Value Based Requirement's Risk Management (VRRM) Process Model

A Thesis Presented to

Department of Computer Sciences
Faculty of Basic & Applied Sciences

In Partial Fulfillment

of the requirement for the degree

Of

Master of Sciences (Software Engineering)

By:
Abdul Basit
(104-FAS/MSSE/F06)

Supervised By:
Dr. Naveed Ikram

International Islamic University Islamabad

(2009)

15-7-22-10

1. Risk management

International Islamic University, Islamabad

Faculty of Basic & Applied Sciences

Department of Computer Science

Dated: December 19, 2009

FINAL APPROVAL

It is certified that we have read the thesis, entitled **"Value Based Requirement's Risk Management (VRRM) Process Model"**, submitted by Abdul Basit Reg. No. 104-FAS/MSSE/F06. It is our judgment that this thesis is of sufficient standard to warrant its acceptance by the International Islamic University Islamabad for MS Degree in Software Engineering.

ROJECT EVALUATION COMMITTEE

External Examiner:
Dr. Rashid Ahmad
Associate Professor
Deptt of Computer Engg
College of E&ME, Rawalpindi

Internal Examiner:
Shahbaz Ahmed
Asst. Prof DCS,
FBAS, IIU, H-10, Islamabad.

Supervisor:
Dr. Naveed Ikram
Associate Professor, Department of Computer Science,
Faculty of Basic and Applied Sciences,
International Islamic University,
Islamabad, Pakistan.

Abstract

This research aims to validate the claims of Value Based Requirement's Risk Management (VRRM) Process Model by implementing it on two separate software development projects in software industry. The first implementation executed by a Capability Maturity Model Integration (CMMI) rated company on a quite large project in the field of telecommunication. The other implementation was executed in parallel by a company employing no industry standard in the internet market space for an online trading company.

The research examines the successful implementation on both projects. The claim of improved risk management noted to be valid as no surprise risk(s) surfaced during the course of implementation. The other important reasons were the linkage of risks with software requirements and then software requirements with business objectives. The involvement and ownership of the success critical stakeholders remained high as they assign the values to the artifacts at three stages during the process.

The differences of implementation on separate projects recorded carefully at each activity of the process. The realization of the importance of a unique risk management process was high in the CMMI rated company which was not the case in other company. The presented differences provide greater insight to the practitioners for its future implementation. The experiences are documented separately for their facilitation.

The research recorded the problems of awareness of the value based risk management, training to implementation teams and success critical stakeholders, timely availability of success critical stakeholders and willingness of the business to mitigate the identified risks.

The research further suggested the future work to be performed in continuity to this case study. The observations for the improvements of process model are very necessary to be considered to make it more robust and available for repetitive use.

Acknowledgment

I am extremely thankful to Dr. Naveed Ikram for his supervision, guidance and necessary support for completion of this research work. He always has been a great source of aspiration in looking into the minute details, understanding the arguments and focusing in achieving the desired objectives of the research.

I am grateful to my colleagues, friends, family members and peers for their precious encouragement and support during the whole duration. I am also thankful to my friends Ghulam Murtaza, Hayat Khan, Arshad Farooq, Nadeem Iqbal, Ahsan Mumtaz and Abid Khan for their extensive moral support to stay abreast with the challenges.

Last but not the least my parents, wife and children for their erstwhile love, encouragement and continued support.

Declaration

I hereby declare and affirm that this thesis neither as a whole nor as part thereof has been copied out from any source. It is further declared that I have completed this thesis entirely on the basis of my personal effort, made under the sincere guidance of my supervisor. If any part of this report is proven to be copied out or found to be a reproduction of some other, I shall stand by the consequences. No portion of the work presented in this report has been submitted in support of an application for other degree or qualification of this or any other University or Institute of learning.

Abdul Basit

104-FAS/MSSE/F06

Dedication

I would like to dedicate my work to

ALMIGHTY ALLAH,

Who has always showered His endless blessings upon me and my family;

I also dedicate this work to my

WIFE, CHILDREN AND PARENTS

Whose sincere prayers and love were a source of strength for me
and made this project successful.

Table of Contents

Table of Figures

List of Tables

Chapter 1 – Introduction

1.1. Research Aim

The research aims to validate the claims made by the Value Based Requirement's Risk Management (VRRM) Process Model [1]. It includes the identification of problems practitioners may face during the implementation of this process model on commercial projects. Also, the research finds out the differences in implementing the VRRM Process Model in two different companies one practicing the CMMI standard and other not practicing any standard at all.

It is hoped that this research highlights the importance of VRRM Process Model for managing the risks related to requirements in value based manners contrary to the general practice where each requirement has equal value. This research is helpful in many ways to all those interested in project management, risk management, and process owners of overall processes of software development. These can include project managers, project team members, requirement engineers, risk managers, functional managers, company executives and students of related disciplines.

1.2. Significance

The value-based risk management includes principles and practices for risk identification, analysis, prioritization, and mitigation by focusing on the value of each requirement, use case, object and test case [2]. These values are determined by the Success Critical Stake-holders (SCS). The Success Critical Stake-holders perceive the risks according to the value of the impact on their domain.

The Value Based Requirements' Risk Management Process Model is first of its kind to provide a risk management process that is based upon the concept of value. VRRM Process Model is based on IEEE standards for risk management (IEEE Std. 1540-2001). It comprises of almost all activities considered mandatory by CMMI Model [1].

The VRRM process is not yet implemented on projects in software industry that requires to be done. This research intends to evaluate the VRRM Process Model and to highlight the potential problems, if any. The claims made by VRRM Process Model require to be validated in order to generalize its practices. The qualitative analysis shall focus on the comparison of

implementation of VRRM in two companies one practicing the CMMI and other without having any standard in practice.

1.3. Related Work

The concept of value is relatively new in the business of software and information. It is getting significant popularity during recent years. There is a shortage of research literature on this concept due to its very new nature in this domain. The Value Based Requirement's Risk Management (VRRM) Process Model is presented during the year 2008. It introduces a concept of value in the process model of Risk Management that is based upon the IEEE standards for risk management (IEEE Std. 1540-2001). Also, it comprises of almost all activities considered mandatory by CMMI Standard [1].

The other somewhat similar to the concept of value is the Riskit Method. The Riskit process revolves around the stakeholder's interest and their relationship with the risks. The risks are characterized by their probability and related losses. The impact of risks on the project is described through the stated project goals which are valued by the stakeholders. The stakeholders then can rank the risks using this whole information from their perspectives.

