DEVELOPMENT OF PROJECT MANAGEMENT SOFTWARE IN A CROATIAN CONSTRUCTION COMPANY

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The paper reviews implementation of construction management computer software in a Croatian construction company. Implemented software was modified as the company's organizational structure changed to the higher level. Modifications and development were in planning, monitoring and controlling of the projects, especially in the phase of project realization. Modifications and improvements that are specified in the paper are based on specific standards of the construction company and on specified demands of the top management and project managers.

KEYWORDS: project, computer software, control.

INTRODUCTION

Numbers of researches carried out in the world and Croatia are pointing to increasing trend of deadline's extensions and delays. For example, World Bank researches on around 1600 projects show 70% average extensions and delays of initial deadline in 88% of projects. Similar researches are carried out in Croatia too. In goal of project realisation within planed time, costs and resources, construction companies should in their development switch initial line organizational structure to functional and finally to matrix organization that provides higher flexibility in project management. Parallel with organizational structure development, also organizational knowledge and tools for planning and control of projects should develop supported by development of computer software. This paper reviews development of project management computer software Maris that was installed by the company IPC Međimurje from Čakovec in Croatia. The initial idea for choosing this software was the fact that the employees from IPC Međimurje Co. were ready to develop and adjust the software following the requests of the users from construction company. This is very important fact because the market is full of project management software that are in general very good but in details that are specific to each construction company's organization, it often happens that organization in company should adapt to the software, instead other way around.

DEVELOPMENT OF COMPANY ORGANIZATIONAL STRUCTURE

In early 1990s new state modes appeared in Eastern and Middle Europe, also in Croatia. The socialism was replaced by the capitalism, in some countries peacefully and in some by the means of war. Here is a review of the establishment and development of one Croatian construction company. As it is mentioned after establishing state of Croatia, lots of construction company giants disappeared and new small one were established.

As the small construction company in the early years employs around 20 to 30 people the projects can be led by using paper, pencil and calculator. The projects are small by the size, also value, and are actually led by director or his first assistant. Only few projects are contracted as turn key model. Usually the company constructs a part of the building, for example only construction part. The employees are carpenters, masons, plasterers and no skill labours. The company hasn't its own accountancy and bookkeeping, but instead it uses external firms. The company grows as the greater and more demanding projects were contracted. As the company starts with realization of greater projects, so it develops organisationally. To achieve successful project realisation, line and functional organisational structure of company develops to matrix. Surely, part of functional structure that related to General affairs and administration was kept, while in part of project preparation, realisation and investment, company is organised as matrix. In that time more and more worldwide known computer software are used in planning and controlling projects.

Project consists of group of linked activities determined with goal, descriptions and technical conditions that must be realized with usage of resources in defined time with limited availability of money for their financing. Project management is usage of knowledge, skills and techniques on project activities with the purpose of realization project goals. Project manager is a leading person of the team responsible for success of the project and participates in the project from earliest preparation phase that is identification of problem and defining a concept. Since that moment he constantly leads project through all phases till the end. Actually he is in fact a general director in miniature, responsible for managing and success of the project.

Project manager's job is influential, responsible, demanding, hard and professional so it requires extremely quality individual, person of specific profile of knowledge, character and skills. Although project manager disposes with state-of-the-art software tools project management is very complex and arduous job. However, the thing that is common in today's projects and projects realized decades before are people. For successful realization of project it is necessary to organise exact number of adequately skilled people, who are forming project team and are available to project manager when the project needs them the most. Successful project manager is aware of his weaknesses and knows when to lean on his project team. Except that, it is important for project manager to have good information system, because without good communication system that kind of information is missing when it is necessary. Computer software Maris was developed in that way, to help project managers and also top management in making the right decisions in time.

PROJECT MANAGEMENT SOFTWARE

Maris is integrated business information system that includes the most business processes of production companies. It contains modules that enable usage in different activity companies but it is mostly used in civil engineering construction companies. Some of the biggest Croatian construction companies use Maris information system.

Modules of Maris are:
- Finance and accounting
- Permanent properties and small inventories
- Sale, procurement and commerce
- Storage

- Human resources and salary accounting
- Management subsystem
- Production
  - Civil engineering construction
  - Metal and food industry
  - Communal systems
  - Hotel systems

Maris is a multiple user system. Each user has a strict defined role in system that defines access rights in different parts of the system. Each data is entered in Maris only once in the particular place and other modules are using the entered data for their needs.

Construction module

Construction module is integrated in the system and creates data that are used by other modules. Also it uses the data entered in other modules. Integration is the greatest advance of Maris.

