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RISK ANALYSIS IN PROJECT MANAGEMENT & CASH FLOW ANALYSIS.

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الملخص العربى :

يعتمد نجاح المشروع بشكل كبير على القدرة على التنبؤ معينة. نظرا الان المخاطر هى الجزء الذى لا يمكن التنبؤيه من المشروع فمن المهم لفريق المشروع ان يكون قادرا على التحكم فيها قدر الامكان وجعلها قابلية للتبؤ بها قدر الامكان فى حالة المشاريع ظهرت المخاطر المسجلة الحالية على النحو التالى: اعادة جدولة الموعد النهائى بشكل متكرر وضعف التنفيذ المالى مما يعنى عدم الامتثال فى ادراة الوقت والادارة الادارية / المالية على التوالى.

Abstract:

Project success has depended significantly on the ability to predict a particular outcome. Since risks are the unpredictable part of the project, it is important for project team to be able to control them as much as possible and make them as predictable as possible. In the case of projects current registered risks have appeared, as follows: frequent deadline rescheduling and poor financial execution, meaning non-compliance in time management and administrative / financial management, respectively. The paper has proposed a practical tool: an application has been developed in order to monitor the project evolution and control the risks in implementation, so as to mitigate them.

Key-Words: - risk identification, risk assessment, software application tool, project management

Introduction:

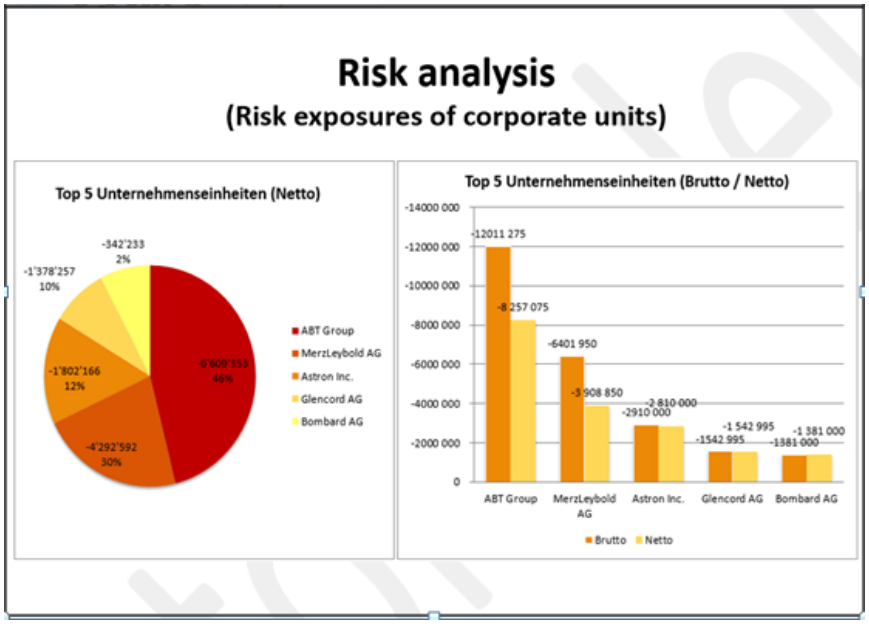
The risk management, as defined in, presents the systematic approach to apply the management policies, procedures and practices to the processes related to the risks context, identification, analysis, assessment, quantification, treatment, monitoring and communication so as to allow organizations to minimize the looses and to maximize effectively the opportunities.

Taking into account the similar description of project management and the fact that, unavoidably, each project involves risk; consequently, project risks are related to the project itself and the project product / result, too.

Risks in projects: an overview:

A risk is a combination of event probability occurrence and its' consequences upon project objectives accomplishment, including the product / results expected quality level. Briefly, the risk is a possible unplanned event; it might be positive or negative. In project management the success of the project depends on the ability to predict a particular outcome. Since risks are the unpredictable part of the project, it appears quite important to be able to control them as much as possibleand turn them to as predictable as possible. A pure risk or threat is a risk that has only a negative possibility as an outcome. The known risks arethose that one can identify, and the unknown risks are those that cannot be anticipated at all.

