

# Companies Approaches in Software Release Planning – Based on Multiple Case Studies

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**Abstract—** In Incremental software development, evaluation of software product is usually determined by user's satisfaction. New features that originate from stakeholders lead to a new software release. Release planning involves decision making activities about features assignment. These complex decisions totally depend on many criteria such as cost, time and available resources.. Nowadays, there are several approaches for release planning, which are used by software companies to generate new releases. However, companies are still unable to determine which exact methods are more exactly suitable for their release planning. This research project investigates the methods companies use to plan for new software releases and the approach they use. In this work, the current approaches that are used in the software industry have been categorized in order to select the most appropriate approach. In order to validate our approach, multiple case studies were conducted. The data were collected using questionnaires. Direct interviewers have been also conducted with representatives of seven software companies with different level of software development experiences. Results showed that experienced companies prefer to improve their existing software products rather than creating a new plan. The reason for this was the invaluable existing trust among clients or customers in their products. By doing so companies intend to improve their condition by increasing the reliability of the software produced. These companies generally prefer to use systematic approaches, when they came to decide for development process. In contrast because of lack of experience, newer companies prefer to rely more on human experience for their releases. Newer companies therefore are not able to foresee the future of the software market. These companies do not just rely on systematic approaches for their development, but they rather use the best available plans to produce good quality product. We hope the results of this research project would benefit companies to overcome the problem of choosing a suitable and optimized release plans and help customising it for their needs.

**Index Terms—** Software release planning, case study, release planning approaches.

## I. INTRODUCTION

The concept of software improvements is still one of the worries that software managers commonly face. Companies try to improve their software products by understating the new requirements and then implementing them in their future software releases. It has been shown that investment in process improvement, has had significant benefits for companies, including improvements of product quality, reduction in time-to-market products and improvements in the productivity [1]. Release planning can be seen as company-wide optimization problem involving many stakeholders where the goal is to maximize utilization of the often companies' limited resources and turn them into business benefit [2].

A major problem faced by companies, developing or maintaining large and complex systems, is to decide on which features should be added to which release of the software [3]. It means although there are many existing release planning approaches for generating new releases, there are still lots of problems such as lack of precise and systematic way to produce optimal products. Carlshamre [4] has classified release planning as a "wicked problem". The concept of a wicked planning problem was first introduced by Rittel and Webber in [5]. Wicked problems are difficult to define and there is often no clear-cut solution to wicked problems.

Companies are therefore always confused and have many problems with the generation of new releases. The aim of this research is to investigate how companies deal with new software releases and what methods are used by the different companies with different levels of experiences in software development that cuts down on the level of confusion.

For this reason, using systematic approach alone is not enough. Companies also need human capabilities and the experience of professional practitioners to carry out such task.

One of possible topics that are discussed within software companies' media is, to what extent is the

human factor important for release planning. Another question is whether or not systematic approach alone can be adequate to respond to various requests, including demands for new features and is there still any need for human creativity and resources for decision makings? For example a new company, which has not yet defined all of its tasks and needs? This company cannot go straight and use systematic approach for release planning. In order to fill the gap, this company will need human resources. Another significant point to consider is the type of planning used by software companies. This largely depends on experience and type of product concerned. For example in some experienced companies, project managers do not try to concentrate much on new plans, because they usually have positive expectations on the future of the current product and its reliability. Instead they will always look for ways to improve product quality. Project managers usually tend to avoid exposure to a risky market. In this paper, we study the different companies' approaches for generating new releases in a release planning concepts based on multiple case studies taken from different software companies.

The rest of the paper is organised as follows: section 2 explain the current release planning approaches that are being used by software companies and section 3 shows the objectives. Section 4 discusses the he research design and case studies structures are explained in section 5. Findings of this research are discussed in section 6 and section 7 concludes the work.

## II. CURRENT RELEASE PLANNING APPROACHES

Although some companies do not see release planning as a separate activity in software development, there are many software companies that have been using release planning methods for generating new releases. Various approaches aimed at addressing the release planning improvement have been used in industry. The general goal of release planning is to assign features to releases in a way that maximizes some stakeholder related objective functions [6]. In the following this paper will review current release planning in both academic and industrial environment.