Functions of construction module are:
- creation of catalogue of works and standards + existing standard database
- creation and standardization of bill of quantities
- transferring bill of quantities from MS Excel and transferring it back to MS Excel
- registering and monitoring contracts
- subcontractors database, creating bill of quantities for subcontractors and selecting subcontractors
- contracting and monitoring subcontractors
- creating of term plan
- transferring data to MS Project and transferring processed data back to the system
- reports of resources through time
- creation and monitoring finance plan
- material ordering on the basis of term plan
- working hours register + automatic transfer of hours to salary accounting module
- making the programme and progress record
- creation of payment certificates (invoices)
- monitoring and control of subcontractor's payment certificates
- monitoring and control of mechanization
- monitoring and control of labour working hours and time related costs
- analysis of planed and used materials
- material and mechanization consumption
- financial analysis of projects
- management portfolio of all projects

Data base

Data base contains catalogue of 8000 standards for construction, craft and installation works. Each work from catalogue is assigned to one or more standards depending on technology that is used for work performance. Standards use labour, material and mechanization resources from resource data base. More different price lists can be created, depending on for example state regions of site constructions. Standards can be referred to specific price list.

Standardization and bill of quantities

Standardization of bill of quantities is a programme for fast, efficient and high quality creation of unit prices on the basis of standard data base and used price list. Except for creation of unit prices, standardization of bill of quantities generates different features:

- reports of resources for each item in bill of quantities
- part of each kind of resource in unit price
- reports of required resources for total bill of quantities
- reports of time related standards for each item in bill of quantities or for group of work

It is often requested for changing the unit prices in biding phase of project and it can be done in different ways in Maris:

- changing the unit price of individual resource means automatic recalculation of all items in bill of quantities that contain that particular resource
- changing the factor of item or work group it can raise or low the unit price of each item in bill of quantities referring to standard unit price
- while biding the discounts can be applied to each item, working group or total price

Figure 1: Standardization of bill of quantities

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Mihovljanska 72

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Stranica 1 od 51

Lista kreirana : 13.04.2009,21:09:

NORMA SATI PO STAVKAMA TROŠKOVNIKA

Troškovnik: 11169   Objekt 11169

Stavka trošk.	Opis stavke	Jmj	Količina	Norma sati po jmj	Uku norma
1.	GRAĐEVINSKI RADOVI				10,7
1.	RUŠENJA I DEMONTAŽE				5,4
1.01	NAPOMENA: U SVE STAVKE URAČUNATI I ČIŠĆENJE PROSTORA NAKON RUŠENJA.	m	93.90	0.400000	
1.02	Demontaža postojećih limenih opšava na ra Demontaža postojećih ventilacionih limenih kanala s pokrovnim kapama, sa svim elementima pričvršćenja. U cijen	m	16.00	0.000000	
1.03	Skidanje postojećih slojeva ravnog krova ukupne debljine cca 20 cm (šljunak, hidroizolacija, beton za pad i sl	m2	985.50	2.200000	2,1
1.04	Pažljivo skidanje postojećeg pranog kulira na krovnom vijencu sa čišćenjem površine koja ostaje te transportom	m2	59.20	0.700000	
1.05	Demontaža vanjskih postojećih prozorskih betonskih i limenih klupčica sa svim horizontalnim i vertikalnim tran	kom	278.30	0.400000	1
1.06	Demontaža unutarnjih postojećih prozorskih drvenih klupčica sa svim horizontalnim i vertikalnim transportima t	kom	223.60	0.400000	
1.07	Demontaža limenih opšava na dvorišnoj fasadi. Demontažu raditi pažljivo da se previše ne ošteti fasada. U cije	m	65.10	0.400000	
1.08	Demontaža limenih vertikala uz dvorišne fasade. Demontažu raditi pažljivo da se previše ne ošteti fasada. U ci	m	19.40	0.400000	
1.09a	Demontaža drvenih prozora s vađenjem doprozornika iz zidova od betona i opeke sa svim horizontalnim i vertikal	kom	20.00	2.000000	
1.09b	b) površine preko 2,00 m2	kom	19.00	3.000000	

Figure 2: Work hours standards report

Transferring the bill of quantities from MS Excel

Nowadays MS Excel is most used tool for creating the bill of quantities so it can be structured and transferred in short time to Maris. Also the other way around, bill of quantities created in Maris can be easily transferred to MS Excel.

Registering and monitoring subcontracts

For every construction contract one is opened in Maris. Also supplementary contracts can be registered in Maris. The most important information can be registered and assigned to each contract like names of project managers, site construction engineers, beginning and ending date of project etc. Results of such evidence are series of reports. Also subcontracts are registered.