The VRRM Process Model is different in concept from Riskit. Initially, it segregates the success critical stakeholders whose participation ensures the success for a project. These success critical stakeholders involves heavily at three stages to assign the values to requirements, risks and risk treatments depending upon their interest on the project. However, VRRM process model does not link it with the stated project goals. The other major difference is in the scope of work for both process models. The Riskit focuses on the risks of the whole project while VRRM narrows only on the risks related with the requirements. Also, as compare to VRRM Process Model, the Riskit gives visual presentation in the form of Riskit Analysis Graph, which gives the risk scenarios, contrary to the resultant of VRRM.

The Value Based Requirement's Risk Management (VRRM) Process Model is not yet implemented on commercial software projects in true business environment. So we don't know whether it is a practicable process model or not? Can it be used with ease? Does it require a formal training to the staff for implementation? Currently, the software business is practicing value-neutral Risk Management Processes in which every requirement related risks are being treated in similar fashion with equal value. Some of the stereo style risk

management processes are employed to manage the requirements risks instead of a value based risk management process.

Samad & Ikram [1] has implemented VRRM Process Model on an academic project "Online Examination System" without consideration of the commercial aspects of the project. This academic project intends to develop a software tool of Online Examination System (OES) to facilitate the internal examinations of the university. This implementation revealed that the VRRM Process Model is a practical Risk Management Process Model and provides various benefits resulting into the success of the project.

But, the academic project can not be replaced with the commercial project in its true sense. The commercial projects have their own business dynamics and variety of stake-holders to deal with. So, the complexity to deal with success critical stake-holders becomes higher when the projects go from beginning to the end. The business dynamics exert their own pressure to make critical decisions and hence posing more risks to the project. In this regard, the claims made by VRRM Process Model require to be validated on commercial projects in both environments one having CMMI standard in place and other without any standard. In addition to this, the comfort of practitioners or Risk Managers should also be taken into the considerations.

1.4. Research Objectives

The objective of this thesis is to validate the VRRM Process Model in the software industry in the form of Case Study. The Case Study shall be conducted in two companies one practicing the CMMI standard model while other not practicing any standard at all. The VRRM Process Model shall be studied in terms of its practicability and its usage in comfortable manners. The research shall answer the following questions:

- What problems practitioners may face during the implementation of VRRM Process Model as it is not yet practiced in software industry?
- Does implementation of VRRM Process Model validates the following claims?
    - Practicality of the process model
    - Improved requirement's risk management

- Conformance to CMMI standard. The company having the CMMI standard processes in practice may face conflicts with regards to the execution of VRRM process model for commercial projects.

- What the difference between implementations of VRRM Process Model is in companies one practicing CMMI and other without any standard?

1.5. Expected Outcome

The case study shall result into:

- Validation of the claims made by VRRM Process Model
- Identification of problems during the course of implementation of VRRM Process Model
- Recommendations for improvement of VRRM Process Model

1.6. Research Methodology

Process validation is the act of investigating the resemblance between intended behavior of a process and the behavior shown by the process in actual environment. It is a structured approach to determine that a process consistently conforms to requirements for which it designed. It is done against some predefined criteria and to complete the validation process, documented evidences are required to verify that whether or not the process model conforms to its claims [38], [39]. Process validation often used as first step to the process improvement which is quite common in the field of business process modeling and re-engineering. In software engineering process, validation is usually used to indentify the positive and/or negative impact of the process model on the overall software development lifecycle that can serve the base for process improvement.

The concept of Process validation is used in almost every field of science and engineering. Each of these fields has its own tools and techniques to validate the processes, however; the natural cycle of process validation remains the same. More or less in every field, following activities are performed for validation of a process model [41].

Determine Evaluation Questions – While validating a process first thing that must be identified is the questions that we need to answer, their purpose and importance. These

questions are derived from the requirements for which the process model is designed. In this thesis the examples of evaluation questions are: Is VRRM Process Model practical? Does VRRM Process Model improve the requirements' risk management?

Determine Set of Activities and their Sequence – After defining the evaluation questions, next step is to identify the activities which are required to be undertaken in order to answer these questions. These activities must be logically ordered keeping the guidelines of the process model under consideration. This step is the logical design of the overall evaluation exercise and must be done carefully. The VRRM Process Model has the set of sequential activities to be executed.

Identify Actors and Define Responsibilities – All relevant stakeholders are identified and engaged with proper responsibilities.

Determine Methodology – Process validation is characterized by collection of data collected through two formats of quantitative and archival. The recorded data should be managed by a computerized tracking or management system. However, the data for qualitative analysis can be obtained through a variety of format such as survey, brainstorming, focus groups and careful observations.

Identify Data Points – Data points are the measures that are needed to be recorded in order to analyze the outcome of the evaluation exercise. These measures must be identified earlier so that all the required data must be recorded and analyzed.

Perform Activities and Collect Data – All the planned activities are performed at this stage. During the course of implementation, it must be ensured that all activities being performed are in consistent with industry quality standards. An unintended activity must be properly monitored and recorded along with its impact.

Data Analysis and Reporting – Data analysis and reporting is a process of gathering, modeling, and transforming data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. There are many statistical data analysis tools that can be used as part of validation like control charts, tolerance analysis, failure modes, effects analysis and others [40]. The selection of tools must be done by careful analysis of actual scenarios. While reporting the result of the case study, data must be logically linked with the evaluation questions and proper conclusion must be documented.

In software engineering not much literature is available on process validation, however; we found a Framework for the Modeling and Evaluation of Software Processes mainly designed to measure the efficiency of the process models. The framework uses the defined parameters of measurement that are measured using designed experiments. Different mathematical formulas are used to calculate the efficiency ratios of the process model. The major limitation of this framework is that it cannot verify the claims made by the process model other than efficiency. Other methods that are in practice for process validation are survey research, simulations controlled experiments and case studies. Different statistical tools mentioned in above discussion are also available but these tools help in reporting the results rather than serving the whole purpose of process validation. These methods have their own merit, worth, and significance, however, case studies are of utmost importance as these are the experiments run in a real environment. A case study is an empirical inquiry that investigates an existing phenomenon within its real life context. Other methods like simulations cannot control the subjective variables, while the other limitation is that a CASE tool cannot be replaced with the actual environments.

Considering all the above discussion and analysis of different process evaluation methods, we come to the conclusion that case study is the most suitable techniques for this particular research which is about validation of claims made by Value-based Requirements' Risk Management Process Model.

