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A SOFTWARE FOR PROJECT MANAGEMENT PROCESS

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Research Project Management Process, implies the allocation of important human and financial resources to guarantee fulfilling of the goal by respecting the pre-defined schedule, under the conditions of expected quality. Considering that, informatics is looking for solutions to support the teams to develop complex projects. In this paper we propose a new software for project management, along with a new approach but at the same time complying to the requests formulated by the TenStep methodology. This application software, manages schedule, changes, quality control, risk and budget for the projects. Research Project Management - RPM software is our proposal for a complete integration of all project management processes in a unique application that offers procedures to coordinate people and activities in a project. It will help during the phase of design and supervise of a project, as well as changing the initial configuration when the project doesn't develop as planned.

Key words: project management; TenStep methodology; software application; quality management; risk management; resources allocation.

1. WHAT IS PROJECT MANAGEMENT?

Once a project is accepted, it doesn't start and develop only by manager's experience. It is recommended to use a methodology and software tools for a structured approach to project management. The project manager needs procedures to coordinate people and activities in a project, how to design and supervise the project, and to make any intervention if it doesn't develop as planned. He defines the specific goals, the activities to be carried out, the terms and the resources for each stage. On the basis of close monitoring, which gives an automatic control of any deviations from the plan, the project can be carried out in a controlled and organized way.

The term **project management** refers to the definition, planning, subsequent monitoring, controlling and conclusion gathering of a project [1]. The larger and more complex a project is, the more it is necessary to have a formal, standard and structured process.

In the recent years, a number of methodologies have been published on ways to make the project management process simpler, easier to implement and more responsive to client expectations.

For example, Prince2 is a process-driven project management method that defines 45 separate sub-processes and organizes these into eight processes as follows [2]:

- Starting up a Project
- Planning
- Initiating a Project
- Directing a Project
- Controlling a Stage
- Managing Product Delivery
- Managing Stage Boundaries
- Closing a Project

In this paper we consider that TenStep methodology [3] is a flexible and scalable approach and provides the framework for managing all kind of projects. Once the project is authorized and ready to be executed, the TenStep methodology is engaged to plan and manage the work to be carried out.

2. A BRIEF PRESENTATION OF THE TENSTEP METHODOLOGY

The various roles and responsibilities involved in a project are fully described and are adapted to suit the complexity of the project, and the accuracy of management activities. It provides a common language for all participants in the project.

Being a structured method, TenStep has a life cycle that consists of four major sequential phases: prepare, plan, execute and harvest. These phases, therefore, encompass the ten steps described as follows [3]:

- **Define the Work** - planning the project to ensure that the project team and sponsor agree on the work that is required and have common perceptions on project objectives, deliverables, scope, risk, cost, approach (from the Project Charter).
- **Build the Schedule and Budget** - the schedule is an important tool that describing the work that needs to be done, the order of the activities, the effort required, and the assigned resources. These two steps aren't necessarily sequential, they could **be accomplished in parallel**. Most of the time, the project manager cannot complete the Project Chart without laying out the overall project schedule.
- **Manage the Schedule and Budget** – is a continuous activity of the project manager to ensure that the project finishes on schedule and within budget. The project manager must evaluate periodically the schedule and determine the current state of the project. For most projects, the schedule needs to be reviewed on a weekly basis.
- **Manage Issues** – define issues that impede the progress of the project. Sometimes, those issues cannot be totally resolved by the project manager and the project team therefore outside help may be necessary in order to resolve quickly and effectively those issues.
- **Manage Changes** – as the initial definition and planning processes are not perfect, potential changes may occur. The project manager and the team must cover all aspects of change: Scope changes, Configuration changes and General changes.
- **Manage Communication** - includes reporting from the project team to the project manager and reporting from the project manager to the sponsor. The two typical forms for communicating project status are through a status meeting and status reports. For larger projects, another approach is based on a Communication Management Plan.
- **Manage Risk** – defining risks as future conditions or circumstances that exist outside the control of the project team and can have an adverse impact on the project. The project manager should perform a risk assessment with the project team and the client, to identify high, medium and low level risks, and find solutions for each type of risk.
- **Manage Human Resources** - the project manager has people management responsibilities by acquiring, developing and managing the project team.
- **Manage Quality** - the purpose of quality management is to first understand the expectations of the client in terms of quality and then implement a proactive plan in place to meet those expectations. The team and the client determine one or more metrics on that respect. So, steps 9 and 10 are closely tied.
- **Manage Metrics** – this step focuses on collecting metrics to determine how well the deliverables satisfy the client's expectations. All projects should be gathering basic metrics information regarding cost, effort and duration. Depending on the results, corrective action or process improvement activities can be undertaken to make the processes more efficient and effective [4]. Metrics management can be used effectively on medium and large scalee projects, because there is enough time to capture the data, analyze the results and make appropriate changes.