Figure 3: Subcontracts register

Subcontracting

Subcontracting is a very complex and demanding process that has a great influence for financial result of the project. Maris has data base of subcontractors where they are registered by the work group factor with all needed attributes. Subcontracting process begins with allocation of items of bill of quantities by the work group representatives that creates MS Excel bill of quantities that is sent via e-mail to the addresses of chosen subcontractors from whom the offer is requested. Returned offer are transferred back to Maris where program compares each unit price and total price and enables the select of lowest price subcontractor or offers numerous comparations reports that are used for making decision for negotiations. Chosen subcontractor is transferred in allocation of bill of quantities that provides the access of finance effects also basis for monitoring and control.

Figure 4: Subcontracts

Creating a term plan

Term plan is created in Maris in the way that bill of quantities is grouped in activities that follow the way of project realization. On the basis of assigned standards program calculates the activity duration. The activities that aren't assigned to standards the activity duration can be entered manually. Term plan created in Maris can be transferred to MS Project where it can be improved and returned back to Maris. On the basis of term plan lists of resources through time are available for each project or for more projects parallel.

Orders and supplies

On the basis of created term plan lists of resources are available and can be automatic distributed to centralized procurement for in time supply.

Figure 5: Material orders

Register of work hours

Evidence of labour work hours provides the exact time related costs in the project and offers comparation of planed and actual costs by the standards and exact total cost of labour work in each project. Entered labour work hours are basis of salary accounting in human resources module.

Costs

Evidence of site construction and project costs contains regularly (daily, weekly or monthly) evidence of costs and assigning them to incoming invoices in company. This method provides in time overview of currently finance result that could be faked because of late arrived invoices.

Figure 6: Labour work hours report

Invoice

Programme and progress record can be managed on the basis of bill of quantities by entering or calculating the realized quantities. Also drawings and pictures can be attached. Entered and calculated quantities are the basis for making the interim payment certificate that can be made by the quantities from programme and progress record or by directly enter of realized quantities. Interim payment certificate can be printed like bill of quantities with all needed elements for creating the invoice.

Subcontracting invoices are monitored and controlled in a program for creating the interim payment certificate for investor in the way that program automatic transfers realized quantities and assign them to the subcontractors by the allocating key that was done when subcontractor was chosen and entered. This way enables the site construction engineers, project managers and finance department the easy control because program automatic alarms the exceeded quantities of subcontractors.

Mechanization

Mechanization monitoring module registers services on construction projects. Services are registered by quantities and costs. Registered services are automatic assigned to the costs of project and as realization of mechanization. This method provides monitoring the actual mechanization costs in the projects and costs effectiveness of company's own mechanization.

Project analysis

Results of method above this text described are various analysis of project. Resource analysis show the comparation of planed (calculated) and actual required quantities. Finance analysis show achieved incomes, costs and the result of project, also comparation of these parameters with finance plan.
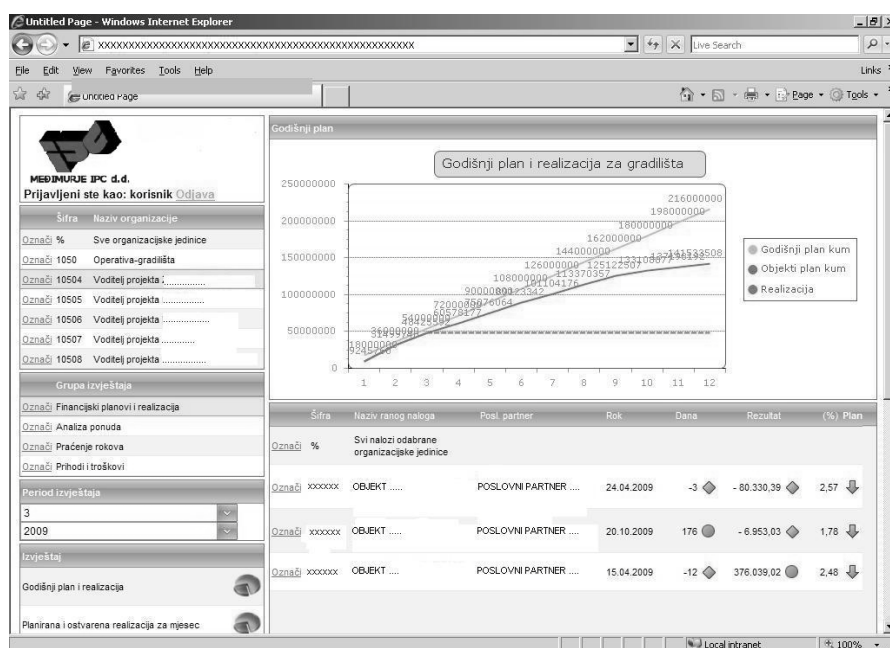

Figure 7: Project portfolio

Project management portfolio

Project management portfolio is the latest upgrade of program Maris that is intended for project managers and also top management like director or president of the board that don't have time or need for entering the Maris modules. All information for all company projects that are showed are mostly graphically (S-curves, histograms, pies), also as indicators of project success or as summary lists.

