

# Release Planning Process Improvement – An Industrial Case Study



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## Practice Section

Planning of software releases is accomplished by the assignment of requirements to the releases, where effort, finance, and risk constraints are considered in order to determine strategic release plans. Planning and re-planning of releases has an impact on time-to-market, customer satisfaction, and stability of the development process. This article presents an industrial case study of the release planning process improvement as performed at Trema Laboratories, Inc. The baseline situation is compared against the improvement gained from the introduction of a more systematic process defined by a decision support tool called ReleasePlanner, and an accompanying methodology. The new process was designed and implemented as part of a trial project performed at Trema. The article describes the main findings of this trial. The study shows that the process improvement introduced has added significant value to the overall business. Copyright © 2006 John Wiley & Sons, Ltd.

KEY WORDS: release planning; decision support; process improvement; ReleasePlanner tool; case study

## 1. INTRODUCTION

Improving software processes can improve software quality, cost, and on-time delivery (Raffo 1993). In a worldwide survey of more than 100 global software companies and 450 top executives, Hoch *et al.* (2000) has presented a summary of some of the strategies used by successful software companies. These include the following:

- Introducing the right product at the right time is important. But management's ability to learn

from mistakes and make the right decisions based on this knowledge is what differentiates organizations that succeed from those that fail.

- It is the development process that can either sink a company or boost its productivity. Software companies that have excellent processes and practices, such as clear team structures, extensive stakeholder involvement, daily builds, and software reuse, make the project more likely to be successful. The right processes make work more enjoyable. Boring rework and bug correction are reduced. At the same time quality increases and product time-to-market improves.

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An approach that improves timely decision making and the development process is therefore crucial to success. The concept of continuous process improvement, which has been long established in



the manufacturing industry, is necessary in the software industry. Investment by any organization in process improvement has had significant benefits including improvements to product quality, reduction in the time-to-market of the product, and improvements in productivity (Zahran 1998), as well as increased organizational flexibility and stakeholder satisfaction (Florac *et al.* 1997). The study by Abrahamsson (2001), '1996 report commissioned by The Data & Analysis Center for Software (DACS), reported that successful SPI programs have reduced the number of defects delivered to customers by 95%, reduced software development schedules by 71%, and increased productivity in terms of lines-of-code or function points per day by 222%. Additionally, SEI (Software Engineering Institute) reported an average return of 5:1 on investments in successful SPI programs.'

In software project management, the project manager has the most control in the release planning and implementation phases, and the benefits derived from good decisions on the success of the project are the highest in these phases. The committed cost of the project is still relatively low during these planning phases (Jurison 1999). The better the decisions made during these phases, the higher the economic benefits realized from the project and the likelihood of project success.

Release planning can be done in an informal way using planning games as done in agile development (Cockburn 2002) or in a more formalized manner as described in the methods proposed in Bagnall *et al.* (2001), Penny (2002), Greer and Ruhe (2004), Karlsson *et al.* (2004), and Ruhe and Ngo-The (2004). Distinguishing parameters in approaching release planning include considered time-horizon of planning, objects of planning, degree of formality in the planning procedure, inclusion of additional constraints as part of the planning process, degree of stakeholder involvement, and the actual solution technique that is applied to obtain release plans. A more detailed comparison of the existing methods is discussed in Saliu and Ruhe (2005).

In this article, we will consider a planning approach called EVOLVE\* (Ruhe and Ngo-The, 2004), which is based on a formal problem description and the subsequent generation of qualified solution alternatives using specialized optimization procedures. The approach was introduced in an industrial environment at Trema Laboratories, Inc. Section 2 studies the baseline situation at Trema

Laboratories Inc. The current planning process is described. On the basis of interviews performed, the key challenges for process improvement were analyzed. Section 3 describes the suggested improved process based on EVOVLE\* and the use of the intelligent decision support tool ReleasePlanner. Section 4 contains details of the case study project including the analysis and interpretation of results. Section 5 addresses the evaluation of the impact of the proposed process changes. Finally, Section 6 summarizes the article and presents conclusions for future work.

## 2. BASELINING

### 2.1. Context

The Trema Group is a provider of strategic software solutions for the financial industry. The software development focus is on providing a fully integrated cash and treasury management product suite designed to support front-to-back office treasury operations, as well as specific applications for cash management and accounting. Following the incremental development lifecycle approach, requirements are added to the product incrementally. So, planning for future releases becomes extremely important for the business success of Trema.