This research is based upon the design of a Case Study. The design of the Case Study is mapped with the methodology of this research. The mapping of the Case Study design is elaborated as follows:

Research Questions – The research questions are defined under the section of Research Objectives.

Proposition – The scope of this Case Study covers the practicality of VRRM Process Model. It focuses on validation of the claims made by VRRM Process Model through execution of all activities on the two separate projects executed in commercial environment. So the Case Study shall result into the answers of the key questions like

- Is VRRM a practical Process Model?
- Does it require any training to the risk managers and risk management staff before implementation?

- Does VRRM Process Model improve the requirement's risk management process?
- Is there any difference of implementation of VRRM Process Model in companies with practices of CMMI standard and without any standard?

Unit of Analysis – The two units of analysis are the "Projects" and "Companies". The problem statement clearly highlights the focus on projects and companies executing those projects.

Logic linking of data to proposition – The VRRM Process Model has key data points of software requirements, elicited values of software requirements, risk categories and risk profile. The risk management policies, risk management plan, risk treatment plan and contingency plan are the key control points in the Case Study. However, the software requirements and their elicited values have major contribution in controlling the entire process of value based risk management.

The execution of Case Study starts with the selection of two companies, based upon the defined criteria. After selection of companies, the right projects of software development are identified as a primary unit of analysis. The software requirement specifications of these projects shall be analyzed and the complete process of value elicitation executed in order to determine the values of software requirements. It is important to mention that the values of requirements are determined by the success critical stake-holders instead of the investigator. The risks related to each requirement shall be identified in the form of Risk Profiles. The identified risks are then prioritized based upon the values of the software requirements. This is the start of risk monitoring and control process of risk management that last till end of the project. The data stores and artifacts require to be updated on as and when required basis.

The implementation shall cover the execution of all the activities given in the VRRM Process Model in the same order. These activities are categorized into Planning for VRRM Process Model, Identification of Risks, Analysis of identified risks, and Treatment of identified risks, Monitoring and control and Evaluation. This would be performed on two separate software development projects executed by a CMMI ratified company and a company having no standard in practices.

The Risk Managers and Risk Management Staff shall be closely coordinated through physical meetings and monitoring in order to identify the problems they may face during the implementation of entire process of VRRM. The necessary overview training of the VRRM

Process Model is in the plan to build the common understanding about this model. The day to day problems shall be documented for future reference and their treatments in order to complete the implementation and provide feedback with regards to practicality of VRRM Process Model. This shall be executed in both companies and resultant shall be carefully analyzed to find out the difference in two implementations. Please note that the implementations at two companies shall go in parallel and outcomes are documented separately.

Criteria for interpreting the findings – The research questions serve as the key criteria to interpret the findings of case study. The interpretation targets the validation of claims made by VRRM process model including its practicality, conformance to CMMI standards and improved risk management process. Alongside the validation of VRRM claims, the identified problems are to be documented to facilitate the risk managers for future implementations. The case study also highlights improvements that should be made in the VRRM process model.

1.7. Research Plan

The proposed timelines of high level activities are given as under:

TABLE 1 SELECTION CRITERIA – COMPANIES

S No.	Milestones	Duration
1	Conduct literature survey to finalize the implementation methodology and detailed activity plan	3 weeks
2	Identify control points	3 weeks
3	Define selection criteria for companies and projects	2 weeks
4	Select companies and projects for implementation of VRRM	1 weeks
5	Implement VRRM	12 weeks
6	Analysis and review of the collected data	4 weeks
7	Documentation of overall results	2 weeks

Chapter 2 – Literature Review

2.1. Introduction to Value Based Software Engineering

The Value Based Software Engineering (VBSE) is based upon the win-win Theory-W proposed by B. Boehm during the month of July 1989. The Theory-W draws upon the Utility Theory, Decision Theory, Dependency Theory, and Control Theory. However, the work on the value based requirements engineering started in early seventies with the topics of economics of computers, software and information technology. The value-based requirements engineering includes principles and practices for identifying a system's success-critical stakeholders; eliciting their value propositions with respect to the system; and reconciling these value propositions into a mutually satisfactory set of objectives for the system [2]. Contrary to the value-based requirements engineering, the traditional requirements engineering includes the value-neutral risk management with having uniform treatment to every requirement, use case, object, test case, and defect regardless of their importance.

During earlier times, the software engineering practice and research was based upon the value neutral manners in which every requirement, use case, object and defect is treated with equal importance. The Methods are presented and practiced as largely logical activities in the value neutral practices. Also, the progress of the System is tracked through the concept of Earned Value rather by the stake-holder or the business value. In addition to this, the responsibilities of software engineers are limited only to turn software requirements to verifiable code. So resultantly, the software decisions had relatively minor influences on System's cost, schedule and value making the value neutral approach workable. However, today and increasingly in future, software has major influence on most System's cost, schedule and value resulting software decisions extraordinary intertwined with System level decisions.

Value based software engineering is an extension in traditional software engineering, as it tries to introduce value considerations into previously defined software engineering concepts and practices. In traditional software engineering the whole development process focuses mainly on successful development of the final product with lesser attention to the fulfillment of the values of stakeholders. On the other hand, in value based software engineering, the focus is taken (or at least tried to be taken) beyond just the development of the software product. Here the main focus is on the value that the software has added/will be adding to the

system. Where the traditional software engineering approach considers only the production/development, the value based software engineering considers the system too, in which that software will be implemented. The value based software engineering is aimed at making Success Critical Stakeholders (SCSs) the winners [1], [2], [4], [6] and to ensure stakeholder satisfaction [42], [43] besides focusing just the successful product development.

In nutshell, the foundation of Value Based Software Engineering consists of following key elements:

1. Benefits Realization Analysis
2. Stakeholder Value Proposition Elicitation and Reconciliation
3. Business Case Analysis
4. Continuous Risk and Opportunity Management
5. Concurrent System and Software Engineering
6. Value-Based Monitoring and Control
7. Change as Opportunity

2.2. Introduction to Value Based Risk Management

2.2.1. Risk Management

Project Risk Management is the art and science of identifying, analyzing, and responding to risk throughout the life of a project and in the best interest of meeting project objectives. A frequently overlooked aspect of project management, risk management can often result in significant improvements in the ultimate success of projects. Risk management can have a positive impact on selecting projects, determining the scope of projects, and developing realistic schedules and cost estimates. It helps project stakeholders understand the nature of the project, involves team members in defining strengths and weaknesses, and helps to integrate the overall processes of project management in order to ensure the success of the project [19]. Project risk has its origins in the uncertainty that is present in all projects. Project risk is an uncertain event or condition that, if it occurs, has a positive or a negative effect on at least one project objective, such as time, cost, scope, or quality. A risk may have one or more causes and, if it occurs, one or more impacts.