In order to manage effectively and efficiently the risk, an overall approach should be adopted meaning that the risk is recommended to be associated to each process and each decision action, all along the project life cycle. All staff involved in the project implementation should be included in the risk managementprocesses through an opened communication, bothinsideand outside the project and an effective cost related risk management.(Fig 1)



(Fig1)

Project risk management should start through the project context drafting; that means active involvement of stakeholders, clear identification of objectives, expected results, management's limitations and threats for a certain project, identification of interfaces with other constrains or organizational / strategically projects etc. This responsibility belongs to the project manager level and includes the following items, too:

- Risk identification management
- Assessment and analysis of risk
- Recommendation, initiation and implementation of risk treatment activities up to reaching anacceptable (controlled) risk level
- Establishment of an executive procedure for conflict related risk treatment Follow up of decisions' effectiveness

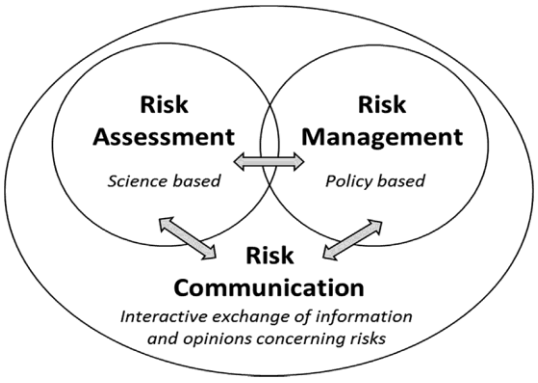
Effective communication in due time, all along the project, of risk related information

Adoption of urgency contingency plans and assurance concerning their operation ability

Risk management monitoring & implementation of corrective actions, if required

- Drafting a risk related documentation to assure the traceability

Of course, risk management should be treated in a coherent manner, but taking into account the costs related to risk treatment processes. In project management, a quite effective and efficient procedure to treat and control risk is linked to project meetings, dedicated or not to risks, so as to register and report risk related discussions and decisions.(Fig2)



(Fig2)

A good practice to notify is the risk management plan, including project risk related context and limitations, risk treatment methodology (processes and interfaces), risk management in-charge staff nomination, reporting responsibility and authority, meeting schedule, relation with other project documentation (or registration) and plans, relevant organizational procedures, if necessary risk management subcontracting.

Project risk management includes ongoing processes that require to be updated throughout the project. The objectives of project risk management are to increase theprobability and impact of positive events, and decrease the probability and impact of events adverse to the project.

The project risk management processes include the following

a) Risk Management Planning - this process should be completed early during project planning, since it is crucial to successfully performing the other processes.

b) Risk Identification - Participants in risk identification activities can include the following: project manager, project team members, risk management team (if assigned), subject matter experts from outside the project team, customers, end users, other project managers, stakeholders, and risk management experts. Risk Identification is an iterative process because new risks may become known as the project progresses through its life cycle. The project team should be involved in the process so that they can develop and maintain a sense of ownership of, and responsibility for, the risks and associated risk response actions.

c) Qualitative Risk Analysis - Qualitative Risk Analysis includes methods for prioritizing the identified risks for further action, such as Quantitative Risk Analysis or Risk Response Planning. Qualitative Risk Analysis assesses the priority of identified risks using their probability of occurring, the corresponding impact on project objectives if the risks do occur, as well as other factors such as the time frame and risk tolerance of the project constraints of cost, schedule, scope, and quality. Definitions of the levels of probability and impact, and expert interviewing, can help to correct biases that are often present in the data used in this process. The time criticality of risk-related actions may magnify the importance of a risk.

d) Quantitative Risk Analysis - Quantitative Risk Analysis is performed on risks that have been prioritized by the Qualitative Risk Analysis process as potentially and substantially impacting the project's competing demands. The Quantitative Risk Analysis process analyzes the effect of those risk events and assigns a numerical rating to those risks. It also presents a quantitative approach to making decisions in the presence of uncertainty.

e) Risk Response Planning - Risk Response Planning includes the identification and assignment of one or more persons (the 'risk response owner') to take responsibility for each agreed-to and funded risk response. Risk Response Planning addresses the risks by their priority, inserting resources and activities into the budget, schedule, and project management plan, as needed.

f) Risk Monitoring and Control - Planned risk responses that are included in the project management plan are executed during the life cycle of the project, but the project work should be continuously monitored for new and changing risks.

Risk Monitoring and Control is the process of identifying, analyzing, and planning for newly arising risks, keeping track of the identified risks and those on the watch list, reanalyzing existing risks, monitoring trigger conditions for contingency plans, monitoring residual risks, and reviewing the execution of risk responses while evaluating their effectiveness. Risk Monitoring and Control can involve choosing alternative strategies, executing a contingency or fallback plan, taking correctiveaction, and modifying the project management plan. The risk response owner must report periodically to the project manager on theeffectiveness of the plan, anyunanticipated effects, and any mid-course correction needed to handle the risk appropriately.