### A. Hybrid Intelligence Approach

The hybrid intelligence approach for release planning was proposed by Ruhe and An Ngo [7]. The main idea of this approach is to show that only "computational intelligence" methods cannot fully replace human decision makings. He recommends relying on a synergy coming out of computational strength and experience as well as human intelligence of a decision maker.

As one can see in Fig. 1, the architecture of this method is called EVOLVE\* [7]. It is an iterative and evolutionary procedure. In fact it is a combination of real world problems of release planning, in which both human intelligence and computational intelligence are used. This approach is combined of both human and system solutions in a more realistic way.

### Evolutionary Solution Approach EVOLVE\*

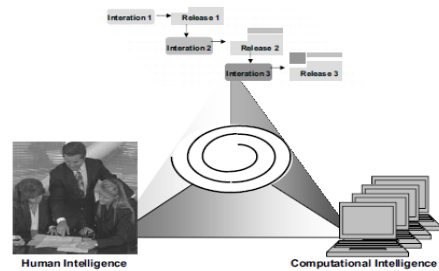


Figure 1: Hybrid release planning framework

Main tasks for release planning process in this approach are: modelling, which has defined variables, resource constraints, objectives and voting; exploring alternative solutions that may come from the application; and consolidating these solutions by human decision makers.

### B. PARSEQ Method

PARSEQ method is aimed to improve release planning decisions that are made in previous releases and it is based on retrospective analysis as a way to look back at the events taken place. This method was proposed by Lena Karlsson and Björn Regnell in [8] based on a new consideration and re-prioritizing of requirements to find possible improvement decisions for release planning in future releases. PARSEQ focuses on finding release planning process improvements through an analysis of earlier release planning decisions.

The method aims at finding improvement suggestions for the release planning activity, as it is regarded as one of the most critical activities in market-driven software development [4].

As shown in [8], PARSEQ is divided into five steps: requirements sampling, re-estimation of cost and value, root cause analysis, elicitation of improvements, and prioritisation of improvements, as shown in Fig. 2.

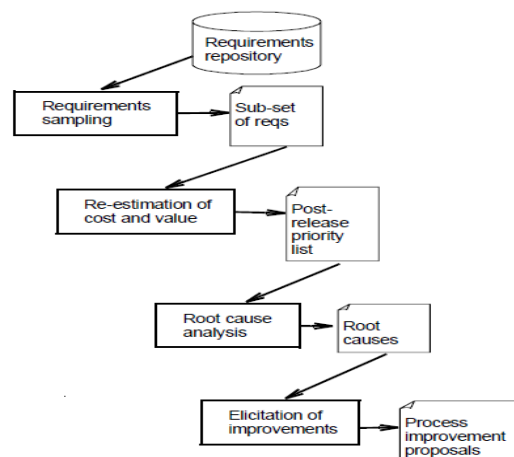


Figure 2: The activity of PARSEQ method

*C. Incremental Funding method*

Many large software companies want to invest in software development, only when it is secured that the turnover is achievable in shorter period of time.

The Incremental Funding Method (IFM) introduced by Denne and Cleland-Huang [9] is a data driven and financially-informed approach to software development. In fact , the IFM is a financially informed approach to software development, designed to maximize returns through delivering functionality in ‘chunks’ of customer valued features, carefully sequenced so as to optimize Net Present Value (NPV) [9]. Minimum marketable features (MMF) describe values of prioritization features, which are most important components of IFM [9]. By definition they are self-contained features that can be presented to the customers very fast with faire market values. In order to analyze costs and estimate revenues of some periods, established by the business, MMF needs to be known.

*D. Optimization-Based Techniques*

Natural complexities that exist in release planning are the cause for having different models. Some of them have formulated. For an optimization model, Bagnall in [3] assigns weights to "customers" according to their degree of importance for a software company. The objective is to find a subset of customers whose features are to be satisfied within the available cost. Ho-Won Jung [10] follows a similar work a goal of selecting features that give maximum value for minimum cost .

It is much easier to cope with larger problem sizes through these optimization methods, but customers are not asked to take part in Release Planning (RP) decisions makings.

Most of the problems mentioned above under “planning games”, as well as customer satisfaction are issues that RP need to deal with.