Organizations perceive risk as it relates to threats to project success, or to opportunities to enhance chances of project success. Risks that are threats to the project may be accepted if the risk is in balance with the reward that may be gained by taking the risk. Persons and, by extension, organizations have attitudes toward risk that affect both the accuracy of the perception of risk and the way they respond. Attitudes about risk should be made explicit wherever possible. A consistent approach to risk that meets the organization's requirements should be developed for each project, and communication about risk and its handling should be open and honest [18].

2.2.2. Value Based Risk Management (VBRM)

Value-based risk management includes principles and practices for risk identification, analysis, prioritization, and mitigation. VBRM optimizes human and financial resources to dramatically improve the risk management process, particularly the highly critical mitigation and control phases. Since its inception, VBRM has delivered substantial benefit on projects ranging in size from a few million to multiple billions of US dollars [14]. The existing and other risk management processes are value neutral and they consider each risk, process, artifact having equal value. However, the VBRM process provides greater insight in knowing the values of risks and eventual treatment at later stage.

The organizations should practice the value based risk management processes and methods to improve its ability to manage the uncertainties and critical risks. The critical risks are detected so that they managed accordingly. The concept of value helps to prioritize for better treatment. It also helps to detect the opportunities well before time hence giving the ample time to make decisions to capitalize them.

There is a shortage of literature regarding value based risk management. Apart from two or three contributors [14] no prominent work in these areas has been found. This is because of the fact that the concept of value in software engineering is a relatively new idea hence having little or insufficient contributions are available [1].

2.3. Identification of Success Critical Stakeholders

Project stakeholders are individuals and organizations that are actively involved in the project, or whose interests may be affected as a result of project execution or project completion [18]. Stakeholders can exist within the project or outside the project in the

organization environment. This distinction segregates the stakeholders in internal and external types. The both types of stakeholders exert influence over the project's objectives and outcomes. However, the influence level is very high during the early phases of the project lifecycle and decreased towards last phases. Keeping in view the elaborative nature of the projects, the more visibility minimized such influences.

The implementation of VRRM Process Model involves the key activity of identification of requirements' risks. The requirements risks are the major possible reasons for project failures or abandonment. On the other side, it should not be surprising that only small number of software projects are delivered within original scope, cost, time and quality requirements due to its inherent complexity involves in the overall process of risk management [11]. However, the important element to be considered is that requirements originate from the stakeholders. According to this definition, a large set of stakeholders to be considered and managed in the process of risk management which may cause un-necessary overhead to the project management team. In order to deal with the larger set, the concept of Success Critical Stakeholders is introduced in the VRRM Process Model. The risk managers and project management team should focus only on the Success Critical Stakeholders instead of the larger set containing every critical or non-critical stakeholder.

Identification and management of Success Critical Stakeholders (SCS) is of great importance for success of the project. The project management team should effectively manage the expectations of SCS from beginning to end of the software development project. The expectations are originally the software requirements or the intended services expected from the software system. The identification of SCS is very essential in the context of software development projects as the software requirements originates from them. The chances of missing out software requirements exist due to non identification of SCS that leads to the failure of software projects. The management of software requirements becomes trivial as they may change during execution of the project due to a change in set of earlier identified SCS. This phenomenon demands the identification of Success Critical Stakeholders (SCS) by using a sophisticated technique or proper mechanism.

The wide variety of techniques is available to identify the Success Critical Stakeholders (SCS). Most of these techniques are rooted in the management literature and can be adopted in the context of software engineering. The usage of appropriate technique always been a challenge due to the dynamism exist in the situations. The teams involved in software

engineering should use the appropriate technique to identify the Stakeholders on a particular project. Likewise the management literature, the software engineering domain also emphasizes the need for identification of Stakeholders as software requirements comes from them which are the foundation to the software system. However, the Software Management Processes do not suggest any specific technique to be used on the given situation. Further, the Project Management Standard like PMI does focus on the need to identify the stakeholders but application of appropriate technique is left with the judgment of project management team.

The literature reveals that there are number of techniques available to identify the stakeholders of the project. All of these techniques are based upon the categorization of stakeholders on a particular attributes and given situation. Some of the important techniques are listed below for better understanding with regards to their implementation and usage according to the given situation:

1. Theory of Stakeholders Identification and Salience
2. Baseline-Outward Approach
3. The Basic Stakeholder Analysis Technique
4. Power Versus Interest Grid
5. Stakeholder's Interest Diagram
6. Participation Planning Matrix
7. Bases of Power–Directions of Interest Diagrams
8. Finding the Common Good and Structure of a Winning Argument
9. Tapping Individual Stakeholder Interests to Pursue The Common Good
10. Stakeholder-Issue Interrelationship Diagrams
11. Problem-Frame Stakeholder Maps
12. Stakeholder Analysis Diagram
13. Three-Way Stakeholder Structure

14. Project Sociology

15. Stakeholders Identification (Tool#8)

16. Stakeholder Identifications in Standardized Processes

17. Method For Stakeholder Identification In Inter-Organizational Environments

18. Stakeholder Identification by Classification

19. Stakeholder Identification Model

20. Stakeholder Identification using Use Case Diagram

Based upon the in-depth review of the techniques listed above, the Theory of Salience is the more suitable and practical technique to be used for identification of stakeholders. This technique has the efficacy for identification and classification of stakeholders among the listed techniques [35]. Most of the other techniques get influenced from this technique. Theory of Salience focuses around the important attributes of Power, Legitimacy and Urgency. The stakeholders possessing all three attributes are called as definitive stakeholders. However, the overall framework gives the classification of whole set of stakeholders into seven groups depending upon the presence of one, two or three attributes in different combinations. This salience classification explains why (and when) managers give attention to certain stakeholders. The framework provides insights for understanding how stakeholders can gain or lose salience to the managers of an organization and who are, for that reason, able to influence organization's activities [24]. Moreover, a recently conducted analysis of stakeholders' identification techniques suggests the uses of salience theory for identification of stakeholders on a software development project. It is further suggested that this technique should be used repetitively depending upon the judgment of project management team to address the dynamism exists in the involvement of stakeholders to the project.

This technique is applied on the two projects being primary unit of analysis for this case study. The stakeholders will be categorized on the bases of its key attributes of Power, Legitimacy and Urgency so that the success critical stakeholder can be found out of them. So, during the course of execution of VRRM Process Model, only the success critical stakeholders shall assign values to software requirements, related risks and the alternate treatments.