The requirements for the next releases of the suite of products come from different sources such as contractual commitments, market positioning, technology opportunities, sales analysis, customer needs, and existing functionality enhancements. The planning for the next releases is also tied to strategic priorities, which could change from release to release. The strategic priorities include:

- Marketability
- Performance
- Customer functionality
- Stability
- Quality
- Scalability
- Technology
- Contractual commitments

To better understand the existing challenges in planning of releases, a series of questionnaire-based interviews were performed. The 23 participants were project managers (8 participants), product



managers (5), development managers (6), and functional architects (4). The key messages to emerge from the survey and interviews are summarized in Table 1. The results were computed on the basis of the percentage of respondents ranking any of the factors as the greatest challenge.

The questionnaire contained ten key challenges facing the industry, and participants were asked to rank them in order of magnitude of the degree of the problem they presented. The sample for the survey was small, but care was taken in drawing conclusions from the results through follow-up interviews with respondents to explore their understanding of some of the terms and issues in the survey in more depth.

### 2.2. Ad hoc Planning Process

An ad hoc planning process had been employed at Trema before the introduction of the improved process described in this article. The ad hoc planning process was performed in two stages. The first stage involved the development of the long-term roadmap, also known as the *strategic*

Table 1. Ranked priority of challenging factors in release planning at Trema

Challenging factors	% of Response
No easy way to get good overview of dependencies of requirements	26
Stakeholders participation difficult especially in a distributed environment	22
Difficulty in re-planning due to late breaking requirements or changing stakeholder priorities	17
Managing resource constraints and their effect on a release is tedious	13
Difficulty of translating corporate strategy to the product through the plan	9
Assigning the right resources and skills to tasks to be performed in each requirement	4
Visibility of the required skills and roles to implement each requirement	4
Adequate interaction among the stakeholders during the selection of requirements for a release	4
No easy way to obtain stakeholder votes for requirements	0
No easy way to generate reports showing the overview of stakeholder voting for each requirement	0

*release plan*. This usually spanned three or more releases over one or more years. The roadmap was used as a strategy and planning document for the organization. The ultimate goal was to provide an optimal long-term release plan that would help fulfill the product’s mission based on all the requirements that have been received. The roadmap was generally taken as a living document that evolved over time and became more concrete and offered more details as one got closer to each of the releases on the roadmap. This strategic plan was also revised on the basis of the lessons learned from each of the releases as they were scheduled and executed. From the roadmap, the focus was usually on the near-term release and on how to achieve successful scheduling and execution of that release.

The inventory of requirements from which the roadmap or strategic release plan was developed usually contained over 500 items that were requested to be present in future releases. Some of these items were dependent on other items in the inventory. There were five or more stakeholders with varying interests in each of the requirements participating in prioritizing these items. The stakeholders were located in different places around the world. The process of ranking and agreeing on the content of the releases took several days using spreadsheets to calculate and collate the results. Some of the problems with the ad hoc approach included the following:

- There was usually no way of knowing all the alternative solutions considering all the constraints and dependencies between the requirements. The end result was the nonfeasibility of the generated solutions.
- Getting all the stakeholders together for meetings and going through all the requirements took time.
- Every stakeholder had a different opinion of what was important and the process of negotiation among the stakeholders sometimes took too long.
- Requirements were continuously changing and evolving. The impact of the changes on the strategic plan was not immediately obvious.



### 3. THE IMPROVED PROCESS

#### 3.1. Overview

To mitigate the problems of the ad hoc planning process, a more systematic approach was introduced. The quality of a release plan is supposed to be strongly correlated to the quality of the process used to develop the plan. The process described in Figure 1 is an instantiation of the more comprehensive release planning process model as presented in Saliu and Ruhe (2005). Therein, three roles that contribute to the process and products of release

planning are identified as (i) the project (or product) managers, (ii) all stakeholders, and (iii) a support environment. Activities occur directly under the roles, which are actively involved in the project. For example, project managers' and stakeholders' roles are involved in feature elicitation, while a support environment maintains the group of features elicited. The support environment may be a simple spreadsheet or it may be an intelligent tool support, depending on the sophistication of the release planning methodology. Major activities of the process model are described by rounded-rectangles, while

