

Integrated Qualitative and Quantitative Risk Analysis of Project Portfolios

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Abstract

Project portfolio risk management and risk analysis is one of the critical components of ERM. Organizations measure and analyze risks associated with projects, project portfolios, and programs. Such risks can be related to project schedules and affect project durations, completion dates, costs, resources, success rates, etc. The project risks can be also non related to particular project schedules and affecting market, capital, insurance, joint ventures, and other parameters.

The process of project portfolio risk management is started with risk identification. Risks are included to the corporate risk register and presented on the risk matrix. At this step risk probabilities and impacts are defined qualitatively. The second step of the process is quantitative risk analysis of project schedules using Event Chain Methodology (ECM). ECM is a stochastic modeling technique for schedule risk analysis. All risks, including schedule and non-schedule related risks are assigned to a particular project and within this project to the particular activity or resource. Each risk may belong to different categories and for each category may have different impact. For example, financing risk may affect task duration, cost and resources and cause delay ranging from 10% to 30%. Such delay can be modeled using statistical distributions. According to ECM each risk may switch the project activity to a different state. For example, financing problem risk will switch an activity to a slower state. Further, ECM allows to model relationship between project risks by defining risks, which cause or trigger other risks. All risks and relationship between them will be presented on the project or portfolio Gantt charts using Event Chain Diagrams.

After risks are assigned to project and portfolio schedule, Monte Carlo simulation of project schedule is performed based on standard scheduling algorithm. Statistical distributions of project cost, duration, finish time, resource allocation and other parameters help to determine the chance that the project can be completed on time and on budget. Risk impact is calculated based on correlation between incremental increase of task's cost or duration and project cost, duration, and other parameters. Risks within a risk register are ranked based on calculated impact and probabilities. Composite risk scores are calculated with taking into an account different risk categories using Analytical Hierarchy Process. ECM also allows performing project tracking with risks and uncertainties.

The methodology simplifies complex risk analysis process, which in most cases is performed by project schedulers. The described methodology and software for integrated qualitative and quantitative risk management and analysis is actively used by many organizations, including US Department of Energy, NASA, USDA, FAA, FDA, Boeing, Lockheed Martin, L-3Com, HP, P&G, IBM, Syncrude, BP, Mosaic, Ericson, Novartis, Schlumberger and many others.