**Project Management Report**

Nicholas Wiggins

Johns Hopkins University

Risk Management Analytics

Dr. William Spinard

**Abstract**

This report explores the application of @Risk software to model uncertainties, inflation, and event risks associated with a project. It analyzes the results and proposes risk-adjusted decision making for project management. The report is structured according to the grading rubric provided, addressing parameters and distributions, inflation estimation, event risk modeling, correlations, results analysis, risk-adjusted decision making, and recommended improvements.

**I. Parameters and Distributions for Uncertain Inputs**

Project planning thrives on accurate estimations, but uncertainties are inevitable. Uncertainties inherent in project planning require careful consideration. This model employs specific probability distributions to represent these uncertainties, balancing practicality with business considerations:

* **Project Costs (PERT Distribution):** The PERT (Beta) distribution is chosen for personnel, training, and software costs. Lessons 8 and 9 emphasize the value of expert judgment when historical data is limited. PERT captures this range by incorporating optimistic, most likely, and pessimistic cost estimates (Rees, 2015). This approach aligns with business needs by considering best-case, expected, and worst-case scenarios for informed budgeting.  
    
  
* **Project Timing (Triangular Distribution):** Project phase durations (design, build, implement) are modeled using the Triangular distribution. This aligns with situations where minimum, most likely, and maximum durations can be defined, reflecting potential variations in project timelines (Rees, 2015). This practical approach resonates with businesses as it acknowledges realistic timeframes for each project stage.  
    
  

**Justification:**

Both distribution choices provide a realistic representation of uncertainties without requiring extensive historical data collection. Additionally, they allow for easy scenario analysis by adjusting the estimates or minimum, most likely, and maximum durations for costs and timings, respectively (Rees, 2015). The PERT distribution allows for incorporating expert judgment, leading to a more realistic assessment of potential cost overruns.

**II. Inflation Estimation**

Accurately estimating inflation over the project timeframe is crucial. This model employs PERT as a curve-fitting tool (FIT) to estimate the three-year inflation rate based on historical data from about the unemployment rate in Tampa-St. Petersburg-Clearwater, FL (MSA) for the years 2008 to 2018.

While the specific data is limited, the PERT fit considers past inflation trends and potential future deviations. This approach yields a more reliable estimate compared to a single point prediction, offering a more accurate picture of potential cost changes due to inflation over the project life cycle (Project Management Institute, 2017). It also allows for a more robust assessment of project costs over the project duration.

**III. Modeling Event Risks**

Unforeseen events can significantly impact project outcomes. This model incorporates event risks such as severe labor shortages, supply chain disruptions, and cross-over failures. The specific frequency and severity distributions for each risk depend on the nature of the event and available data (Chapman & Ward, 2017).   
  
**Event Risks for Project Costs:**

* **Frequency (Bernoulli Distribution):**

The Bernoulli distribution is a well-suited choice for modeling the frequency of occurrence for event risks impacting project costs. This distribution applies to events with only two possible outcomes: either the event occurs (causing a cost overrun) or it does not. Examples of cost-related event risks suitable for Bernoulli modeling include:

* Severe labor shortage (occurs or does not occur)
* Supply chain disruption (occurs or does not occur)
* Cross over failure (occurs or does not occur)

The Bernoulli distribution allows assigning a probability (between 0 and 1) to each event risk occurring, enabling a data-driven assessment of potential cost impacts.  
  


* **Severity (Triangular Distribution):**

The Triangular distribution effectively captures the potential range of cost overruns associated with each event risk. This distribution requires defining a minimum, most likely, and maximum cost impact for each event. This approach is practical as it reflects the inherent variability in the severity of event consequences. For instance, a labor shortage might cause minimal disruption (minimum impact), moderate delays with associated costs (most likely impact), or a complete project shutdown with significant cost overruns (maximum impact).  
  


**Event Risks for Project Timing:**

* **Frequency (Poisson Distribution):**

The Poisson distribution is a strong choice for modeling the frequency of events impacting project timelines. Unlike the Bernoulli distribution, the Poisson distribution applies to situations where a specific event can occur multiple times within a given timeframe. This aligns with event risks that might happen repeatedly throughout the project, affecting the overall schedule. Examples of timing-related event risks suitable for Poisson modeling include:

* Loss of key employees
* Workers' strike
* Pandemic

The Poisson distribution allows assigning a parameter (lambda) representing the average number of times the event risk is expected to occur during the project timeframe. This provides a more nuanced understanding of potential schedule disruptions compared to a simple binary (occurs or does not occur) approach.  
  


* **Severity (Triangular Distribution):**

Similar to cost-related event risks, the Triangular distribution effectively captures the potential range of schedule delays associated with each timing-related event risk. This distribution requires defining a minimum, most likely, and maximum delay duration for each event. This approach reflects the variability in how frequently occurring events might impact the overall project timeline.



**Frequency x Severity Outputs:**

The "Freq x Severity" columns represent the expected impact (cost or time) of each event risk scenario. By analyzing these values, project managers can identify the event risks posing the greatest potential threats (Chapman & Ward, 2017).