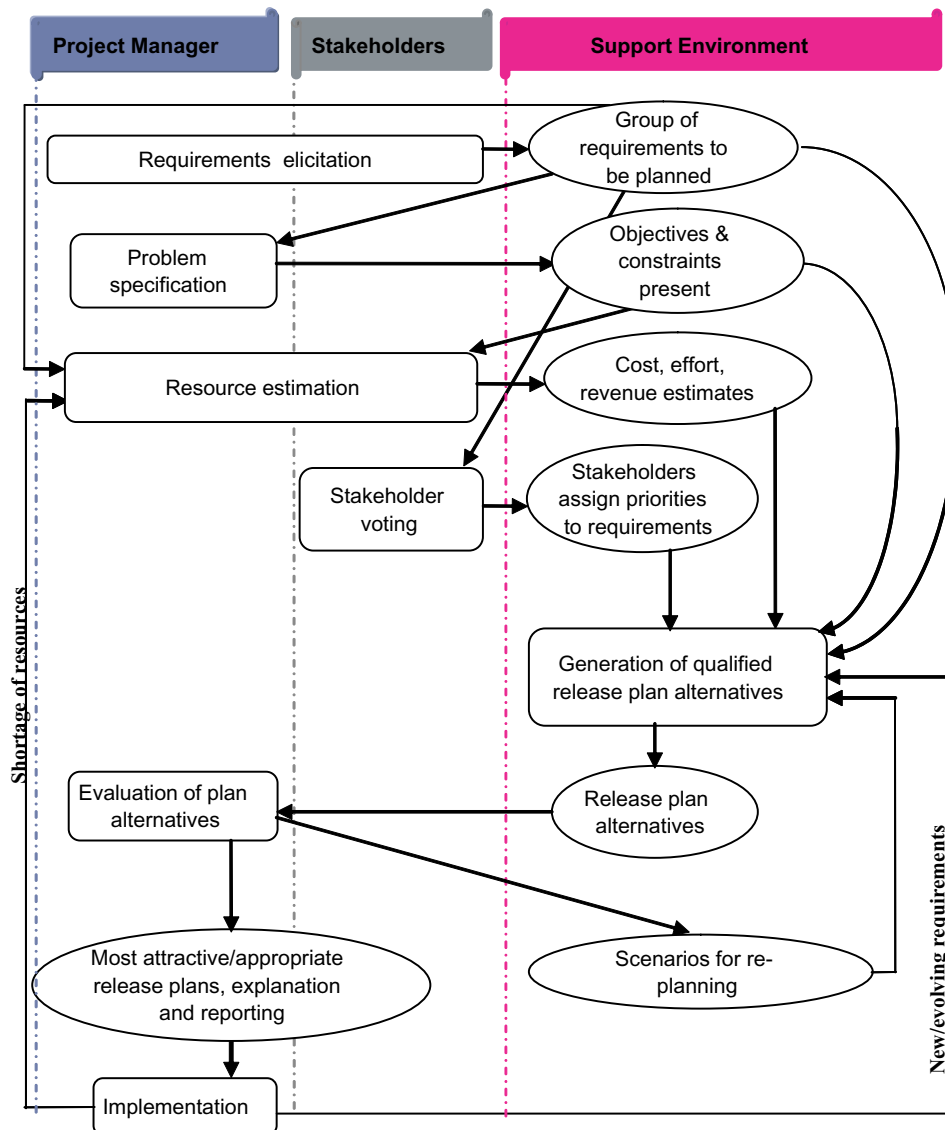


Figure 1. Release planner process model



intermediate results of each activity are shown in ovals.

### 3.2. Process Steps at Trema

#### 3.2.1. Requirements Elicitation

The requirements elicitation process ensures that misunderstandings between the customer and the development labs are minimized. The process starts with the product managers meeting with the customers at the beginning of the release. In many cases, this is not practical, as many of the customers are in geographically diverse locations and the costs of traveling the distances are prohibitive. In these cases, the requirements elicitation process is conducted via e-mails and interviews through phone calls. Another technique used is through user group meetings and workshops, in which the users meet at a location discussing possible new features and requirements for the next releases. An advantage of this approach is that everyone attending the meeting has an equal opportunity to present his/her views.

After the requirements elicitation, the functional specification documents are created. These documents provide more details on the selected requirements described in the software requirements document above. The product's behavior as seen by the customers is described, as also the technical information and data needed for the design. The specification document defines what the functionality will look like and it is the document that the developers use to create the detailed design document that explains in detail how the software will be designed and developed.

The functional specification document translates the requirements gathered during the elicitation process into a technical description that ensures that the features that will be delivered in the next release are correctly understood before moving into the design stage. Once this document is complete, a joint review with the stakeholders either on site or through telephone conference call is held so that consensus agreement and formal approval can be reached. The details in this document also provide the project manager the information to prepare detailed project scoping and plan.

#### 3.2.2. Project Scoping

The purpose of this process, also referred to as *problem specification* in Figure 1, is to establish

reasonable plans for managing the project to deliver the release. This involves developing estimates for the work to be performed, establishing the necessary commitments among the stakeholders, establishing the release plan, and defining the schedule to perform the work. The process starts by defining the statement of the work to be performed, and other constraints and goals that define the release. The scoping process includes steps to estimate the size of each requirement and the resources needed, produce a schedule, identify and assess software risks, and negotiate commitments among the stakeholders.