*E. Planning game (Extreme Programming)*

The planning game (PG) refers to the process of planning and deciding what to develop in extreme programming (XP) projects [11]. Extreme programming (XP) is a popular agile software development methodology used in software projects. Extreme Programming proves to be a successful methodology since it focuses on customer satisfaction. XP emphasizes teamwork. Managers, customers, and developers are all equal partners in a collaborative team.

III. OBJECTIVE OF STUDY

The aim of this study is to investigate how companies plan new releases, and what approaches are used by software companies. Based on this, we categorized and analyzed approaches currently used by software companies. Choosing an appropriate approach can help with the quality of the product in a new release. For example, for some software companies, release planning depends solely on management and members of software developing team, therefore a new release depends on

them, but some other companies rely on the use of automation for their new release. Therefore, there are difficulties to identify suitable methods for new software release because release planning does not have a specific rule and it is impossible to have a comprehensive method for release planning to cover all companies. This research compared software companies with different products and experiences in software development and found some useful results which can help software companies to choose an appropriate method in delivering a new release.

IV. RESEARCH DESIGN

This research analysed seven cases (software companies) in the software industry. Further we investigated their current release planning approaches, and their plan for new releases. Software development is a complicated process. It requires careful planning and execution to meet the goals.

Therefore it is very important to see how companies choose methods for their optimal release planning.

Some companies prefer to choose only human based approach and they rely on judgment of management and staff and others prefer to use just the systematic approach. It is not easy to say which one is better and more useful.

The study was conducted in seven software companies with different experiences and products in Iran .The goal of this work was to identify the ways companies deal with release of a new generation of software. We have used semi-structured interviews as the primary data collection method, and for this we asked the staff to fill out the questionnaires and explained to them what exactly they should do. We interviewed and discussed with fifty-one software professionals, working for software companies including 8 project managers, 17 developers, 15 analysts and 11 quality assurances managers. The role of the survey respondents are shown in Table I.

For the reasons of confidentiality, we did not reveal names of participating companies. Instead, we referred to these companies as: A, B, C, D, E, F, and G.

Table I. Participants in the survey

Role respondent	of number	Companies
Project managers	8	A,B,C,D,E,F, G
Developers	17	A,B,C,D,E,F, G
Analyzers	15	A,B,C,E,F,G
Quality Assurance	11	A,B,C,D,G

All the companies studied in this paper develop software with differing experience in software development. As shown in Table II, some of them are old companies and have great experiences in software development; however others are new major international organizations who have established their activities in software banking in Iran. Their projects vary in team size, experience and duration as well.

Table II. Companies characterized

Company	Type of product	experience
A	Banking software	1 year
B	Database systems	3 years
C	Web-based application	8 months
D	Banking software	9 years
E	Banking software	12 years
F	Database systems	1 year
G	Medical systems	2.5years

In this paper, semi-structured interview [12] with technical questions was conducted with the team members for data collection and sometimes we asked some complementary questions to have more elaboration on the answers. As we mentioned before 51 staff including project manager, developer analyser and quality managers attended the interview. The time spent on interviews and filling forms varied between 30 to 45 minutes in length for each one.

The summary of questions that were asked:

- 1- *When do you generate a new application?*
- 2- *What approaches do you prefer more to plan for new releases?*
- 3- *How do you rate the role of human in generating a new release? (Indicate your score with percentage)*
- 4- *How do you make decisions for a new release?*
- 5- *Does your previous experience affect a new release? If yes, how?*

## V. RESULT

Analysis of this research is presented here, data were collected from the companies, and following is the summary of companies' behaviours in release planning:

### • *Company A*

This company has about one year experience in developing banking software, this new company develops cutting edge banking systems. The company's goal is to come up with new ideas and new plans in the banking domains, both offline and online. Based on the information gathered from practitioners, and considering the newness of the company in software development, developing new application follows orders received from banks and governmental organizations. The role of human in creating a new plan is highlighted because they do not rely on systematic approach for new plans. Company's goal is to automate banking operations and add new relevant features. This company does not follow any specific regulations related to release planning. They make decisions based on the existing circumstances and needs. This company tends more towards the human resources and according to the data collected from responders of company A (see table 4), 85.7% of the responders believe that human resources are very essential for the process of release planning. 57% of them agree to use both human and systematic resources, while 28.6% of the responders just want to use human resources.