**IV. Correlations**

Event risks may not be independent. For instance, a severe labor shortage might increase the likelihood of a supply chain disruption. Documenting the specific correlation assumptions made in the model is crucial. This might involve assigning correlation coefficients between relevant event risks, reflecting the degree of influence one risk has on the other. Justifications for these assumptions can be based on industry trends, historical project data, or expert judgment. For example, a strong positive correlation might be assumed between labor shortages and supply chain disruptions, reflecting the interconnectedness of these factors in today's globalized economy (Chapman & Ward, 2017).

**V. Analysis of Results**

This section delves into the insights gained from the model's outputs, focusing on understanding the potential range of project outcomes and identifying the most impactful uncertainties.

**Overall Projections:**

The model generates overall project cost and time projections after considering uncertainties, inflation, and event risks. Summarize these projections, highlighting the expected range of outcomes (minimum, most likely, maximum) for both cost and duration. This provides a realistic picture of the potential project completion window and associated costs.

**Sensitivity Analysis:**

Sensitivity analysis helps identify the most impactful uncertainties. Techniques like the tornado and spider graphs are used to visualize how project timelines react to changes in specific uncertain inputs. Project managers can identify which factors require the most stringent control measures by analyzing these graphs.

This analysis reveals which factors have the greatest influence on project success (Rees, 2015).

A graph with red and blue squares

Description automatically generated

A graph of a graph showing different colored lines

Description automatically generated

**Scenario Analysis:**

Unlike traditional risk assessments that rely on historical data, scenario analysis takes a future-oriented approach. It helps you identify and understand potential risks that haven't happened before. The analysis involves creating different scenarios, encompassing both best-case and worst-case possibilities, as well as some in between. Understanding the range of potential outcomes across different scenarios allows project managers to make informed decisions concerning resource allocation, contingency planning, and stakeholder communication.

A graph of a project

Description automatically generated with medium confidence

**Summary Statistics:**

The model's summary statistics provide crucial data points for informed project planning and resource allocation. One key statistic is the probability of meeting the base case. This value indicates the likelihood of completing the project within the initial cost and time estimates. Another valuable statistic is the total budget required at a specific confidence level. This helps determine the additional budget allocation required to achieve a desired level of certainty regarding project completion costs. This information is crucial for setting realistic budgets that account for potential cost overruns due to uncertainties and event risks. Finally, the model can estimate the contingency required for risks. Knowing potential cost overruns due to risks allows for establishing realistic contingency budgets to manage unforeseen circumstances. This statistic helps project managers plan for potential disruptions and ensure sufficient resources are available to address them (Rees, 2015).

Rees' criteria for sensitivity analysis and risk-adjusted decision making should be applied (Rees, 2015). These criteria emphasizes the importance of not only understanding how individual uncertainties affect project outcomes but also incorporating risk interactions for informed decision making.

**VI. Risk-Adjusted Decision Making**

The model's outputs empower project managers to make informed decisions that proactively mitigate risks and improve project success. This risk-adjusted approach translates to tangible benefits throughout the project life cycle.

One key application is establishing contingency budgets. Contingency budgets act as a safety net, mitigating the disruptive impact of unexpected events and allowing the project to stay on track. The model's insights also inform ongoing project monitoring and control efforts. By proactively identifying potential risks based on the model's outputs, project managers can take corrective actions to minimize disruptions and stay on track. Finally, the model's outputs can be used to effectively communicate project risks and mitigation strategies to stakeholders. Presenting clear visualizations and data-driven insights fosters transparency and buy-in. Stakeholders gain a clearer understanding of potential challenges and the project team's preparedness to address them (Hopkin, 2018).

By leveraging the model's outputs, project managers can make informed decisions throughout the project life cycle, increasing the likelihood of achieving project objectives while fostering collaboration with stakeholders.

**VII. Recommended Improvements**

While the model effectively demonstrates the functionality of @Risk software, there are opportunities for further refinement.

One limitation is the model's reliance on limited data sources. The accuracy of the risk assessments can be enhanced by incorporating data from additional sources, such as industry benchmarks or expert opinions from similar projects. Integrating these insights allows for refining the probability distributions and risk assessments, leading to more accurate project forecasts and improved decision-making.

Another area for improvement is the oversimplification of complexities. Real-world project risks can have cascading effects. For instance, a labor shortage might lead to supply chain disruptions and schedule delays, creating a domino effect of negative consequences. The model can be improved by considering these cascading effects (Hopkin, 2018).

Finally, the model might not capture all relevant risk factors specific to the project. A thorough risk identification process should be conducted to ensure all potential threats are captured and modeled within the @Risk framework. This might involve brainstorming sessions with project stakeholders, industry research, and reviewing historical project data. By integrating these additional risk factors, the model can provide a more holistic view of the project risk landscape, enabling a more comprehensive risk mitigation strategy.

**Conclusion**

This report has explored the application of @Risk software to model uncertainties, inflation, and event risks associated with a project. The model provides valuable insights for risk-adjusted decision making, enabling project managers to proactively mitigate risks and improve project success. By continuously refining the model with additional data and incorporating new risk factors, project managers can enhance their ability to navigate uncertainties and achieve project objectives.

**References**

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