#### 3.2.3. Resource Estimation

As part of the preparations for the joint review sessions and commitment negotiation with the stakeholder, the developers prepare the initial estimate of the time, effort, and cost required to completely deliver each of the requirements, and the project manager collates these for presentation to the stakeholders. The developers use their past experiences with similar projects to come up with the estimates for the new requirements. These estimates and the assumptions made in deriving the estimates are documented, reviewed, and agreed to by the stakeholders.

#### 3.2.4. Stakeholder Voting

The main objective of this process is to derive a prioritized list of requirements to enable the design effort to be focused on areas that will make the maximum contribution to satisfying the stakeholders. In view of capacity limitation, the emphasis is to start implementation with high urgency and then medium urgency requirements. The stakeholders assign weight or priorities to the requirements on the following basis:

- High – the requirement is a must-have and critical to the stakeholder business;
- Medium – the business can still be carried on without the requirement, with some work-around;
- Low – the requirement would be nice to have.

The stakeholders are able to directly enter their votes into ReleasePlanner from anywhere in the world as long as they have access to the Internet. The project manager then uses the output of the voting for release plan generation.



### 3.2.5. Release Plan Generation

Considering that the release planning data are usually uncertain and may be incomplete, generating a set of diversified solutions offers a much better chance to achieve meaningful results. ReleasePlanner generates different alternative release plans called release plan alternatives on the basis of all the inputs and stakeholder voting. All the generated plans are feasible with respect to all the defined technological, resource, budget, and risk constraints. It is the project manager's responsibility to generate the plan alternatives and then present the alternatives to the stakeholders. Each stakeholder can review the alternatives online.

### 3.2.6. Evaluation of Plan Alternatives

The project manager and stakeholders review and evaluate the generated release plan alternatives to determine whether any unexpected requirements are planned in any of the releases or for changes that will require plan revisions. ReleasePlanner anticipates and accommodates changes, and these potentially lead to re-planning and new plan generation. At the end of the evaluation of the generated plans and re-plans, the most optimal plan that best satisfies the prioritization criteria, utilizes the project resources most effectively and efficiently, and best satisfies the project stakeholders is selected for implementation.

### 3.2.7. Implementation of Proposed Plans

The project manager reviews and monitors the release plan on an ongoing basis. Possible changes to the release plan and the need to carry out re-planning may be caused by a slip in the development of a release-critical requirement and the plan is adjusted accordingly, or a noncritical requirement is re-examined and suddenly gets elevated to critical by the stakeholders and this impacts the release plan. Changes to a release plan's content or schedule are always reported to the stakeholders.

## 4. CASE STUDY PROJECT

### 4.1. Project Settings

The trial project at Trema Laboratories Inc. included 49 candidate requirements. Certain requirements such as the building of the framework for future

requirements were required to be in the early or first release in the roadmap. Some of the requirements had to precede others in the roadmap. In addition, six coupling constraints had to be considered. This meant that the respective requirements had to be offered at the same release. A sample requirement entry with all the four key resource type estimates is given in Figure 2.

The planning was performed for two subsequent releases 7.1 and 7.2. Six stakeholders were involved in prioritization of requirements. The different stakeholders represented the perspectives of the customers, the management, sales, and the development teams.

Prioritization in general needs to be specified more precisely. ReleasePlanner assumes 'urgency' to be defined on a nine-point scale with the following underlying meaning:

- Urgency = 9 means extremely high urgency
- Urgency = 7 means high urgency
- Urgency = 5 means average urgency
- Urgency = 3 means low urgency
- Urgency = 1 means extremely low urgency

For the special case of planning exactly two releases ahead, a more specific voting mechanism is offered in ReleasePlanner. Each stakeholder assigned to vote on specific features can express urgency by distributing nine points among the three possible releases (Release 7.1, Release 7.2, Postponed). The more points assigned to a release, the higher is the intention to have this feature in this release. The total number of points assigned to the three releases has to sum to nine. Some results of the urgency-based voting are presented in Figures 3 and 4. A voting analysis shows the top five requirements in terms of their weighted average urgency (Figure 3) and the requirements with the greatest discrepancy between stakeholder votes (Figure 4).