### • *Company B*

This company has been producing database systems for over 3 years. They usually take a systematic approach for their release planning and have been successful to some extent. Their main focus is more on maintenance and improvement of current products rather than developing new products. The reason for this lies in the satisfaction they have with their current products. Without the specific need for any new and profitable product, they usually do not concentrate on new plans. They have developed special regulations for a new release, including several meetings with the clients for every new plan. Company B has just passed its third year of being in business, 45% of the responders like to use a combination of human and systematic resources, 22% of them prefer only systematic approach, while 33% of them like to use human resources.

### • *Company C*

This company produces and designs web-based applications and websites. Since this company is very new in the market, they do not have a comprehensive plan for new releases. Their activities are based on customers' orders and new releases are based on customers' requests. They prefer to have new contracts and adjust themselves to various plans to improve their development process. As a result of their newness in this industry, the role of human is high. With numerous meetings and discussions with customers they try to achieve more systematic approaches. But because they do not have enough feedback, most of the decisions are based on the agreements between the customers and system developers. They also do not have a specific regulation for a new release. Company C is new in business, and therefore human resources play a major role in their decision makings, 60% of the members use a blend composite of human and systematic methods, 40% of them just believe in human methods. In this company, a new release, without human intervene is baseless.

### • *Company D, E*

These two companies which are supported by the government have a long experience in banking projects and cooperation with each other. They have interdependent relationship and work together to develop projects in the area of banking software. Nearly all software that are used by the banks and financial institutions affiliated with the government have all been developed by these companies. Therefore these companies are more inclined to support and improve their own software with an emphasis on re-planning new release. Systematic approaches are utilized in developing a new release; for example, parts like requirement elicitation, requirement estimation, and requirement prioritization are defined to complete this systematic approach. Role of human is more dominant in requirement elicitation, and older releases are very important because improvements are done in those

releases. Creating a new release is based on the customers' request and is usually done twice a year. Companies D and E are relatively long time in the business of producing banking software, as we can see from the table 4, 40% to 50% of the responders from these companies see the use of systematic approach as a necessity, only 18% of the responders from company D and 20% of the responders from company E, still prefer to use human resources in their planning.

• **Company F**

This company has one year of experience in database systems and information retrieval for governmental and private organizations and institutions. This is a private company that creates a new application based on the requests from clients. Since this company is relatively new, and it does not have a specific plan for a new release in the foreseeable future, the role of human in decision makings and investigating of requirements is very significant. They must decide what features they want to add in the new release, and when it is going to be released. Since they have only one year experience in software development, developers try to create samples and libraries to move to a systematic approach. 42% of the responders from company F prefer to use human resources, 35% of them like to use systematic approach, and 25% of them just like systematic approach.

• **Company G**

This company develops medical software. Due to the fact that this software is used in hospitals and in medical centres, creating a new release is based on the requirements and features that are elicited from the real environment. We can say that the method which is used in this company is like INF, it determines the value of each new feature that is going to be added to the new system. The role of human in their release planning is fading and it is needed only for collecting the requirements from the environment. Previous experiences are actually the base for creating new releases.

After reviewing the data that are collected from the companies we were able to achieve following important findings that are proven in next section using statistical methods: Older and experienced software companies tend to focus on improving their current products rather than to create a new product or a new release. For them improving the quality of their products and customers' satisfaction is more important, and in fact they do not want to take a risk of developing a new product. This is because their products have reached an acceptable level of reliability in the market. A new release could be produced based on feedback they get from their products. These kinds of companies use more systematic approach than human approach when making decisions. Newer companies have usually no experience in developing software, therefore these companies start from ground zero, they come up with a new plan. For them to be successful in the market means they have to be creative and their plan should cover best capabilities. The

manager of this kind of companies usually think that using only systematic approach is not enough and they believe using human abilities bring stability to their companies. As we can see from table 4, 50% of the responders from company G like to use a blend of human and systematic approach, 17% of them prefer human resources and 35% of them just want to use systematic approach.

