Making the Business Case for RMTrak

Overview: *Using a requirements management tool like RMTrak helps your organization manage complex and changing project requirements. Additionally, RMTrak can help your organization satisfy Client needs, comply with certification standards, promote communication, maintain a practical project scope, meet project deadlines, and lower project costs. When you weigh the high cost of requirement errors against the inexpensiveness of RMTrak, your organization can't afford not to have RMTrak.*

RMTrak is RBC Product Development's new requirements management tool for tagging, tracing, allocating, and verifying product requirements. RMTrak is a simple, non-intrusive program that captures, tracks, and manages the project requirements information in your requirements management documents from outside of the document creation process. This lets you use the tools you are already familiar with to format your documents, including Microsoft® Word with its powerful word processing features.

RMTrak was designed to work with your existing requirements management process. Whether you're new to requirements management or an experienced professional, this document makes the business case for purchasing and using RMTrak in your organization

Requirements Management

Product development companies frequently deal with requirements management. Their Clients, developers, and industry standards determine the many requirements necessary to complete a project. The product development Company then must keep track of each requirement, ensure it correctly meets its standards, and know when it's been successfully implemented and tested. Since large projects can have thousands of requirements, which can change over time, this is often a difficult and tedious chore.

Studies indicate that U.S. product development companies spend millions of dollars in failing projects. Additionally, over half of the projects developed in the U.S. come in late and over budget or are lacking in some of the key requirements needed to make the product successful. These organizations fail because they have difficulties implementing the project's numerous requirements, which can be forgotten or left behind. Many of these projects end up cancelled and result in a significant waste of Company resources—not to mention the loss of market share and

> Studies have shown that neglecting to carefully elicit project requirements and poor management of those requirements are the most significant reasons that 40 percent of all software projects fail. (CHAOS 1997. The Standish Group International, Inc., Dennis, MA.)

Note: Your organization's project might or might not include product development. Many organizations, and most of the organizations using RMTrak, are familiar with product life-cycles; however, if your organization is not developing a product, *project life-cycle* seems more appropriate. For these reasons, the words *project* and *product* are used interchangeably in this document.

life-cycle profitability for a product. The key to successful projects is having an accurate and thorough collaborative requirements management process. The key to successful collaborative requirements management is finding the right tool to manage the process.

The Requirements Management Process

RMTrak helps you with your requirements management process, which involves capturing project requirements, conceptualizing them, documenting them, validating them, then using your requirements management tool (RMTrak) to help you apply, test, and close them.

Requirements management can be divided into different tasks:

- Exploring and determining product requirements through observation, task analysis, etc.
- Creating a conceptual model of the product as seen by the system's eventual users. This model should capture the semantics of the real world and provide the foundation for an abstract description of the requirements.
- Documenting requirements and describing the components of the conceptual model(s). The resulting documents may act as contracts between the organization and their Client.
- Validating requirements by evaluating, analyzing, and testing requirements documents for completeness and accuracy.
- Managing requirements by developing a set of procedures to assist in maintaining the requirements throughout the project life-cycle. These may include planning, tracing, assessing impact of changing requirements, and other activities.
- Implementing requirements using the requirements documents, concept models, and requirements management processes as guidelines.
- Verifying and validating requirements by testing implemented requirements for accuracy, completeness, and functionality.

Why Your Organization Needs an Automated Requirements Management Tool Like RMTrak

Using a requirements management tool like RMTrak can benefit your organization in several ways. The chart below lists the most commonly faced development challenges, how a requirements management process can help solve those challenges, and how RMTrak can facilitate the process.

Development Challenge	Benefits of a Requirements Management Process	Additional Benefits Provided by Using RMTrak
Satisfy Client needs	• Promotes complete, clear, and correct definitions of project requirements • Enables the project team to fully understand and meet the needs of Clients the first time • Enables earlier identification of requirement deficiencies, ambiguities, and errors	• Enables analysts to assign attributes to requirements for classification and prioritization • Allows the project team to easily identify requirements within the project scope • Allows Clients to review requirements and ensure their needs were understood and documented correctly • Allows collaborative discussion to refine and prioritize requirements more completely
Comply with certification standards	• Provides guidelines for documenting requirements • Allows analysis of requirements and requirement relationships • Drives using requirements as a basis for solid development and test plans	• Stores requirements in a central location for a collaborative development environment • Maintains traceability links between requirements and related development and testing information to facilitate impact analysis • Allows project managers to quickly identify gaps in the project design and extraneous requirements to produce better development and test plans
Promote Communication	• Provides a central location for accessing requirements documents • Promotes full definitions, including the use of supporting information • Offers a formal process for recommending changes to requirements • Promotes discussing and investigating the impact of changes prior to making them	• Makes requirements easily accessible to the project team • Allows files to be linked to requirements to provide supporting information
Maintain a Practical Project Scope	• Promotes tracking relationships between requirements to aid in impact analyses • Keeps project team focused • Reduces project delays	• Uses traceability to show how changing requirements will affect other requirements • Allows project managers to easily identify extraneous or missing requirements through a traceability matrix