### 4.2. Qualified Solution Alternatives and Comparison with Manual Plan

ReleasePlanner is an intelligent decision support tool. It can be used online to determine best possible road-mapping and prioritization strategies. To facilitate human involvement and to address inherent uncertainties in the problem, a set of structurally different alternatives are generated. Release planning data are uncertain and incomplete. Coping with uncertainty is essentially based on bringing in complementary knowledge and to appropriately



**Requirement Properties**

Requirement ID: CMM-1019A

Name: CFF - Phase II

Description: Incorporate the ability to reconcile/compare forecasted information. This will include: include Entity Hierarchies in reporting selection criteria; Inter-company forecasts; Aggregate (GI) vs. Enter individual item (BTI = for large amounts, specific date and/or counterparty); Selectable rate scenarios for FX amount reporting;

Resource	Optimistic	Likely	Pessimistic
Product Specialist (Efforts) in Mandays:	2.50	4.00	6.00
Analyst and Designer (Efforts) in Mandays:	1.00	3.00	5.00
Developer (Efforts) in Mandays:	15.00	25.00	35.00
Tester (Efforts) in Mandays:	3.00	5.00	8.00

Manual Pre-Assignment: Force this requirement to be in 1

Attachments: No files or links attached

Stakeholder Voting

Key	Description
TBV	This stakeholder has not yet voted on this requirement.
N/A	This stakeholder does not have permission to vote on this requirement.

Stakeholder	Urgency
cclarke	(6, 2, 1)
drossman	(9, 0, 0)
jmomoh	(9, 0, 0)
mcrupp	(9, 0, 0)
pbahr	(9, 0, 0)
sknodel	(8, 1, 0)

fields in bold are required Add To Notification List  Save Changes

Figure 2. Capturing of the requirements, their effort estimates and the stakeholder votes

which are the five most conflicted requirements from stakeholder voting

Requirements	Conformance	Average Urgency
Automation Performance and Coverage		
Overall CMM Integration II		
Context Sensitive Help		
CFF - Phase III		
Security and Auditing for MIHB		

Figure 3. Most urgent requirements based on weighted averages of stakeholder voting

which are the five most urgent requirements as requested by the stakeholders

Requirements	Conformance	Average Urgency
Transaction Message Integration		
Parsing and Enriching		
Report Manager Infrastructure for Forecast Reports...		
Overall CMM Integration I		
CFF - Phase II		

Figure 4. Top five requirements in terms of their degree of conformance between stakeholder votes



handle this knowledge during the decision making process. An important part of the knowledge necessary to solve the problem cannot be integrated into the model and therefore stays within the experience and expertise of the decision makers.

To address these concerns, diversification of solution alternatives as studied in Ngo-The and Ruhe (2005) was applied. The basic assumption here is that a set of diversified solutions offers a much better chance of achieving meaningful results for the actual problem. In Figure 5, the set of qualified solution alternatives generated from maximization of the stakeholder satisfaction – based objective function are presented. We observe that for some requirements, there is consistency in their assignment to releases. For others, different alternatives suggest different options. This offers flexibility to the human decision maker to address implicit concerns or hidden knowledge that is not part of the explicit problem formulation.

To facilitate comparison between the baseline solution (the manual plan) and the optimized roadmap alternative, comparisons of resource consumption were performed. As can be seen from Figure 6, the manual plan exceeds existing capacity

bounds for both the developer and the tester of resources in the first release period. If such a plan is implemented, this increases the risk of schedule delays and cost overruns.

### 4.3. Re-planning Scenario

Re-planning is of high importance to keep the planning results consistent with the actual problem parameters. Requirements volatility, changes in resource capacities available, or changes in the business priorities are good reasons to update the planning results. For the case study project, re-planning was performed for a scenario of adding additional human resources from European business sites into the process. Fifty respective 30-person-days were added for both release cycles in the available resource capacities of developers and testers, respectively.

The results of the re-planned process show that the degree of stakeholder satisfaction (the formalized objective function of the planning process) could be increased by 4.9% relative to the former situation. As another indicator of the imposed changes, the number of features assigned to the

1. Structure of plan alternatives						
Requirement	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Manual Release Plan
Add TRM, MT, and LT forecasting functionality to CMM	3	3	3	3	3	3
Automatic Reconciliation and Tolerance Enhancement...	3	3	3	3	3	2
Automation on new look and feel	2	3	2	2	2	2
Automation Performance and Coverage	2	1	2	2	2	1
Balances: Derivation and Display	3	3	3	3	3	3
Bank Account Statement Export	3	3	2	2	3	3
Bank Account Statement Report	2	2	2	2	2	2
Bank Holidays Enhancement	3	3	3	3	3	3
Bank Records for Internal Transactions: Creation...	1	1	1	1	1	1
Cash Reconciliation	2	2	2	2	2	2
COF - Phase II	1	1	1	1	1	1
COF - Phase III	2	2	2	2	2	2
COF - Phase IV	2	2	2	2	3	3
Charting	3	3	1	1	1	3
CMM/ADM Integration	3	3	3	3	3	1
Context Sensitive Help	1	2	1	1	1	1
Credit Lines support: commitment and drawing fees	2	2	2	2	2	2
Dashboard	3	3	2	2	3	3
DC Specific Interfaces	2	2	2	2	2	2
Flexible Parameters	1	1	1	1	1	1
Forecast Entry and Upload	2	2	2	2	2	2
FX Position Report	3	3	3	3	3	3
Handling Bank Transactions originated by the Bank	1	1	1	1	1	1
Instant Messaging/Event Messaging	3	3	3	3	3	3
Intercompany Direct Debits	2	2	2	2	2	2
Interest Calculations	2	2	2	2	2	2
Locking Bank Statements	3	3	3	3	3	3
Manual entry of bank statements	3	2	2	2	2	3
Many to many reconciliation	2	2	2	3	2	2