There are many software applications for project management, some of them implement the TenStep methodology, but they are also very expensive. So, our team decided to develop our own software for project management. The experimental software *Research Project Management - RPM* is the alternative approach for research project management, according to the requests formulated by TenStep methodology.

In this paper we want to present the most important specifications of RPM software that was developed using the Microsoft Access Databases Management System, and VBA language [5] for implementing the modules.

3. RPM SOFTWARE FOR PROJECT MANAGEMENT

RPM software consists of all the components to coordinate people and activities in a project, how to design and supervise the project, and measures to be taken if the project has to be adjusted in case it doesn't develop as planned. On the basis of TenStep methodology, using RPM, the close monitoring of the project can be accomplished in a controlled and organized way.

In this software, the project is divided into manageable phases, each of them specified with its particular goals, resources and activities to be carried out. That gives an automatic control of any deviations from the plan. The structure of RPM database is too complex to be presented by one image. It contains tables with specific information about project phases (budget, terms and persons involved) and the relationships between them.

RPM must be implemented on the Intranet network and, for advanced security, some of the modules are protected by a password, known only by the project manager.

According to the stages of TenStep methodology, the system will contain six functional modules:

1. **Initialization** – corresponds to the first and second step of the TenStep methodology (*Define the Work, Build the Schedule and Budget*) and it has three parts:
 - a. Phase's registration,
 - b. First version information saves,
 - c. Reports.
2. **Evaluation** – corresponds to the third step (*Manage the Schedule and Budget*) having the goal to evaluate periodically the schedule and determine the current state of the project.
3. **Changes** – covers *Manage Issues* and *Manage Changes* stages; it is recommended to execute this module after the Evaluation module, that allowing to see the state of the project. The project manager can modify phase information (budget, terms) and then save these changes in a new version, automatically increased.
4. **Communication** – covers the *Manage Communication* and *Manage Human Resources* steps - includes reports from the project team to the project manager and from the manager to the team and the client.
5. **Risks** – corresponds to the *Manage Risk* stage – this is a complex module that analyzes the possible risks and possible solutions for each situation. After the financial and timing evaluation of each solution, the application indicates an optimal solution.
6. **Quality and metrics** - covers *Manage Quality* and *Manage Metrics* steps – this module is designate to realize a final evaluation of the entire project by calculating the values of several metrics and comparing them to the optimal values expected by the client.

1. Initialization module. This module is designated to plan the project phases before the teamwork begins. The project manager must ensure that the project team and the client have common understanding of what the project is going to deliver, when it will be complete, what will be the costs, who will do the work and how the work will be done.

So, the project manager must define the team member roles, according to the activities of the project, the phases and the specifications for each of them. The *Initialization* module is designed to introduce the primary information about goal, budget, terms and personnel involved for the project phases. RPM software offers correlated forms to introduce these elements (figure 1).

The screenshot shows a software window titled 'CONTRACTS'. The main section is 'PROJECT INFORMATION' with a table containing one record:

Contract	Project title	Project manager	Start date	End date
2430	INTEGRATED INFORMATIC SYSTEM	Aldea Dan Liviu	01.07.2008	30.06.2009

Below this is the 'PROJECT PHASES' section, showing details for phase 2430.1:

Phase code	Phase description
2430.1	Feasibility study

Additional details for phase 2430.1:

Start date	01.07.2008	End date	30.05.2008
Budget	15000	Version	1

The 'TEAM SCHEDULE/PHASE' section shows a table of team members and their hours:

Member Code	No. of hours
1 ALDEA DAN LIVIU Project manager	120
2 MANEA SORIN Member of team	60
3 ENESCU EMILIA Member of team	100
* 4 POPESCU MARIA Member of team	0
5 SIMION ALEXANDRU Member of team	
Re 6 BADEA ANDREI Member of team	

Navigation controls at the bottom show 'Record: 1 of 5'.