Troškovi

Stavka	Planirano	Realizirano	Udio u ukup. %
10 - Materijal	0,00	816.066,87	11,82
11 - Neknjiženi materijal	0,00		
20 - Rad	0,00	1.095.618,29	15,86
30 - Kooperanti	0,00	648.977,16	9,40
40 - Pogoni Team	0,00	724.707,48	10,49
50 - Iznajmljeni kapaciteti	0,00	2.730,00	0,04
60 - Prijevozne usluge	0,00	1.262.684,76	18,28
70 - Ostali direktni troškovi	0,00	198.666,07	2,88
81 - Ostali troškovi	0,00	-60.720,00	-0,88
82 - Nedospjeli troškovi	0,00	1.564.734,24	22,66
UKUPNO:	0,00	6.253.464,87	90,55
80 - Opći troškovi poduzeća	0,00	652.984,02	9,46
83 - Planirani troškovi	8.415.308,54	0,00	0,00
UKUPNO:	8.415.308,54	652.984,02	9,46
SVEUKUPNO:	8.415.308,54	6.906.448,89	100,00

Udjeli u ukupnome

■ 10 - Materijal	11,8%	
▨ 11 - Neknjiženi materijal	0,0%	
■ 20 - Rad	15,6%	
■ 30 - Kooperanti	9,2%	
■ 40 - Pogoni	10,3%	
▨ 50 - Iznajmljeni kapaciteti	0,0%	
■ 60 - Prijevozne usluge	18,0%	
▨ 70 - Ostali direktni troškovi	2,8%	
■ 81 - Ostali troškovi	0,9%	
■ 82 - Nedospjeli troškovi	22,3%	
■ 80 - Opći troškovi poduzeća	9,3%	
▨ 83 - Planirani troškovi	0,0%	
Total:	100,0%	

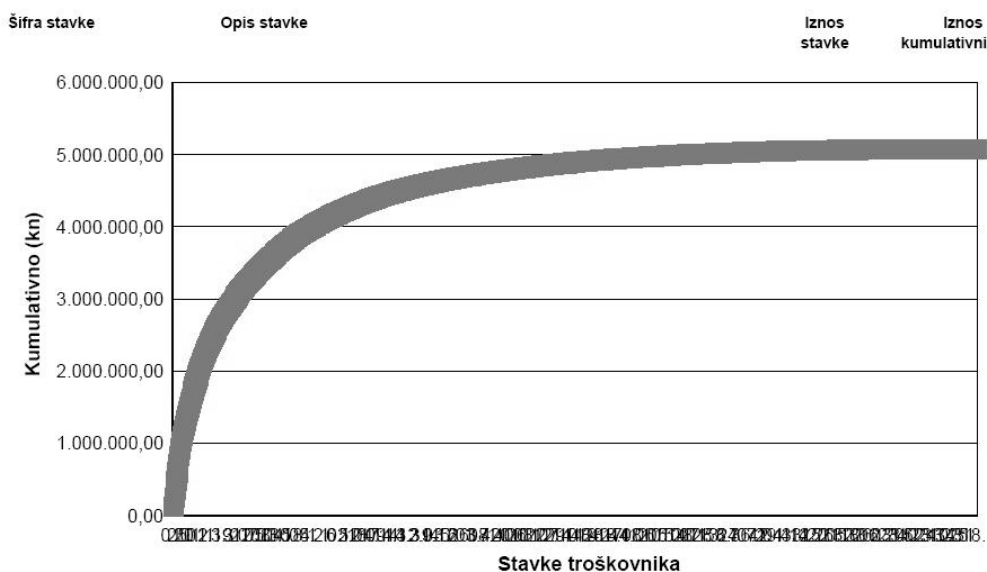Figure 8: Cost analysis report

Troškovno značajne stavke

Figure 9: Cost significant activities report

CONCLUSIONS

As it was mentioned and described in the text, nowadays project manager disposes with state-of-the-art tools but his work is very complex and arduous job. Programme Maris followed the development of the organization structure of the construction company to provide project managers and top management a good information system that provides information to intervene if it is necessary in time because all information is available to the top management in real time. The main achievement of software was the reducing of the time delay costs information for a month. It provided to have results of project in the first week of the month that followed for the month before. As it is known that the picture speaks thousand words so was the primary idea to develop an upgrade Maris to make portfolio of projects as much as it was possible to be graphical tools like S-curves, histograms or pies. Programme is adapted to the organization of company, and not the other way around. Software also provided transparency of information and faster data flow because each data is entered only once, placed in it's particularly place and can be used by various programme modules. This is one of the main goals of programme, also saving time. Data entered by civil engineer manager is available to the finance manager and also other way around.

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