Figure 5. Structure of five qualified release plan alternatives generated by ReleasePlanner



4. Evaluation of plan alternatives according to resource consumption

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Manual Release Plan
Product Specialist	39.9%	40.9%	40.9%	40.9%	40.9%	49.6%
	56.7%	59.8%	56.7%	58.8%	57.7%	56.7%
Analyst and Designer	34.7%	38.6%	33.7%	33.7%	33.7%	39.6%
	44.5%	43.6%	40.0%	41.8%	45.5%	42.7%
Developer	95.2%	98.6%	97.2%	97.2%	97.2%	110.0%
	97.7%	99.4%	98.8%	98.8%	99.7%	96.8%
Tester	99.8%	61.2%	99.8%	99.8%	99.8%	105.5%
	63.5%	100.0%	71.6%	73.0%	64.9%	63.5%

Figure 6. Comparison of resource consumptions of a manual plan and the plan alternatives generated by ReleasePlanner

Release 7.1 (taken as the sum of all five alternative plans) was increased from 70 to 83, and the ones in Release 7.2 from 106 to 117. That means, almost three more features could be implemented in Release 7.1 and another two more in Release 2 on average. On the other side, the number of features to be postponed was reduced from 69 to 45 this way.

## 5. IMPACT ANALYSIS

### 5.1. General Observations

At the start of the case study, the release planning methodology at Trema Laboratories was mostly carried out ad hoc. Many of the personnel involved in the planning process have extensive experience with this ad hoc approach to strategic and operational release planning. We have been involved in the release planning process in the organization for more than 4 years. This provided a good basis to measure the impact of introducing a new approach using ReleasePlanner.

Most organizations expect decision support systems to be a 'silver bullet' that will kill the problems of planning and re-planning of releases, the cost of stakeholder participation, lower quality of the product, and others. Decision support systems for release planning can have positive impacts in many areas, and this was demonstrated during the case study at Trema Laboratories, Inc.

This article also provides some practical guidance for understanding and computing the costs and benefits of using ReleasePlanner. There are many other factors that should be considered

when using an intelligent decision support system such as ReleasePlanner. Such systems have some impact on the organization in areas such as planning approaches, resource utilization, resource scheduling, task granularity, product features, and the release dates or time-to-market of the product. It is therefore useful to understand the impact, potential benefits, and value added to the business by the use of an intelligent decision support system.

### 5.2. Impact on Generated Release Plans

#### 5.2.1. Structure of Release Plans

There were some obvious differences in the release plan alternatives generated by the ReleasePlanner and the manual plan using the ad hoc approach. From looking at the case study results in Figure 7, we observe that alternatives are similar in the assignment of requirements to release 1 except for the 'context sensitive help' requirement that goes into either release 2 or 3 in some of the alternatives. On further examination, the distinguishing differences between the alternatives are the assignments of requirements to releases 2 and 3, as shown in Figure 7.

#### 5.2.2. Quality of Release Plans

ReleasePlanner enabled the maximization of efforts available to the release, which is difficult to achieve using the ad hoc planning approach. That means that at least 95% optimality is guaranteed for the proposed plans in terms of the best possible satisfaction of the (weighted) stakeholder priorities.



### 5.3. Impact on Release Planning Process

#### 5.3.1. Planning Process

Pulling together the roadmap and generating the release plans has taken 60% of a full-time job for a product manager and a release manager for a period of study of 1 year. The effort spent on this activity depends on the size of the organization and the complexity and size of the product. Bigger organizations tend to expend more effort for this activity. Keeping an overall view of all the requirements and the dependencies between the requirements makes this extremely difficult, especially when dealing with hundreds of requirements. Also, determining the effort to implement each requirement and establishing the capacity *versus* the required effort for a release is a tedious process. ReleasePlanner provides a quick overview of these requirements, and the generation of alternative release plan becomes trivial. During the case study, we experienced a reduction of the time spent in pre-planning to less than 20% compared to the 60% using the ad hoc approach.