VI. FINDINGS AND DISCUSSION

This section presents our findings discovered during the interviews and discussions. Based on data, collected from different companies, there are two recognizable categories:

*a. Categorization of software release planning approaches from the view point of either re-planning or new plan.*

Software developments planning is crucial to success of the project [13]. A software development plan aims to define various tasks such as phases and releases of software development. One of most important tasks of developing software is requirement elicitation from the customers. The extent of knowing these requirements, and the percentage of implementation depends on the company's plan. Applying the requirements may lead to either creating a new plan or to improve the existing plan.

As mentioned before, there are many release planning approaches for implementing requirements, some of them function based on new plan and new release, and others are based on product background.

Fig.3 illustrates that collected data are divided into two main groups: the first one, is called re-planning and is used for new release without any background, meaning there is no need for past details. Newly established companies use these methods, because they don't have any history or experience with their products, i.e. their products are new. They need to estimate resources, efforts and everything needed for defining a good plan for future production. These companies prefer to use new plan for their start, because they are in a risky situation, they don't know whether or not their product will be a success.

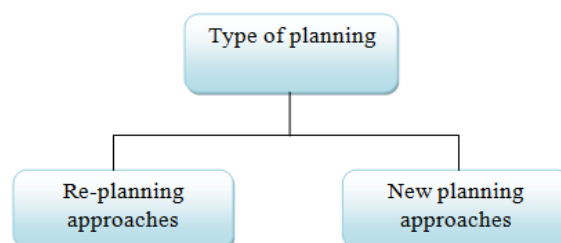


Figure 3: Categorization by view of planning

Second group is called new planning, this group uses methods that have improved versions of the older releases, i.e. and decision making is based on the improvement of previous releases and re-planning that



most of older companies try to that. They get customers' feedback and want to improve a current software. Re-planning means creating a new plan to solve application's malfunctioning. It can be seen as a procedural use of past work, which is a special kind of plan reuse. In plan reuse, current plan is used to solve a new problem, by changing the state of initial goal.

Table III shows the individuals' preferences for planning of a new release. It shows that people in newer companies such as A, C and F prefer more to select new planning, and older companies such as B, D, and E that have a longer experience in software development, don't want to be exposed to any risk, and they try to improve their products because it has already paved its way into the market.

Table III. Individual's responses in companies

Company	New planning	Re-planning
A	57%	42%
B	34%	66%
C	80%	20%
D	28.6%	71.4%
E	30%	70%
F	71.4%	28.6%
G	16.7%	83.3%

Reliable software products force managers to continue and focus more on their existing products.

Based on the survey carried out on 51 people, including project managers, developers, and so on, as well as from the following diagram, one can see that with the increase of companies experience from C to E the tendency goes toward re-planning and company E shows the highest score. For example, In Company C that is newer Company in our research 80% of responders are in favour of re-planning, 20% of them prefer new planning.

As illustrated in Fig. 4, (see continues line) demonstrates that the tendency to re-planning goes up steadily with the increase of companies experience. This means companies like to focus on re-planning and improving their product. On the other hand, the dotted line which shows the tendency to new planning is coming down with the increase of experience

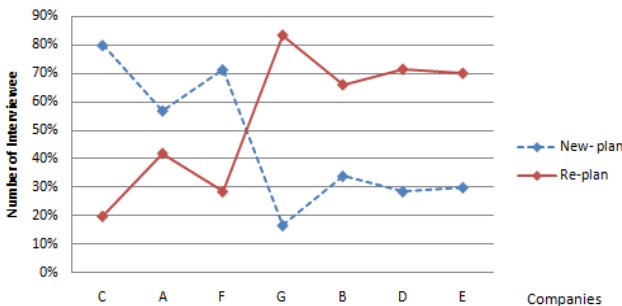


Figure 4: Tendency of companies to re-planning and new planning

**b. Categorization of software release planning approaches based on usage of human resource**

Nowadays most software companies tend to develop their software by using systematic and automated methodology, and this applies to release planning as well, which is a part of software development process, but in the real world it might be impossible to carry out.