Development Challenge	Benefits of a Requirements Management Process	Additional Benefits Provided by Using RMTrak
Meet Project Deadlines	• Provides a method for controlling project requirements, which form the basis for creating an accurate project schedule • Allows identification of requirement changes that may affect the schedule	• Allows project managers to more easily control project requirements through security profiles and attributes • Allows easy identification of requirement changes and their affects on other requirements through the traceability matrix
Lower Project Cost	• Allows project scope to be managed more effectively, reducing feature creep and re-work • Provides the means to more accurately estimate timeframes and work estimates • Improves communication between team members and Clients so Client needs can be met the first time	• Allows project mangers to implement a requirements management process more efficiently and effectively, through customizable support for any process • Allows project teams to quickly identify requirements within the project scope • Helps Clients and team members define and understand requirements more quickly to establish and maintain a more accurate project schedule • Allows project teams to meet the Clients' needs the first time, reducing re-work

The High Cost of Requirement Errors

Numerous studies have been performed to determine how costly errors can be. These studies measure and assign costs to errors occurring at various phases of the project life-cycle. Although these studies were performed independently, the majority of them reach roughly the same conclusions:

- If a unit cost of "10" is assigned to the effort required to detect and repair an error during the coding stage, the cost to detect and repair an error during the requirements stage is approximately *ten* times less (or "1").
- Furthermore, the cost to detect and repair an error during the operational stage is *forty* to *one thousand* times greater, depending on the complexity and distribution of the product.

The below figure illustrates the costs of errors as they are detected during each phase of a project's life-cycle[1].

[1] Gause, Donald C. and Gerald M. Weinberg. *Exploring Requirements: Quality Before Design*. New York: Dorset Hourse Publishing, 1989.

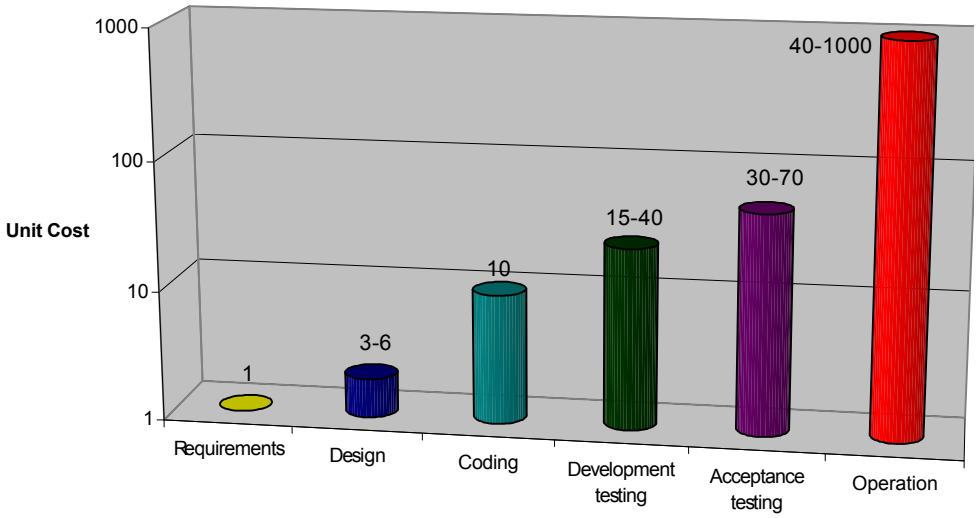

Figure 1: Unit Cost Per Phase

Requirement Errors Are the Most Common Errors

Requirement errors are the largest class of errors typically found in product development projects; they typically constitute between 40 and 60 percent of the total number of errors, while design and coding defects combined attribute to only a third of the errors found. The below figure summarizes these findings.

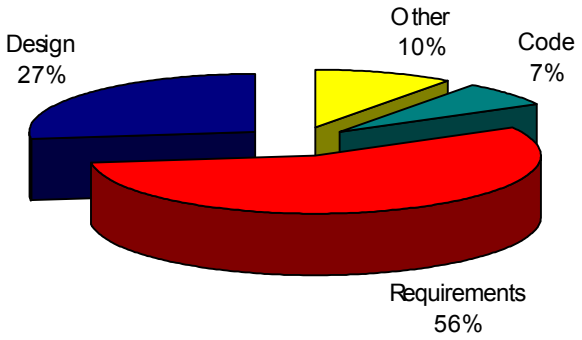

Figure 2: Distribution of Errors

Simply finding errors is not enough, however. A lot of work is required to correct those errors. The distribution of effort required to fix requirement defects is over 80 percent.