2.4. Value Based Requirements Risk Management (VRRM) Process Model

VRRM Process Model proposed jointly by Samad and Ikram in the year 2008. It is a Risk Management Process for software requirements. It is mainly based upon IEEE Std. 1540-2001 Risk Management Process and conforms to CMMI as it employ almost all the activities that deems to be important and taken for the purpose.

VRRM Process Model takes into considerations the concept of value in software requirements which are ultimately owned by the stakeholders. Since, the wide variety of stakeholders exists so the term of success critical stakeholders (SCS) is introduced to value the requirements and related risks in order to ensure the effective participation of success driven stakeholders for the software development projects.

VRRM Process Model is represented at two levels of abstraction. The first level is called as Abstraction Level-1 and the second level is referred as Abstraction Level-2. At the higher level, the Abstraction Level-1 comprises of Management and Assessment & Mitigation of risks. The Management part contains the Planning and Monitoring and Control. The Assessment & Mitigation part comprises of Identification, Analysis and Treatment of Risks for a software development project.

The second level of Abstraction presents the complete set of activities divided into further six major categories which are given as under:

1. Plan
2. Identify
3. Analyze
4. Treat
5. Monitoring & control
6. Evaluate

The value based requirements risk management (VRRM) process has been designed at two levels of abstraction. The first abstraction level is rather simple and gives a good overview of the main activities carried out. The second abstraction is designed at a more detailed level and presents all the activities that have to be performed for VRRM. The both abstraction levels are represented in the following diagrams.