#### 5.3.2. Re-planning Capabilities

The re-planning process takes even further time and effort. Whenever there is a change in requirements, in the estimated size of requirements, or a change in stakeholder priorities, there is always a need to revise the plan to accommodate the changes.

This process consumed about 30% of a release manager's time. In addition, the time used by other stakeholders involved in the release must be considered. It was estimated that the other stakeholders (6 in this case study) spent an average of 3 hours a week for re-planning during the release.

ReleasePlanner provides a number of ways to modify the project in order to easily perform re-planning or to analyze what-if scenarios. These include:

- Generating plan alternatives optimized for individual stakeholders, or for certain groups of stakeholders by adjusting their weights or importance levels;
- Adjusting resource capacities when increases or decreases of available resources arise;
- Changing the properties of the requirements of the project. These changes include preassigning requirements to specific releases in order to explicitly satisfy some business need, and adjusting the estimated resource needs of requirements once those resource needs become better known; and
- The possibility of adding or removing dependencies between requirements to plan for scenarios where either a dependency can be worked around, or where there is the chance that certain requirements end up being more tightly coupled than the original designs state.

### ReleasePlanner

Requirement	Alternative 1
OFF - Phase II	1
Report Manager Infrastructure for Forecast Reports - Phase II	1
Overall CRM Integration	1
Transaction Message Integration	1
CRM-ACM Integration	1
Target Balance	1
Transaction / Cash Record Reporting	1
Bank Records for Internal Transactions - Creation and Reconciliation	1
Handling Bank Transactions originated by the Bank	1
Menu Cleanup	1
Security and Auditing for MIHB	1
Automation Performance and Coverage	1
Parsing and Enriching	1
Flexible Parameters	1
Context Sensitive Help	3
OFF - Phase III	1
Report Manager Infrastructure for Forecast Reports - Phase III	1

### Adhoc Release Plan

Requirement	Functionality Description
C1019A	OFF - Phase II
C1090A	Report Manager Infrastructure for Forecast Reports - Phase II
C1118A	Overall CRM Integration
C1076	Transaction Message Integration
C1092	CRM-ACM Integration
C1028	Target Balance
C1049	Transaction / Cash Record Reporting
C1043	Bank Records for Internal Transactions - Creation and Reconciliation
C1034	Handling Bank Transactions originated by the Bank
C1119	Menu Cleanup
C1047	Security and Auditing for MIHB
C1015	Automation Performance and Coverage
C1022	Parsing and Enriching
C1120	Flexible Parameters
C0638	Context Sensitive Help



Figure 7. Comparing ad hoc *versus* ReleasePlanner generated release plans



### 5.3.3. Stakeholder Involvement

There was a noticeably greater involvement of stakeholders in the planning process because the use of ReleasePlanner eliminated the traveling overheads for remote stakeholders owing to the web-based nature of ReleasePlanner.

### 5.3.4. Frequency of Planning Meetings

The frequency and length of meetings were extensively reduced. There is, however, the need for stakeholders to be able to provide comments for each requirement when they vote on them.

### 5.3.5. Less Effort on Planning and More on Features

With the number and frequency of meetings reduced, the time saved from these is now channeled to and focused on the delivery process of more requirements for the releases. The quality of the product also receives better focus and emphasis.

## 5.4. Impact on the Product

### 5.4.1. More Focused Delivery

During the case study, we found that ReleasePlanner provided a good means of communicating the roadmap to customers. The impact of changes to requirements could be quickly assessed and presented. More effort could then be devoted to delivering the requirements on the plan.

### 5.4.2. Time-to-Market of Features

There was perception that there was an improvement in the time-to-market of the features. I found this difficult to evaluate, but it could be a subject of further study.

### 5.4.3. Customer Satisfaction

The ability to better understand and address customer priorities provides an excellent means for increasing customer satisfaction with the end-products.

## 5.5. Return of Investment

The benefits listed above are both tangible and intangible. Most of the benefits are dependent on the size of the organization and the complexity of the product. Given below are some of the measurable financial values that affect business value by using

ReleasePlanner. The value  $V(\Delta T)$  during a time interval  $\Delta T$  can be defined as:

Value  $V(\Delta T) = \Delta(\text{Benefits from Release Planner over ad hoc}) - \Delta(\text{Costs of Release Planner over ad hoc})$

The reduction of fixed costs includes the savings during initial planning, and improvements from re-planning. The variable cost of ad hoc planning is the cost incurred from stakeholder participation. This includes travel costs and the time spent in meetings for requirements selection and prioritization. The variable cost of planning with ReleasePlanner is the new cost incurred from stakeholder participation.