When we consider the cost of finding and correcting errors in the requirements phase versus the operational phase of the development life-cycle, we conclude that it would have been considerably less expensive to concentrate on fully defining and documenting the requirements at the beginning of the project.

The below figure illustrates the distribution of effort.

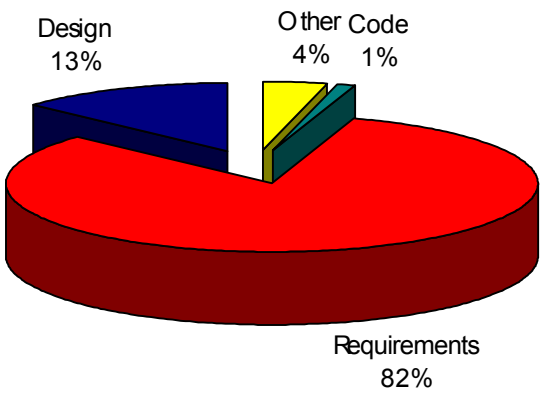

Figure 3: Distribution of Rework Cost

To better understand the impact and costs associated with errors, consider the following documented project failures[2].

- In 1996, the maiden flight of Europe's Ariane 5 rocket ended in complete destruction of the rocket. The cause was a software error, perhaps the most expensive software error on record at over seven billion dollars. The root cause of the error was a breakdown in the requirements process.
- In another example, the FAA canceled its ten–year effort to modernize the nation's air control system in 1994. About 1.3 billion dollars was written off. In ten years, the requirements phase of the project had never come to closure.

These are examples that have gained a tremendous amount of attention due to the costliness of the failed project. In everyday business, organizations are experiencing project failures due to a lack of requirements management.

To more effectively reduce requirement errors, many organizations strive for:

- Accessible requirements repository, facilitating team communications
- Better organization and documentation of requirements
- Better requirements traceability and testing
- Improved reporting processes
- More effective requirements elicitation
- Walkthroughs and reviews of requirements with Clients and end users

[2] Van Buren, Jim and David A. Cook. "Experiences in the Adoption of Requirements Engineering Technologies." *CrossTALK, The Journal of Defense Software Engineering* 11.12 (Dec 1998): 3–10.

Sample Return on Investment (ROI) Calculation

The table below shows a sample return on investment (ROI) calculation using these factors:

- Project team consists of six (6) developers and four (4) support personnel, including Project Management and Quality Assurance
- Project duration is twelve (12) months
- Overhead is $10,000 per month per project member, including salary, benefits, burden
- Estimated cost of rework is 30 percent (based on Client interviews and industry research)
- Person-months of coding for 6 developers is 47.4 working months
- Requirement errors estimated to be 70 percent of rework cost

Table 1: Sample Project Cost Estimates for a Software Project

Description	
Number of team members	10
Person months of coding	47.4
Time to market (months)	12
Overhead per month per team member	$10,000
Total projected labor costs	$1,200,000
Total rework costs (30% of project costs)	$360,000
Total cost of project	**$1,560,000**
Total cost of requirements errors (70% of rework cost)	**$252,000**

Investment

The investment in RMTrak, using seat-based licensing for the ten-person project above, is as follows:

Table 2: RMTrak Pricing (List Pricing)

Description	**QTY**	**Total**
RMTrak 10 Seats	10	$1,895
Total Investment		**$1,895**

The return on investment is based on the percent of reduction in requirement errors. The below table illustrates the return based on the above investment. The figures are derived from the project in Table 1.

Table 3: Return on Investment (ROI)

Description	Case 1	Case 2	Case 3
Investment	$ 1,895	$ 1,895	$ 1,895
Requirement error reduction	50%	25%	15%
Cost savings for project	$126,000	$63,000	$37,800
Percent return on investment	**6649%**	**3325%**	**1995%**

Summary

Considering that the total cost of requirement errors (as shown in Table 1) was $252,000, the cost savings for this project can be quite significant. Table 3 shows the investment in RMTrak with three different scenarios. Conservatively, if you estimate that RMTrak only reduces requirement errors by 15 percent, the return on investment is 1,995 percent after just one project. The figures are based on using RMTrak for a single twelve–month project.

But these hard costs exclude the intangible costs associated with a requirement error. Intangible costs include lack of features that could have been delivered had the project resources not been devoted to rework, loss of confidence on the part of Clients, and lost, unrecoverable market share, revenue, and profit.

When applied to any environment, the benefits and inexpensive costs of RMTrak significantly outweigh the enormous costs of requirement errors and unorganized product development.

Additional Information

RBC Product Development is dedicated to helping you succeed. If you need additional information about making the business case for RMTrak, please don't hesitate to contact us or visit our RMTrak Web site.

RMTrak Web site: http://www.RMTrak.com

General inquiries: RMTrak@rbccorp.com

Technical Support: RMTrak.Support@rbccorp.com