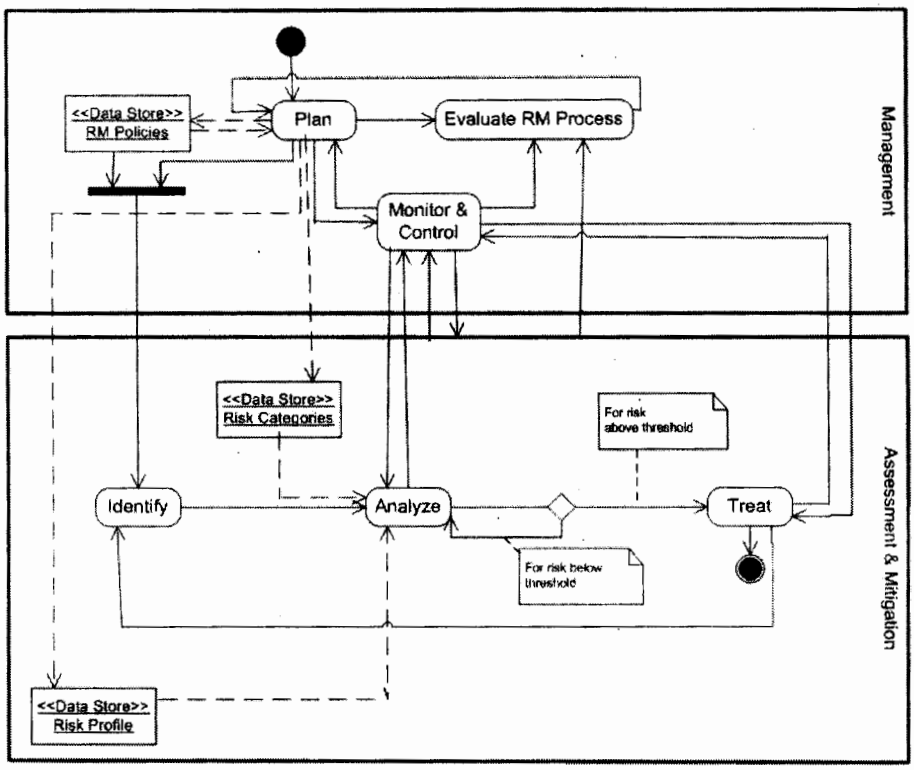

Figure 1 : VRRM Abstraction Level – 1

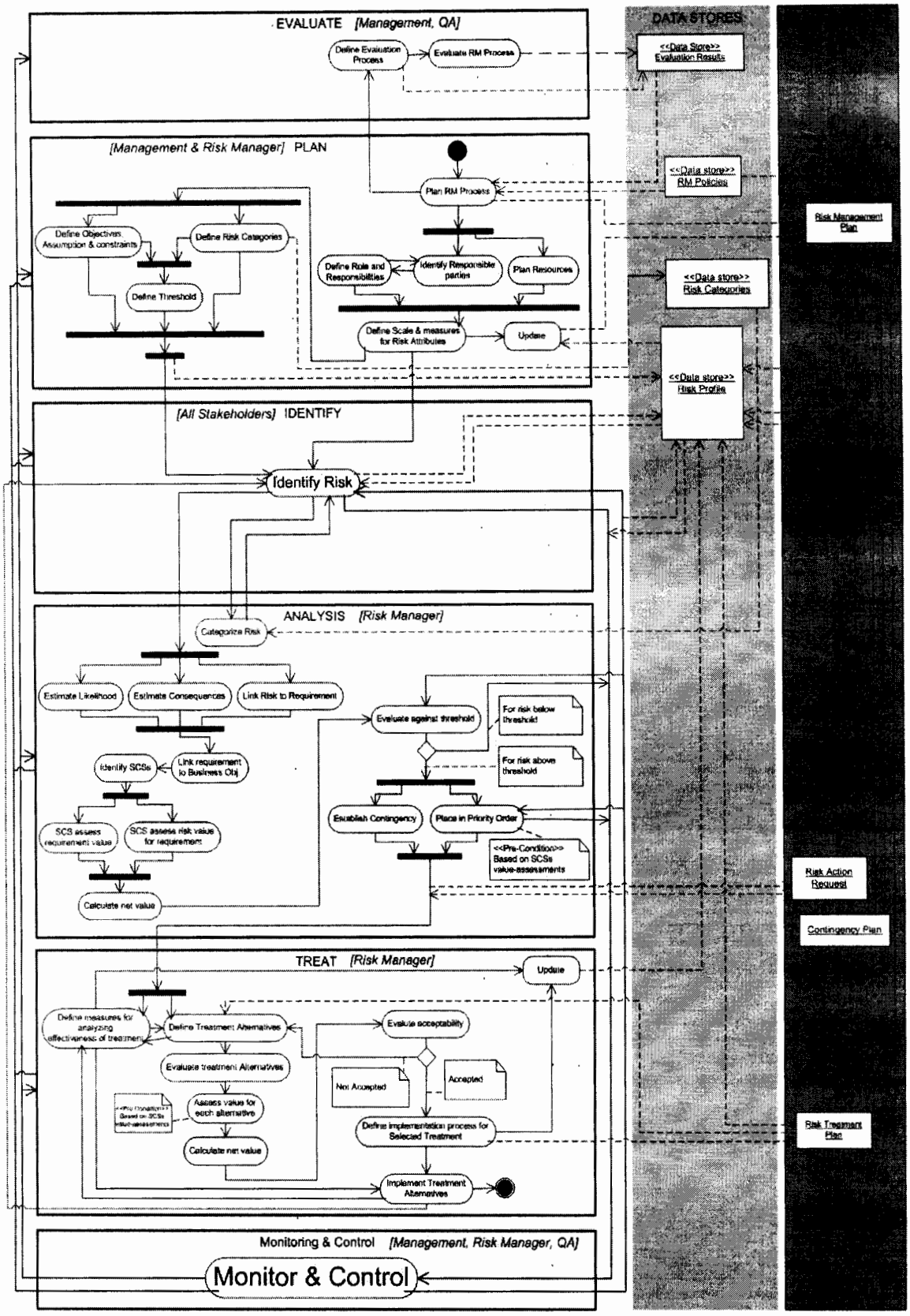

Figure 2 : VRRM Abstraction Level - 2

Chapter 3 – Implementation of VRRM Process Model

The implementation of VRRM Process Model started with the selection of two companies having separate execution of software projects called as "Project-A" and "Project-B". The both companies, executed the project, operate in commercial environment and intend to generate revenues by delivering the software solutions to their customers. The company executing the "Project-A" is referred as "Company-A" while the other company is mentioned as "Company-B" in the following sections of the thesis.

3.1. Selection of Companies and Projects

In order to select the appropriate companies and projects, separate criterions were established for clarity purpose. The companies with somewhat maturity to execute the project were picked up along with their projects being examined during similar timeframe. The important considerations were the experience of companies to execute the projects for non-government customers along with the accessibility and availability of success critical stakeholders.

TABLE 2 SELECTION CRITERIA – COMPANIES

S.N.	Parameter	Criteria	
		CMMI Rated Company	Other Company
1	Status	Legally registered entity	Legally registered entity
2	Maturity level	CMMI level 2 or above	Practicing no standard
3	Age	At least 2 years	At least 2 years
4	Experience	At least 12-15 projects of indigenous software development	At least 12-15 projects of indigenous software development
5	Employee strength	Min 15 employees	Min 15 employees

TABLE 3 SELECTION CRITERIA - PROJECTS

S.N.	Parameter	Criteria
1	Commercial	Yes
2	Type	Software development

3	Duration	Approximately: 12 weeks
4	Stake-holders	Identifiable and accessible
5	Customer	Non government

Based on the criterion given above, the selected companies are taken as unit of analysis for this case study.

3.1.1. Introduction of Company-A and Project-A

The Project-A is carried out by a multinational company "Company-A" which provides software solutions to telecommunication operators across the world. As a whole, the Company-A has the strength of 50,000 employees and 8,000 of them are working in about 100 representative offices around the world. Also, it has established joint laboratory partnerships with many worlds leading technology providing companies and universities. The Company-A is holding the status of CMMI level-II.

The Project-A is executed for a larger telecommunication company ("Telecom Company") providing reliable and converged services from basic voice telephony to data, internet, video conferencing and carrier services to consumers and businesses all over the country. It has employee's strength of more than 25,000 employees with more than 4 million subscribers of basic telephony services. This Telecom Company entered into the broadband market in 2004 and now having the subscribers of data services more than 130,000.

The Project-A intends to provide the various modern services to its subscribers like controlling the TV channels interactively. The responsibility of Company-A includes to provide real-time or near real-time Billing and Customer Care functions as key deliverables for Project-A. The deliverables should have a best-fit with the existing Billing and Customer Care System (B&CCS). The project has special focus on the Customer Care System (CCS) including revamping of new connection services and post installation services of Triple Play Products. The scope further covers the interfaces of Customer Care System (CCS) Module with Operations Support System (OSS) via MS SP (Mediation Service Provisioning) for services according to the North Bound Interface (NBI) shared by the OSS. However, the scope of work does not include separate Billing and Receivable Module and shall not

generate separate Customer Invoices. The developed software shall be deployed on the existing hardware of B&CCS for quick delivery of services.

The main components of the Project-A are:

1. New PSTN, New Broadband, New IPTV
2. Existing PSTN, New Broadband, New IPTV
3. Existing PSTN, Existing Broadband, New IPTV
4. Post Installation Services
    i. Change of package
    ii. Permanent close
    iii. Temporary close due to no payment
    iv. Temporary close on customer request
    v. Restore due to payment
    vi. Change of ownership
    vii. Change of password
    viii. Shift of IPTV service
    ix. Change/Replacement of CA Card
    x. Change of modem
    xi. Change of STB
    xii. Credit control procedure
5. New packages
6. Withdrawal
7. Management of pending orders
8. Inventory management
    i. CA inventory
    ii. Modem inventory
    iii. STB inventory
9. B&CCS-OSS External Interface

i. North Bond Interface (NBI)

ii. Electronic Programmable Interface (EPI)

iii. File Interface of Billing with AAA for Video on Demand (VOD)

3.1.2. Introduction of Company-B and Project-B

The second project was carried out by Company-B for a Web Company in USA. The Company-B started its business back in 2004 with the aim to provide cookie cutter software solutions related to web development. Since its inception, it has delivered more than 30 small or medium projects meeting or exceeding the expectations of customers. It does not possess any certification and employ no standard methodology or framework necessary for software development process and lifecycle. Building upon the informal methods of communications, some of the reference documents are produced which never upgraded with the introduction of changes. The development team comprises of around twelve technical staff members engaged in multiple activities with no formal distinction in software development phases and functions. The requirements are usually gathered on email following multiple phone calls and development is done in small iterations.

The Company-B developed the software for a Web Company. The Web Company is one of the leading e-commerce companies on wireless technology and wireless products. It is engaged in the operations of one of world's popular online marketplaces. Since its incorporation in 1999, it has been successful in the marketplaces for wireless technology and products. It has more than 1000 members who trade wireless products daily through the internet. Its member base is increasing day by day with heavy transactions in the area of wireless products like phones and accessories. The web site contains the cutting edge features to facilitate the state-of-the-art trading environment to its members. The features set includes Shopping, Trading, Blogs, Yellow Pages, Forums, Helpful Links, Prepaid, Trade Publications, Travel, Calling Cards, Ringtones, Trade Shows, World Clock, Cellular Library, Live Chat, Jobs, Mobile Reviews, Currency Convertor, News and Wholesale.