A case study: software for riskassessment:

"The evaluation of a project' evolution" was an application developed starting from the following objective: to monitor the project evolution (through a Web application), starting from the basic phases of a project implementation (initialization, plan, execution, monitoring & control and project closing). The main steps for the project completion were

1. Documentation of project management and risk factors

2. Identification of risk indicators and formulas

3. Program implementation for risks and distances between performance indicators

4. Realization of a friendly user interface Brief description of the application

The project has a time and a budget with units of measure of hours and pound. The user will define these parameters in the program.

During the first phase, the user will insert the number of parameters between 1 and 20 (in this case: 2 parameters – time and budget)

Cash flow analysis Contractors':

Nowadays, the construction industry continues to face the effects of economic crisis. Even so, the actual funding systems are not encouraging the companies to improve their practices related to the project finance management. With high capital expenditures and high level of competition in the market, the construction companies have to accept a large number of risks, which make them very vulnerable. In order to stay in the market, the construction companies often participate in tenders with prices increasingly smaller, making them vulnerable to the occurrence of unforeseen events that are inherent in any construction project. In the last annual report, the president of FIDIC mentioned that "Unreasonable price competition in the awarding of engineering services is more frequent today than ever before".

The type of contract that is the foundation of the relationship between the parties has significant effects on the strategy that the construction company will adopt to achieve the objectives of cost, duration and profit. The large investments from EU founds or state budged involved in the infrastructure construction projects requires balanced, accepted and tested type of contracts In such case, FIDIC Conditions of Contract amended by particular conditions are the most used contracts. According to the statutes, FIDIC (International Federation of Consulting Engineers) is a federation of member associations that represent the consultingengineering industry globally, aiming to enhance the image of consulting engineers and to be the authority on issues relating to business practice. Developed over 50 years asglobal standards, theFIDIC contracts are recognized and applied in many types of projects. They describes all aspects that govern the relationship between the employer and the contractor: general provisions and actors of the contract, material, labor, equipment and machinery, execution period, delays and suspension, taking over and defects notification period, measurement and evaluation, variations, contract price and payments, termination, force majeure, insurance and claims, disputes and arbitration. The financial aspects are tackle with in Clause 14 - Contract Price and payments, which sets out the sequence of events typical payments. FIDIC Red Book "Conditions of Contract for Construction of buildings and engineering works designed by the beneficiary" defines the sequence of typical events of payments: at the end of each month or the reporting period, the Contractor submit the Statement and the supporting documents to the Engineer. After its verification, if the Statement is accepted, the Engineer will issue in maximum 28 days the Interim Payment Certificate. The Employer shall pay to the Contractor the amount certified within 56 days after the Engineer receives the Statement and supporting documents. The Employer will make the final payment within 56 days after the Engineer issue the Final Payment Certificate. If we take into consideration that the minimum time needed by the Contractor to prepare the Statement and supporting documents is 7 to 10 days, the first Interim Payment Certificate (IPC) will be issue at 65 days after the Date of Commencement. Considering that issuing the invoice by the Contractor is 7 days, the first payment will be done in 100 days after the Date of Commencement.

However, this sequence in time may be distort if the employer modifies the related sub-clauses, leading into larger time intervals of payment. In such case, the contractor will be force to support a greater financial effort in order to complete the works. There are also other reasons the payment may be delayed: the contractor is not enough well organized and prepared to submit in time the Statement and supporting documents and the Engineer may issue the Interim Payment Certificate with delay. Such events will cause an increasing financial pressure for the contractor reflected in his cash flow, without taking into account the risk events and uncertainties typical for construction projects. Several studies were run on the construction project financial management practices, in relation to the contracting clauses, revealing the associated risks. In 2015, KPMG ran a global survey for the construction sector

