



# Applying Contingency Reserves for Managing Uncertainties of Information Technology Projects

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**Abstract** - *Projects in modern days have a short duration and smaller number of project members because Project Managers tend to follow Rapid Application Development, Agile Development, and other methodologies. With this, risks such as inadequate planning of contingency reserve may be realized. In applying contingency reserve, a Project manager should determine Project Uncertainty profiles first, through quantification of Variance and Risks, before applying specific contingency reserve. This paper presents the types and sources of Project Uncertainty and how to manage them using Reserve Analysis methodology which includes Contingency Reserve for Variance and Risk. The Contingency Reserve provides funds for dealing with Risk Realization and Variance changes.*

**Keywords** - *Project Risk, Uncertainty, Contingency Reserves, Reserve Analysis*

## 1. Introduction

Project Management Institute [1] stated that Project risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives such as scope, schedule, cost, and quality. A risk may have one or more causes and, if it occurs, it may have one or more impacts. A cause may be a given or potential requirement, assumption, constraint, or condition that creates the possibility of negative or positive outcomes. Project risk has its origins in the uncertainty present in all projects.

The website of Project Management Knowledge [2] defined term contingency reserve refers primarily to the amount of quantity of funds or other financial resources that are required to be allocated at and above the previously designated estimate amount to reduce the risk of overruns to an acceptable level for the financially responsible organization. However, contingency reserve need not refer exclusively to monetary terms. It can also refer to as a specific quantity of time in many hours that must be allocated above and beyond the previously determined quantity of hours required to assure that any overtime or other unexpected hours of work required can be properly compensated for. Typically the contingency reserves, in terms of both

finance and time, are determined at the outset of a project. However, as a project is ongoing, if it appears that the project will require additional funds or time allocation to complete, contingency reserves can be instituted or modified at any time to better prepare the organization for the possibility of their usage at some point in a projects life.

Many modern-day projects follow some newer methodology of one of the following: Rapid Application Development (RAD), Prototype, Agile Development (Extreme Programming, Scrum), or others. The project durations are in general shorter with smaller number of project members who work at intensive paces; the project team interacts with users more frequently and may need to manage the requests of scope changes by users. Risks such as inadequate planning of contingency reserve may be realized. Some traditional project management methodologies, such as System Development Life Cycle, concentrate at the operational level; they may not be effective in mitigating these risks.

## 2. Related Works

Herman, S [3] stated in his paper that almost all project plans include contingency reserves in both



budgets and schedules. Effective management of these contingency reserves is essential to prevent overspending and to reduce project duration. He also proposed the principle of aggregation and its application to the management of contingency reserves are discussed in this paper. Human behavior under conditions of uncertainty plays a major role in the management of contingency reserves and to exploit the opportunities that the principle of aggregation offers, these human behaviors have to be taken into account.

The paper of Al Agha, M. [4] presents the advantages of using quantitative risk analysis techniques to describe what risk managers will expect and what is required to be done to enhance the performance of the organization. It also provides better information to support critical decisions which helps to estimate the size of contingency reserves for time and cost that would be appropriate for stakeholders.

Another paper written by Buerthey J. et.al [5], reviews the risk management process of contingency estimation holding that the deterministic method of contingency estimation lacks basis and confidence for the management of uncertainties on construction projects. The authors present the use of risk categorization and analysis to determine the most important risk-taking into consideration organizational process asset, and external project variables. The authors concluded then that design risk with an emphasis on scope changes, incomplete scope definition, changes in specifications, design completeness, and differing site conditions are the most critical cost risk. Other economic risks such as micro and macroeconomic indicators and delayed payment problems can be said to be the secondary factors that as well affect the project cost risk during the cost contingency estimation process.

### **3. Uncertainty**

Risk and uncertainty [5] are two misconstrued concepts but distinct in nature. Whereas risk is upheld as an uncertain discrete event that can be estimated using probabilistic analysis, uncertainty is associated with an uncommon state of nature characterized by the absence of any information related to the desired outcome.

Risk is only one type of uncertainty to a project and is not the only thing to consider during quantification for funding reserves.

#### **3.1 Types of Uncertainty**

According to Elzink, C. [6], the following are main areas of uncertainty related to managing a project: *Variance*, *Foreseen*, and *Unforeseen* Uncertainty.

*Variance* relates to the uncertainty within the estimate of an activity. The estimate is typically identifiable and uncertain within a range of confidence. Subject matter experts, when estimating their activities, are going to provide a worst and best case scenario, order of magnitude, or a 3 point estimate concerning the duration, cost, and performance levels. This range is the Variance. For example: “Requirements gathering to take between 6 and 8 weeks”.

*Foreseen* Uncertainty equates to identifiable, but uncertain (known unknowns), influences, variables, or events, typically known as Risks and managed formally throughout the project, ideally under a documented framework. For example, the number of people required for testing a developed Information Technology project, to be valid, may not be reached within the timeframe available.