Figure 1. Initialization module: Phase-Budget-Term

Also RPM software uses report (figure 2) and graphic representation similarly to the Gantt diagram for Phases – Team worker – Time (figure 3).

The screenshot shows a software window titled 'ACTIVITY PLAN'. The main section is 'THE ACTIVITY PLAN FOR THE TEAM MEMBERS' for Contract no. 2430 INTEGRATED INFORMATION SYSTEM. The report is a table with columns for PHASE (title, final term, budget) and PROJECT TEAM members: ALDEA DAN LIVIU, BADEA ANDREI, ENESCU EMILIA, MANEA SORIN, POPESCU MARIA, and SIMION ALEXANDRU.

PHASE (title, final term, budget)	ALDEA DAN LIVIU	BADEA ANDREI	ENESCU EMILIA	MANEA SORIN	POPESCU MARIA	SIMION ALEXANDRU
2430.1 Feasibility study 30.05.2008 15000	120	100		60		
2430.2 Equipment acquisition plan 30.09.2008 20000		250				100
2430.3 The system concept development 31.12.2008 8000		200	120			
2430.4 Implementation phase 31.03.2008 5000				130		175
2430.5 Finalizing the project 30.06.2009 4000	150	30	70	120	30	40
Total ore	720	250	70	310	30	315

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Figure 2. Initialization module: Phases – Team worker

This module is write-protected by password, but its information can be read by any team member. Once the project schedule is finished and ready to be executed, it should be authorized and saved automatically as the first version in a history table.

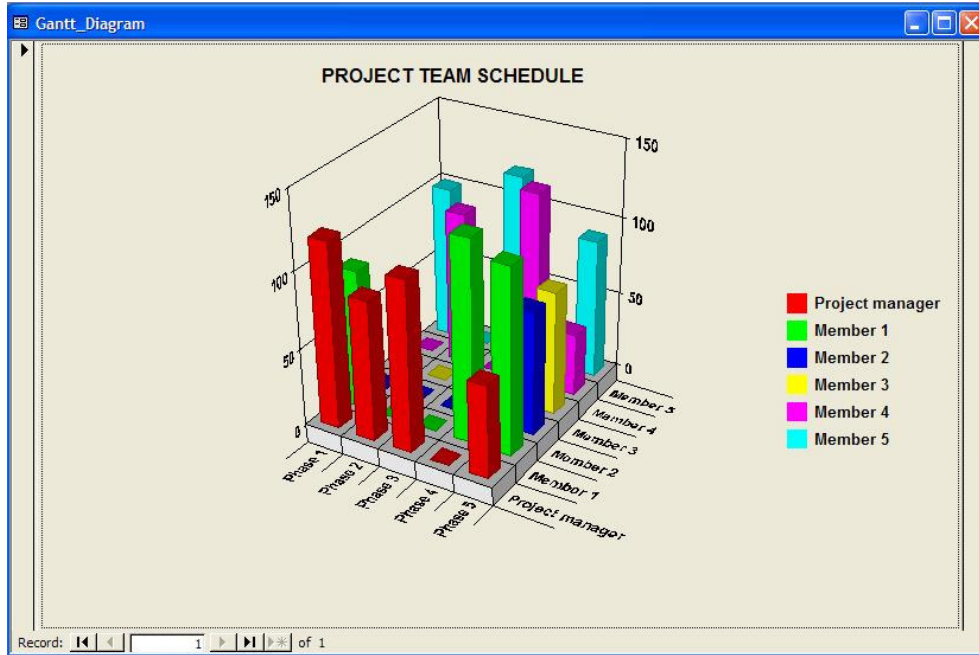


Figure 3. Initialization module: Phases – Team worker plan

In time, there are changing aspects that can occur on the project and they will be treated by another module: *Changes*. Only the project manager can modify the initial information about scope, schedule or cost, after an agreement with the client.

