?
 Are there any strategic changes in your project? If yes, what is their impact?
 What kinds of stakeholders exist in the project? How are they involved in your project?
 Who are your most customers or end users?
 What is of most importance to the managers?
 How are the new decisions made for a new release?
 Do the managers have any plan or prediction for the future of product to ensure that the last release is the best one?
 How do project managers evaluate the progress and completeness of the work?
 What is the output of the release planning?
 What kind of complexity you face? Does the complexity affect the process of your project?
 What are the resource and technical constraints in your project?
 What is your plan for release time? How is the time for next release determined?
 Is this system related to other systems? If yes, which ones?
 Are there any pressures on you for a new release?
 How are the requirements prioritized in your projects?
 Do you have any tools to support your process of release planning?

Table 2. Projects characteristics.

Project description	Damoon	Saba	PKI /CA	EXIMBILLS	Islamic loan
	Internet shops	Internet banking systems		Trade Finance Systems	Islamic Loan systems
Number of employee	8	15	12	18	26
Customers/End-users	Melli, Saderat Mine and Industry bank	Melli, Saderat Mine and Industry bank Export and Development bank	Central bank of Iran	Melli, Saderat	Melli, Saderat Mine and Industry bank Export and Development bank
Number of releases until now	2	6	2	2	9
Resources type and unit	Planning 3 man month Analysis 6 man month Design 9 man month Construction 12 man month	Planning 6 man month Analysis 9 man month Design 12 man month Construction 20 man month	Planning 2 man month Analysis 3 man month Design 3 man month Construction 5 man month	Planning 5 man month Analysis 7 man month Design 9 man month Construction 12 man month	Planning 10 man month Analysis 22 man month Design 25 man month Construction 35 man month
Planning Criteria	Low	High	High	Low	medium
Requirements s groups	Yes	Yes	No	Yes	Yes
Requirements dependencies	Yes	yes	No	Yes	Yes
Role and responsibility	Project manager and a system analyst, The project manager was responsible for making sure the questions are on the right track and the analyst was responsible for getting the right reply (for this system, no existing system was available)	Project manager and a system analyst, The project manager was responsible for making sure the questions are on the right track and the analyst was responsible for getting the right reply	Project manager and a developer, The project manager was responsible for making sure the questions are on the right track and the developer was responsible for analyzing the required system	Project manager and a system analyst a developer, The project manager was responsible for making sure the questions are on the right track and the analyst was responsible for getting the right reply and understanding the existing system	Project manager, and two system analysts, The project manager was responsible for making sure the questions are on the right track and the analysts were responsible for understanding the existing or old system
Project evaluation	Regular bases and weekly	Regularly and weekly the resources are modified according to project needs	Regularly and on monthly bases	They have meeting every two weeks	Regularly and once every month.