3.2. Implementation of VRRM Process Model

The VRRM Process Model implemented on two commercial projects in the software industry. The first project of Project-A was examined during its implementation by a CMMI rated company "Company-A". The second project "Project-B" was examined during its

development by "Company-B". The examinations for both projects were done in parallel. The subsequent sections capture detail activities of VRRM Process Model for both projects.

3.2.1. Plan

The VRRM process starts with the Plan activity. There are total number of 8 activities in this group that are performed in order to produce three deliverables; Risk Management Plan (Annexure-B), Risk Categories (Annexure-C) and Risk Assessment Register (Annexure-F). The risk management plan is part of the project plan and it gives the overall risk management process overview that how it will be implemented, how the activities will be carried out, who will be responsible for which activities and how will be the process evaluated for improvement purposes. The planned information is also passed on to data stores of Risk Profile and Risk Categories. The planning was done separately for both selected projects (Project-A and Project-B); however the planning at Project-B was very difficult due to lack of specialized risk management and project management resources. This was the major risk during the implementation of VRRM process model. Most of the planning and execution was performed by the author himself. However, for Project-A the proper team was allocated so, here the situation was much better.

Plan RM Process

In Project-A the VRRM Process was planned along with the project team and responsible parties. Company-A considers Risk Management as an important factor to improve its business, products, services, solution and eventual satisfaction of the customers. As per risk management policy of Company-A, the management aims to achieve best practices in managing all risks. So, it order to achieve this aim, risk management standards involving risk identification and risk evaluation linked to practical and cost-effective risk control measures. All the planning was done by focusing on VRRM process model guidelines and risk management policies of "Company-A". The collected information was documented in "Project-A: Risk Management Plan" (Annexure B).

Same planning process was followed by "Company-B" for "Project-B". Before this implementation, "Company-B" didn't have any documented policy for risk management. So, the risk management policy (Annexure-A) and Risk Management Plan (Annexure-B) were documented from the scratch. These documents were developed by applying the best

knowledge and experience of two partners of the company with necessary assistance of the author.

Plan Resources

In Project-A, a dedicated risk management team was established for execution and management of VRRM process model. After negotiations with Project Managers of both sides (Company-A and Telecom Company), the Risk Manager (Company-A) was heading the team of three members including the following individuals:

1. Software Engineer, Company-A
2. Manager B&CCS, Telecom Company
3. Manager Multimedia & Broadband, Telecom Company

Risk management team was properly trained for the execution and management of VRRM process model. In addition to the dedicated risk management team author was actively monitoring the whole process. All the necessary material resources were also provided to the subject team.

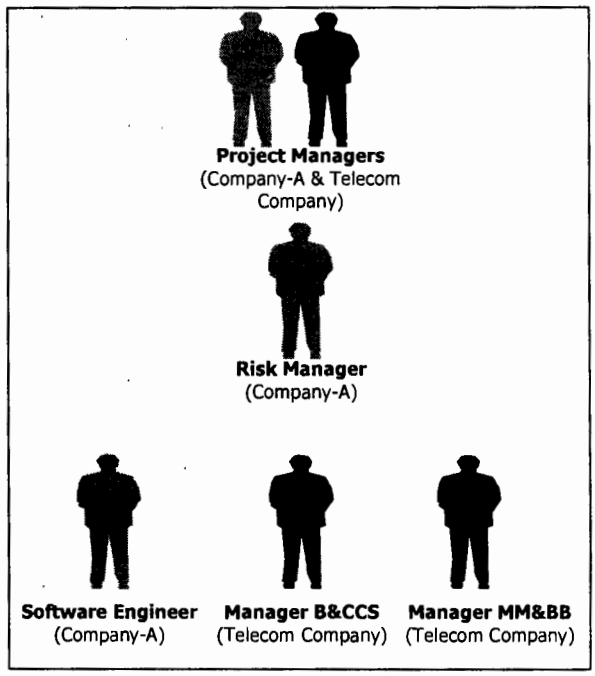

Figure 3: Risk Management Team

On the other side of the implementation at "Project-B", properly dedicated risk management team was not available. Most of the work was executed by author himself. However, a team comprising of two people was established in addition to the author to perform the activities of VRRM Process Model along with their key role in overall management and development of software. The team includes following individuals:

1. Project Manager (Shareholder/Partner of company)
2. Senior Software Developer
3. Author

Similar to the Project-A, this team was trained and author was actively involved in the execution of activities of the VRRM process model. Essential training and material resources were also provided.

Identify Responsible Parties

The Risk management is a continuous process which requires risk awareness and proactive measures by all the resources and the stakeholder who actively participate to eliminate the occurrence and impact of risk events.

In "Project-A", responsible parties for managing the risks were the Project Manager, Risk Management Team and the author himself. The management of both companies (Company-A & Telecom Company) was regularly evaluating and reviewing the measures for the best fit for achieving business objectives. Keeping in view the complexity lies in the volume and spread of geography, the team comprises of two members from Telecom Company for coordinating the risk management activities within the organization.

In "Company-B", the responsible parties of the execution and management of VRRM process model include author and Project Manager (Partner-1). A senior software developer was also available on as and when required basis.

Define Roles & Responsibilities

As mentioned in the above two sections, at "Project-A" the risk management team was responsible to conduct the risk management along with the facilitation and participation of author himself. The team was focusing on the implementation activities of risk management process and its monitoring and controlling. The risk management team worked in close coordination with project management team under the leadership of a dedicated Project Manager. Further, the Risk Manager was attending all the meetings with regards to the requirements and status reviews. Apart from the regular feedback, the Project Manager was taking instant and ad-hoc feedback on as and when required basis depending upon the situation. The risk management team was also having a mandate to coordinate with all success critical stakeholders to ensure the effective mitigation of the risks. Risk information was regularly communicated among all relevant project team members according to the schedule (time-periods) set by Project Manager and Risk Manager. The Risk Manager was also entrusted with the responsibility to disseminate the risks related information to all stakeholders. The risk management team ensured the effective management of data stores for

VRRM Process Model. The risk mitigation strategies were formulated after deliberations and discussions among risk management team and with the help of executive management of Telecom Company and success critical stakeholders.