focusing on the project management practices (planning, risk management, controls and governance, project performance and collaboration between the owner and contractor). The survey reveals that for 72% of awarding contracts cases, full competitive tenders took place. Despite some concerns about a lack of flexibility, the traditional design-bid-build approach remains one of the two most popular project delivery strategies, enabling the owner to work with various suppliers for different aspects of the project. One of the biggest concerns expressed by the survey participants is the accuracy of the estimated costs before committing to the project. The contingency model (for example, 10 percent model) is not useful in many cases to cover the risks. The type of contract which is the base of the relationship between the parties have significant effects on the strategy the construction company will take in order to achieve it purposes in terms of cost, duration and profit. The survey also reveals that most of the companies develop financial projections methods based on the deterministic estimation of project financial performance. In, a practical cash flow analysis model is proposed, that can be applied by the construction companies mainly when decisions about project portfolio structure are taken. The proposed model allows construction companies to predict not only when, but mostly what amount of money should be borrowed or obtain from internal or external sources and when and what amount of money should be return. Due to the high amount of money needed to perform the projects, it become reasonable to say that construction companies need a specialized bank and not commercial one, which will supports their financial needs.

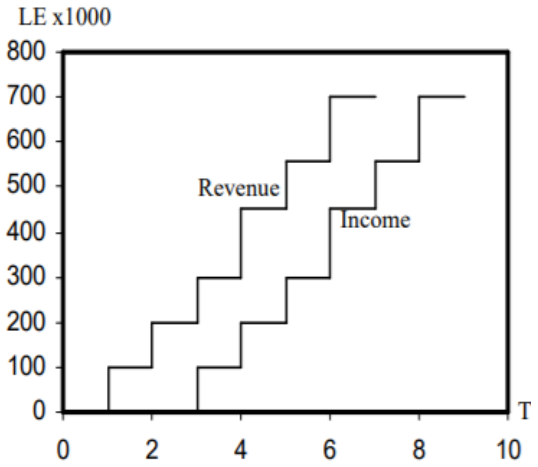
Project Income (Cash-in)

The flow of money from the owner to the contractor is in the form of progress payments. Estimates of work completed are made by the contractors periodically (usually monthly), and are verified by the owner's representative. Depending on the type of contract (e.g., lump sum, unit price, etc.), these estimates are based on evaluations of the percentage of total contract completion or actual field measurements of quantities placed. Owners usually retain 10% of all validated progress payment submitted by contractors. The accumulated retainage payments are usually paid to the contractor with the last payment. As opposed the expenses presented in Figure 6.1 with smooth profile, the revenue will be a stepped curve. Also, when the contractor collects his/her money it is named

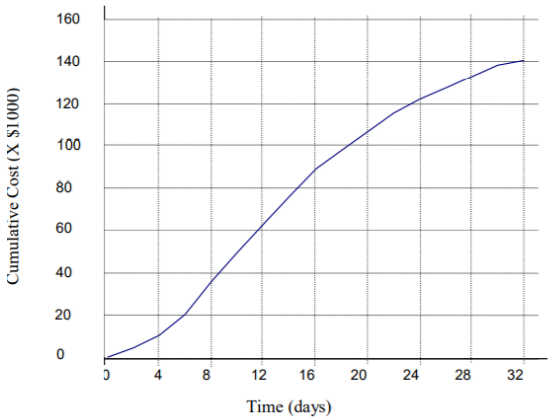
project income (cash in)

The time period represents the time intervals at which changes in income occur.
When calculating contract income it is necessary to pay attention to the retentionand/or theadvanced payment to the contractor if any.

Calculating Contract Cash Flow Having determined the contract expenses andincome aspresented in the previous section, it is possible to calculate the contract cash flow. If weplotted the contract expense and income curves against each other, then the cash flow is the



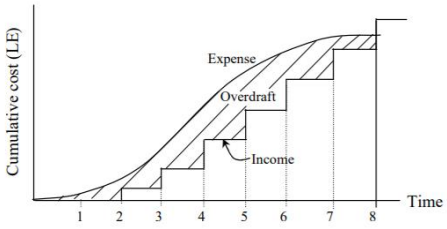
(Fig3 A)



(Fig3 B)

difference between the points of both curves. (Fig 3 A-B)

the cash flow of a specific contract. The hatched area represents the difference between the contractor's expense and income curves, i.e., the amount that the contractor will need to finance. The larger this area, the more money to be financed and the more interest charges are expected to cost the contractor



(Fig4)

The activities involved in the construction of a small building are given below. The price of the work contained in each activity is listed in the table. The contractor undertaking this project would like you to prepare graphs of cumulative expense and income to date against time for activities starting as early as possible. The mark-up is 10% of tender value and retention is 5%. Measurement is made monthly with a payment delay of one month. The retention is paid at the end of the contract. To simplify the calculations you may assume that all costs must be met by the end of the month in which they are incurred. What is the

maximumamount of cash the contractor needs to execute this contract and when does he require this amount?