2. Evaluation module. The project manager and each member of the team must evaluate periodically the schedule and determine the current state of the project. After creating a project schedule and budget, the project manager must manage them to ensure that the project finishes on schedule and within budget. The budget represents the amount of money available to spend within the project. Depending on the Contractor Authority rules, the budget is structured by types (internal labor, materials, investments, dissemination etc.) and the reports analyze the evolution of these categories (figure 4). The process for determining the financial justification for a project is covered by the *Financial* application.

Figure 4 is a screenshot of a software window titled "PHASE/COST" showing a table for "PHASE COST" and a sub-table for "COST/PHASE".

Project phase	Final term	Budget
2430.1 Feasibility study	30.05.2008	15000

Cost Categories	Estimated Values	Actual Values
1 Personnel costs	5000	4800
2 Materials, services costs	500	550
3 Utility costs	9500	9500
4 Investments		

Figure 4. Evaluation module: The structure of the budget

The project manager must do a correct repartition of the budget among the project phases and monitor the costs periodically. For this purpose, RPM software has two types of graphic reports: costs by period (figure 5) and costs by project (figure 6).

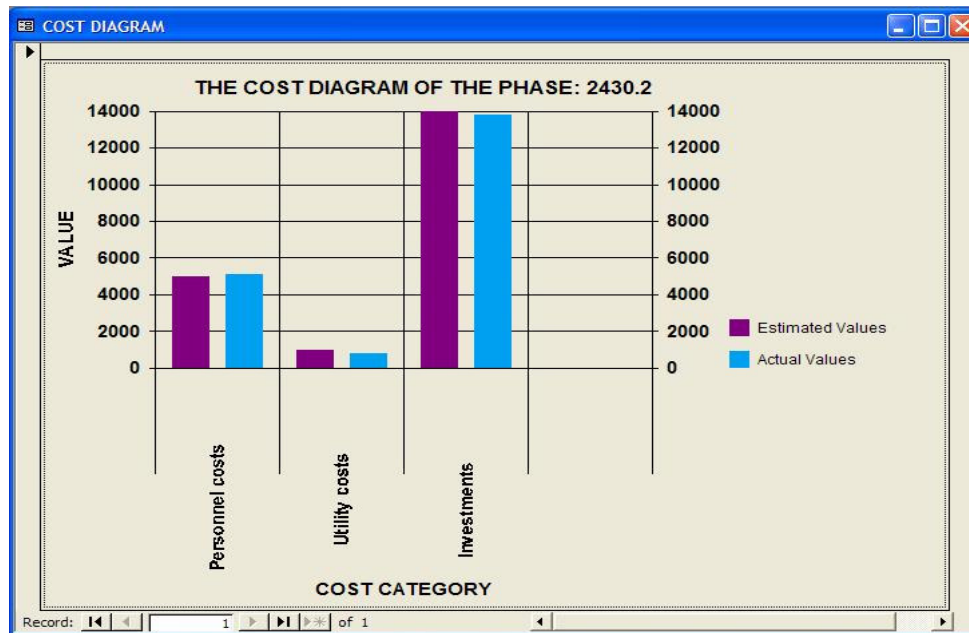


Figure 5. Evaluation module: Costs by period

Both of them represent a comparative view between the estimated values and the current costs, the time periods being different: a phase or from the beginning to the current status.