The ad hoc planning numbers are taken as the baseline costs for the organization. The ReleasePlanner approach may involve additional costs with some expected additional returns, which is where the real value to the business is then realized. The equation above expresses the value  $V(\Delta T)$  during a release time interval conceptually in terms of costs and benefits, but benefits are not computable in the absolute sense, only in relation to some other alternative. In this case, the alternative is between using the ad hoc release planning approach and use of an intelligent decision support system.

The breakdown of the value derived from using the decision support system is represented in Figure 8. It shows the key components where benefits were realized and their relative impact. The overall saving in absolute terms was determined as about \$187,000 per year. For details on how these estimates were determined see Momoh (2004).

## 6. SUMMARY AND CONCLUSIONS

Determining the most appropriate requirements is one of the hardest and most crucial problems of software development (Lehtola *et al.* 2004). The complexity of planning and scheduling a release is greatly increased when there are several requirements in the release to be scheduled. A schedule that satisfies all the scheduling constraints is said to be a *feasible solution*. A general observation is that many companies still rely on an ad hoc approach to prioritize requirements and determine the feasibility of a release. The major finding in this article is that the use of an intelligent decision support system for

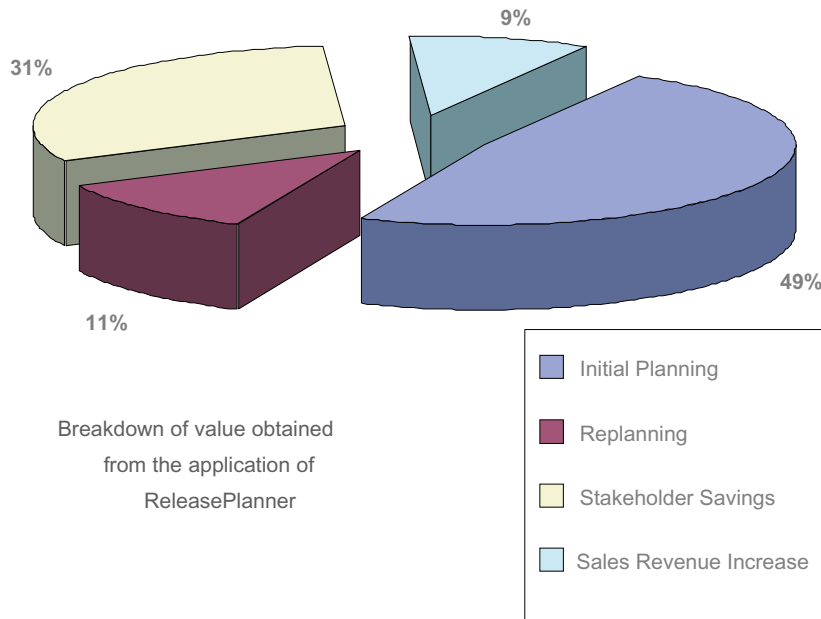


Figure 8. Breakdown of value derived from ReleasePlanner

these scheduling activities removes the major risks and challenges associated with the release scheduling process. This was validated through a case study of a real-life release planning and scheduling process at Trema Laboratories, Inc.

The main contribution of this article is the real-world evaluation of the intelligent decision support tool ReleasePlanner and the benefits realized by a company from the use of the tool. This study shows that there is significant value added to the business compared to the use of an ad hoc approach to release planning.

The value derived by an organization moving from an ad hoc approach to the use of ReleasePlanner depends on the size of the company, the size of the product, the size of the project team, the length of each release, and the number of requirements. The use of an intelligent decision support system is not always appropriate or cost effective, especially for small organizations working on small projects and dealing with a very small number of requirements. The ad hoc approach could work well and be adapted easily to small projects with a few requirements. However, with increasing size and complexity of projects and products, there are other complex factors at play in the making of decisions involved in release planning. In such cases, as demonstrated in this case study, using an intelligent decision support system such as ReleasePlanner adds value to the business.

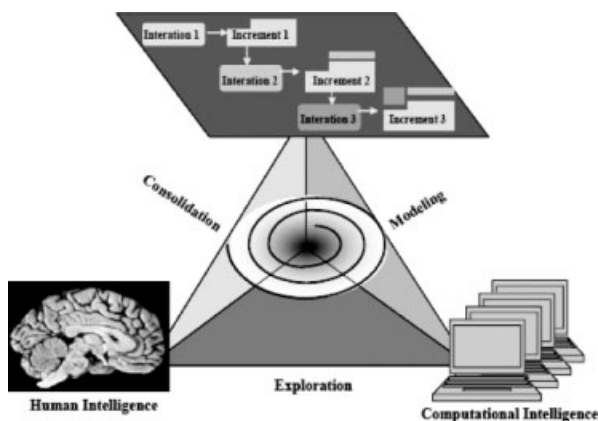


Figure 9. EVOLVE\* process model

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