As mentioned before, Carlshamre in [4] has classified release planning as a wicked problem. This means there are different ambiguous issues that are unpredictable in software development process which may make moving to systematic approaches not always practical and may require human based approaches as well. Release planning is known to be a cognitively and computationally difficult problem [14]. Real-world release planning problems may include several hundred features potentially offered in the next releases [14].

Based on the case studies, we observed a pattern or the differing role that can be played by human in release planning; this paper categorized the release planning approaches used in all the studies companies into three groups which are (a) 100% human based approaches, (b) 100% systematic approaches and (c) blend of human and systematic approaches. This research also observed the correlation which exists between the length of the experienced of the company and the categories. Fig. 5 shows three groups: first one is denoted as "100% systematic based", represents the approach used by older and experienced companies. They use systematic methods only. Second group, named "100% human based", shows the methods used by new companies, they usually focus on the role of human creativity, and as such, they don't consider release planning as a separate activity. Therefore they rely 100% on decisions made by leaders and human experience. Last group which is called "blends of human and systematic" shows a combination of systematic and humanistic role in release planning.

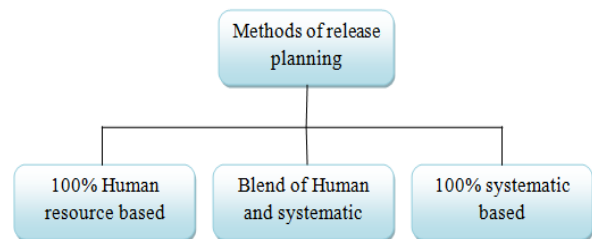


Figure 5: Grouping human resources

Table IV illustrates that at company B, which has a relative good experience in software development, only 22% of the interviewees believe in the role of human and 33% of them believe in systematic approach whereas 45% of them prefer a combination of both approaches for release planning. This table shows that new companies consider the necessity of human role in release planning much higher than systematic approach.

Table IV. Individual’s responses in companies

Company	Only systematic Approaches	Only human base approaches	Blend of Human and systematic
A	14.3%	28.6%	57.1%
B	33%	22%	45%
C	0%	40%	60%
D	40%	18%	42%
E	50%	20%	30%
F	23%	35%	42%
G	33%	17%	50%

Fig. 6 illustrates that from company C (with least experience) on the far left to company E (with most experience) on the far right, the tendency of using automation approach increases and the role of human decreases.

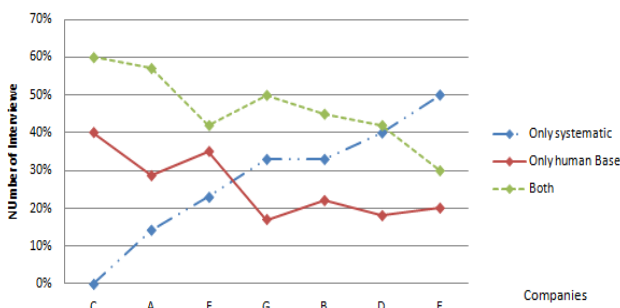


Figure 6: Tendency of companies toward human or systematic approaches

From Fig. 6, we can see that as companies experience increase, use of “only human” resources decreases. (It is shown with a solid line) and this means the tendency toward the only human based approaches is low. On the other hand, the dash-dot-dash line shows only systematic approaches correlates positively with the experience. The dot-line, as it is observed in the Fig.6, is more common because it is a combination of human and systematic approaches.

VII. CONCLUSION

Since there is no unified comprehensive approach for software development planning, this study investigated planning approaches that are normally used by companies on new software releases. The studied companies had different levels of experience and their products were different in nature. The results of this study showed that companies with more experience focus more on improving their existing products and try to avoid taking new risks. These companies believe that their product reliability is quite sufficient to compete in the market. With increasing experience, companies prefer automation and avoid human resources. On the other hand, newer companies without enough experience need more human involvement to achieve that goal.

This study could be further expanded by increasing the number of companies under investigation. Further researches could also be carried out to inspect the challenges that software companies are confronted with

during the development processes. Result could eventually improve the process of release planning.

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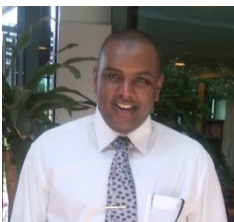


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