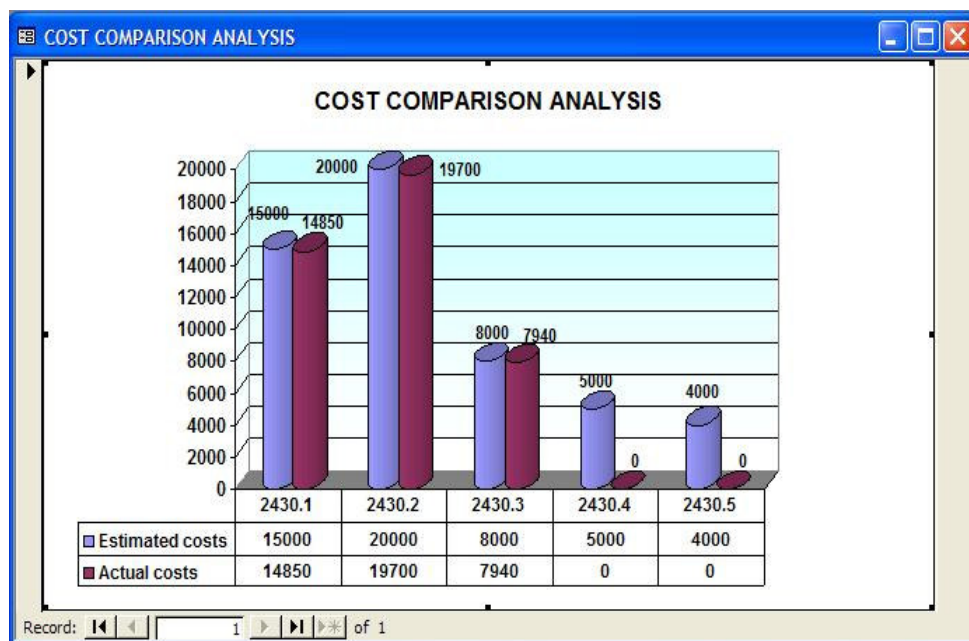


Figure 6. Evaluation module: Costs by project

Similarly, our software contains another application that evaluates the final terms of the stages and the work time for each team member, (estimated and actual).

3. Changes module. For most projects, the schedule will need to be reviewed on a periodically basis. The schedule is the most important aspect of the project management, and all the project management processes are integrated in the schedule. The project manager must implement corrective actions and update the schedule with the current state of work using this software module. There are a number of related aspects of change that can occur on a project.

If the deliverables change during the project (and usually this means that the client has additional expectations), the estimations for cost, effort and duration may no longer be valid. If the sponsor agrees to include the new work into the project scope, the project manager will agree that the current budget and deadline will be modified (usually increased) to reflect this additional work.

When a scope change is requested and approved, the project manager must change the budget and schedule to accommodate the change. For non-scope related changes there are no expectations that the change will result in a schedule or budget update.

If an activity on the critical path is a week or a month delayed, the project manager cannot afford that the entire project will be a week or a month off schedule. Instead, he must evaluate the resources and options available and get the project back on track. After executing the *Evaluation module*, the project manager must operate some changes in previous version of the schedule. The *Changes module* is equivalent with *Initialization module*, it offers the possibility to the manager to update the information about phases, including the addition of new phases.

Every change is saved in History table, having another version number and the last update is the current reference for the project team.

4. Communication module is designate to keep a communication channel always open between the project manager and the rest of the team. Also, some general information about the project progress is accessible to the client (the sponsor). This module includes reporting from the project manager to the project team and reporting from the project manager to the client. We suppose that the team has access to all information about the project evolution by Intranet, but only the project manager can change the basic data. The access is secured, so the information is confidential, only for the project team. Every member of the team accomplishes a working plan, according to the activities of the schedule and communicates all problems to the manager.

5. Risks module analyzes the possible risks and offers solution proposals for each situation. Before starting the execution of the project, the team must identify the risks and introduces them into a Risk List. Using different methods (including brainstorming, historical situations, and statistics) for each risk, the team will indicate solutions to solve the possible problem.

Risk refers to future conditions or circumstances that exist outside of the control of the project team, and may have an adverse impact on the project if they occur [6]. Whereas an issue is a current problem that must be dealt with, a risk is a *potential future problem* that has not yet occurred. A reactive project manager tries to resolve issues when they occur. A proactive project manager tries to prevent potential problems before they occur [7].

RPM software gives the project manager the possibility to define a Risk List with the project team and the client, identifying high, medium and low level risks for every phase.

All projects have some degree of uncertainty due to the assumptions associated with them and the environment in which they are executed. Although not all risks can be eliminated entirely, most of them can be anticipated and managed ahead of time.

The purpose of *Risk module* is to identify the risk events for the project and then establish a Risk List and a Risk Solutions List to minimize the probability that the risk event will harm the project.

If the risk event occurs, the team must choose only one solution, making a comparative analyze of the consequences (quality, terms and budget) to minimize the impact of the risk.