-A simplified project. The direct costs associated with the individual activities are shown above the bars. It is assumed that project indirect cost will amount to 5000 LE monthly.The contractor included a profit mark-up of 10000 LE to his bid so that the total bid price was 210000 LE. The

owner retains 10% of all validated progress payments until one half of the contract value (i.e. 105000 LE). The progress payments will be billed at the end of the month and the

No.	Activity	Duration (months)	Predecessors	Overlap	Value (LE)
10	Excavation	2	-	-	9000
20	Concrete bases	3	10	1	12000
30	Erect frames	1.5	20	1	18000
40	Concrete floor slab	1	20	1	15000
50	Fix cladding	1.5	30	1	6000
60	Install plant	1	40, 50	-	20000

(Table1)

owner will transfer the billed amount minus any retains to the contractor's account 30 day later. Determine the expenses and income profile of this project.

-The table below lists the cumulative monthly expenses incurred by a contractor and the corresponding monthly payments which are received from the client of a project. Calculate the cost to the contractor of providing the working capital necessary to finance the project if the chosen annual investment rate is 10%.

If the client makes his payments one-month later than anticipated in the table, by what percentage will the financial charge increase?

End of month	Cumulative expense (LE x 1000)	Cumulative income (LE x 1000)
0	0	0
1	12	0
2	20	0
3	54	0
4	90	14
5	130	40
6	180	100
7	220	130
8	240	190
9	260	210
10	290	300
11	290	320
12	290	340

(Table2)

Two projects A and B have annual net cash flows as shown below. The company discount rate is 10% per year. Assume all cash flows occur at the year-end. Establish the ranking of

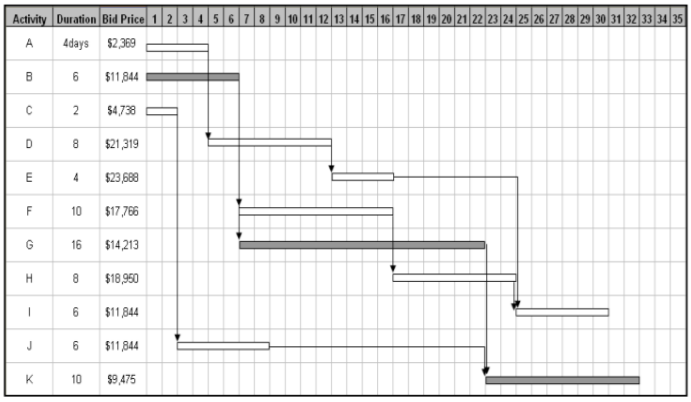
Year	1	2	3	4	5
Project A (LE)	-100	100	30	20	10
Project B (LE)	-100	10	30	60	100

Table3

the projects attractiveness in order of to the company

using: a. N.P.V. b. I.R.R. c. Payback period

The Bar Chart for a small project, durations, schedule, Bid Prices, and logical relationships among activities are all shown. Use the following additionalinformation to calculate the



(Table4)

maximum amount of cash the contractor needs and when dose him/her requires this amount. Indirect cost is $ 1000 per day Contractor markup is 5% Time period is 8 days with interest rate of 1% per period Retainage amount is 10%, and all withheld retainage money will be paid back 2 periods after the last payment Owner's payment delay of any invoice is one period.

-Given the project below, and the minimum attractive annual rate of return of 30%, how much would you mark up the project based on cash flows? Lag factors for all costs incurred are zero. No office overhead is considered. Income is received one period after expense incurred. Assume retainage equals 10%.

Month	Mobilization Demobilization	Subcontractors	Equipment	Materials	Payroll	Site overhead
0	LE 40,000	0	0	0	0	0
1	-	10,000	20,000	10,000	10,000	1,000
2	-	30,000	10,000	20,000	15,000	5,000
3	-	30,000	20,000	30,000	20,000	6,000

(Table 5)

Research purpose:

To be more effective, we must first define risk management and its stages, which are as follows:

Determining the risks : determining which risks are most likely to affect the project, and documenting the characteristics of these risks.

Risk measurement: assessing risks and their interaction with the project and its outputs.

Developing responses: identifying reinforcement steps to prepare the response to respond to these risks.

Risk response control: responding to changes in risk over the life of the project.

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