*Unforeseen* Uncertainty is usually not formally identified, is generally not anticipated (true unknown unknowns), and often just referred to as Uncertainty. An example of this could be not anticipating those 9 years old or more records in the database would be found, requiring specialized removal or archiving.

For ease of terminology, these three areas of uncertainty will be, from here on, referred to as Variance, Risk, and Uncertainty.

#### **3.2 Sources of Uncertainty**

Table 1 shows the sources of uncertainty concerning favorable and unfavorable uncertainties. [7]

<b>Uncertainty Source</b>	<b>Unfavorable Uncertainty</b>	<b>Favorable Uncertainty</b>
Financial	Financial conditions	Financial conditions

	inside or outside the organization that could potentially threaten the success of the project.	inside or outside the organization that could enhance the viability of the project.
Technical	A possible technical challenge that could alter the course of the project negatively.	A possible technical breakthrough that could alter the course of the project positively.
Business Environment	A possible market, political, or regulatory condition that could make the project outcomes less attractive than anticipated.	A possible market, political, or regulatory condition that could make project outcomes more attractive than anticipated.
Social	A project challenges associated with potential stakeholder interference in the project. Stakeholders can be inside or outside the organization.	Unexpected support for the project from a stakeholder group that might help the project advance. Stakeholders can be inside
External/Natural Environment	Acts of nature such as disease epidemics, floods, earthquakes, tornadoes,	Acts of nature such as the spontaneous end of a disease epidemic, changes in

	weather patterns, or oceanic circumstances that can harm the project.	weather patterns, or favorable tidal phenomena that can make the project unexpectedly easier to execute.
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Table 1: Sources of Uncertainty

#### **4. Methodology**

All of the standards discuss the importance of ensuring that reserves exist at all levels of project funding for managing all types of uncertainty.

##### **4.1 Reserve Analysis**

According to the PMI [1], Cost estimates may include contingency reserves (sometimes called contingency allowances) to account for cost uncertainty. Contingency reserves are the budget within the cost baseline that is allocated for identified risks, which are accepted and for which contingent or mitigating responses are developed. Contingency reserves are often viewed as the part of the budget intended to address the “known-unknowns” that can affect a project. For example, rework for some project deliverables could be anticipated, while the amount of this rework is unknown. Contingency reserves may be estimated to account for this unknown amount of rework. Contingency reserves can provide for a specific activity, for the whole project, or both. The contingency reserve may be a percentage of the estimated cost, a fixed number, or maybe developed by using quantitative analysis methods.

As more precise information about the project becomes available, the contingency reserve may be used, reduced, or eliminated. Contingency should be clearly identified in schedule documentation.

##### **4.2 Contingency Reserve for Variance**

A value for Variance typically involves quantifying the best and worst-case scenarios, order of magnitude ranges or 3 point estimates. Taking the

most conservative or worst-case scenario as justification for inclusion to the Contingency Reserve value. For example, if an estimated range is given for an activity of \$500 to \$1000, the raw estimate could be some midpoint like \$750 and the difference to the worst case of \$1000 of \$250 would be included in the Contingency Reserve. The quantification of Variance, at a minimum, needs to be a mandatory inclusion in the Contingency Reserve. It can be managed separately to Risk value or included in risk such as 'Insufficient Estimate'. [6]

### 4.3 Contingency Reserve for Risk

When looking to develop a Contingency Reserve to manage Risk, it can be difficult to know where to start. The PMI, through the PMBoK, provides three basic approaches to determine the reserve value for Risk; that being to calculate based on a percentage of the estimate, a fixed amount or through quantitative analysis. While the first two approaches have appeal, they will not suffice in a contract environment and can be open to being rejected when there is an inability to justify the percentage or fixed amount used. Percentage and Fixed amount approaches do have their place in the very early stages of budget estimation, however as project funding approval becomes imminent; the more robust method of quantitative analysis will provide better justification for the budget estimate. [6]

### 5. Conclusions

Project Managers tend to include contingency reserves in the project plan, especially for modern-day IT projects which follow some newer methodology of one of the following: Rapid Application Development (RAD), Prototype, Agile Development (Extreme Programming, Scrum), or others. In which project durations are in general shorter with smaller number of project members who work at intensive paces; the project team interacts with users more frequently and may need to manage the requests of scope changes by users.

By determining the Project Uncertainty profiles through quantification of *Variance* and *Risks*, the application of a contingency reserve to manage

project uncertainties becomes justifiable. With this, it means that projects stand a greater chance of success.

Effective planning and control of contingency reserves in project budgets are essential to prevent overspending. Likewise, effective management of contingency reserves in project schedules will contribute significantly to shorten project duration.

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