Figure 7 presents the form to introduce the risk and its solutions while figure 8 shows an example of Risk Solutions List for a research project.

RISKS AND SOLUTIONS

RISK MANAGEMENT PLAN

1 The low experience of the project team with PM

RISKS CATALOGUE

Phase	Solution code	Risk level	Validate	Prime responsibility
2430.1	11	Medium level	<input checked="" type="checkbox"/>	Project manager
2430.3	12	Medium level	<input type="checkbox"/>	Member
2430.1	42	Low level	<input type="checkbox"/>	Member of team

Record: 1 of 3

RISKS SOLUTIONS

Solution code	Defining solutions	budget influence	quality influence	term influence	validate solution
11	Periodical evaluation of the current status of project	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
12	Replace one of the team members	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
21	Review of the contract clauses	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
22	Phased delivery of the equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Record: 1 of 4

Figure 7. Risks and solutions

RISKS AND SOLUTIONS

RISK MANAGEMENT PLAN

Contract no. 2430 INTEGRATED INFORMATIC SYSTEM

Phase	Risk event	Solution	Defining the solution	Prime responsibility
2430.1	Feasibility study	1	The low experience of the project team with PM	
		11	Periodical evaluation of the current status of project	ALDEA DAN LIVIU
		42	Changing the parameters	MANEA SORIN
2430.2	Equipment acquisition plan	3	Problems with a member of the project team	
		31	Complete team member training	ENESCU EMILIA
2430.2	The equipment supplier doesn't deliver in time	2		
		21	Review of the contract clauses	MANEA SORIN
		22	Phased delivery of the equipment	POPESCU MARIA
2430.3	The system concept development	23	Replacing the equipment supplier	ALDEA DAN LIVIU
		1	The low experience of the project team with PM	
		12	Replace one of the team members	ENESCU EMILIA

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Figure 8. Risk solutions list

6. Quality and metrics module represents a method of evaluation using metrics to indicate how close the project and deliverables come to meet the client's requirements and expectations.

Since quality is defined by the client or by the project manager, it may be completely subjective. However, there is a lot about quality that can be made objective. First, this requires breaking down the generic term of "quality" into the specific aspects of quality that are important to the customer [8]. Then, each of the individual aspects can be transformed on one or more metrics that can be collected to measure the quality

aspect. For instance, one of the features of a quality solution may be that it has a minimum amount of errors. This parameter can be measured by counting errors and defects after the solution is applied. For every metric, an evaluation team can establish notes to make the process more objective. So, for quality management, some characteristics of the project need to be measured, otherwise it's difficult to improve processes.

Our software implements *Quality and metrics* module for gathering three important metrics on a project. Because metrics can be hard to define and collect, we decided to evaluate the quality by the basic metrics information regarding cost, effort and duration.

This module focuses on evaluation of these metrics, correlate them into a table that establishes notes or points if the results are between some values. *Quality and metrics* module can be launched at every moment and depending on the results, it can determine a corrective action or process improvement activities.

Metrics are used to give some indication of the quality in the beginning state and whether quality is increasing or decreasing in time. Metrics management can be used effectively on medium and large projects because there is enough time to capture the data, analyze the results and make appropriate changes [9]. Project teams should know the meaning of the calculated data (the metrics). RPM software gives an interpretation of the metrics to help the manager as well as the team members. If other metrics are also helping to manage the project, there may be a reason to gather and calculate additional information for an appropriate interpretation. Project metrics are important, but the most value from capturing metrics is gained if they are used to drive improvements at the organization level.

4. CONCLUSIONS

A software system for managing any type of projects is an imperious request of any research team. Instead of losing time by considering the current situation and the level of every phase, with appropriate software the team can focus on the activity within the project development.

The experimental system RPM, conforms to the rules specified in TenStep methodology. Based on what was presented above, the development of an RPM system leads to the following *conclusions*:

- There is a lot of interest for the project management especially from research community and government agencies implicated in research;
- The future and increasing usage of project management software depends mainly on the evolution, security and results of the managing processes;
- RPM modules contain control information and solutions for every problem and risk initially formulated by the project team;
- The working group of RPM is able to develop this software after testing on a number of different types of projects, offering a unified interface system.

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