Same responsibility assignments were also done in Company-B but, the dedicated Risk Manager was not available. So, the Project Manager (Partner-1) was performing the tasks of Risk Manager in close coordination with author. All the activities and documentation required for the implementation of VRRM process model was done by Project Manger and author with assistance of a software developer.

Define Scales & Measures

The same scales and measures were used at both projects. The defined scales and measures were:

1. Likelihood of each risk item was assessed on scale of 1-10
2. Impact of each risk item was classified on scale of Low, Medium and High. In quantifiable terms it was measured on the scale of 0-1 where "0 - 0.3 = Low, 0.4 – 0.6 = Medium and 0.7 – 1 = High".
3. Magnitude of each risk item was calculated on basis of probability and impact
4. Value assessment of requirements and risks from success critical stakeholder was done on the scale of 1-10 in all three perspectives of Technical, Organizational and People (TOP).
5. Net value was calculated by aggregating the value of all stakeholders.
6. Threshold for acceptance of risk item was decided to be 5 keeping in view the risk management practices of Company-A for Project-A. However, for Project-B the same threshold was used for the purpose of uniformity. Only the risk entities with aggregate value greater than 5 (calculated on basis of magnitude and net stakeholder value), were accepted as risk and treatment activities planned for them accordingly.

Define Objectives and Assumptions

The objectives are given under:

1. Identification of the risks and their mitigation in value based manners

2. The requirements and allied risks to be valued by the success critical stakeholders instead of the project or risk management teams
3. The success critical stakeholders value the identified alternate treatments for successful mitigation of the identified risks
4. The companies executing the projects were willing to employ the value based risk management process model to ensure successful delivery of the software projects
5. The development companies had the focus on their processes related to the risk management

Define Risk Categories

The risk categories were defined as Product and Process risks as given in the description of VRRM Process Model. There were some other suggestions too but it looked feasible to categorize them in this manner as they can easily be mapped for requirements risks specifically to fulfill the mandatory requirements of VRRM Process Model. Focusing strictly on VRRM Process Model, the product risks included only the risks related to end-product itself and the process risks covered all the other risks which were related to development process or team involved.

Data Stores

In order to implement VRRM Process, it requires the organization's business objectives and organizational risk management policies to be documented during project planning phase. The implementation was done in continuous coordination with all project team members to keep low the chance of biasness. During the implementation process, all the artifacts were produced more or less according to the templates suggested by IEEE Standard for Risk Management (IEEE Std. 1540-2001) except for contingency plan as this Standard doesn't provide any template specifically for contingency planning. The Standard template was used according to description given in VRRM Process Model.

A master list containing all risks "Risk List" is maintained throughout the lifecycles of both projects. The other artifacts of Risk Management Plan (RMP), Risk Assessment Register (RAR), Risk Treatment Plan (RTP) and Risk Contingency Plan (RCP) were produced during the process of risk management. These artifacts were updated continuously as new risks

discovered with the resolution of few of them. During the implementation of VRRM Process Model, the data stores to be maintained are given as under:

1. Risk policies (Annexure A)
2. Risk Management Plan (Annexure B)
3. Risk categories (Annexure C)
4. Business Objective Document (Annexure D)
5. Requirement Document (Annexure E)
6. Risk Assessment Register (Annexure F)
7. Value Assessment Register (Annexure G)
8. Risk Treatment Register (Annexure H)

All the above artifacts were developed for both projects separately. Except the Risk Register, these data stores may contain the information and data from previous projects, if any. However, these data stores were empty at the beginning as this was the first implementation of this risk management process. These data stores provided a comprehensive repository for future implementations and finding the analogies for specific purposes.

3.2.2. Identify

In this group of activity, risks were identified for both projects separately according to the companies' risk management policies and risk management plans. As VRRM Process model does not recommend any specific technique for identification of risks, best practices from risk management literature (project information, brainstorming, interviews, analysis of historical data and cause & effect analysis) were used for risk identification. Twenty four risks were identified for Project-A and thirteen for Project-B. The risk identification exercise was done by risk management teams at both projects in close coordination by the author. All the information was recorded in the Risk Assessment Register (Annexure F).

3.2.3. Analyze

Risk analysis is the third group of activity in the VRRM process model. It started immediately after the identification of risks. The core activities of value-based requirements'

risk management process model belong to this activity group. During the risk analysis, the success critical stakeholders were involved actively as they assess the requirements' and risk's value for the acceptance of risk. The Analyze process was executed for both projects and related detail is given as under:

Categorize Risks

The process used the categorization of risks into Product and Process for separate purpose. Being an integral part of VRRM, the risks identified in the category of Process were helpful in process evaluation and its improvements. However, the risks in categorized as Product lessen the chances of failure of delivered product. Jointly, these categories were helpful in improving overall quality of the product and process ensuring successful product development in terms of cost, time, quality and value. Categorization of risks was done by risk management teams in consultation with relevant stakeholders. This exercise was completed separately for both projects and the information recorded in the data stores of Risk Assessment Registers (Annexure F).

Estimate Likelihood & Consequences

Likelihood of the risk is its probability to occur during the project lifecycle and Consequences referred as expected impact of the risk, if occurs. The values of Likelihood and consequences to the risks were assigned by risk management team in close coordination with project management team on the scales defined during the planning phase. Net magnitude was then calculated through product relationship of likelihood and consequences. This information was recorded for both projects separately in data stores of Risk Assessment Registers (Annexure F).

Link Risks to Requirements

From this step to onward the core activities of VRRM Process model started. As VRRM process model deals only with requirements related risks, it was needed to identify that which risks were associated with a particular requirement or vise-a-versa. This association was established by risk management team by conducting in-depth analysis and consultation with success critical stakeholders. In Project-A, this exercise was completed seamlessly because most of the success critical stakeholders were available for face to face meetings and a proper risk management team was working for the coordination and management of the process. But in Project-B, the process was bit difficult due to the communication issues of global software

development between the customers and the risk management team. The second reason was the lack of specialized risk management and coordination team. However; the process was completed successfully and the results were recorded in Risk Assessment Register (Annexure F).

Link Requirements to Business Objectives

At this stage, the Business Objectives were identified which could be affected as a result of risk occurrence. It is important to note that all risks were linked with Business Objectives through means of Requirements. So, only those Business Objectives and Requirements were recorded having some risks associated with them. This exercise was also done by risk management teams and separate Requirement Document (Annexure E) and Business Objective Documents (Annexure D) were maintained for both the projects (Project-A & Project-B).

Identify Success Critical Stakeholders (SCSs)

As VRRM process model brings the concept of value in risk management process and the values are assessed by success critical stakeholders. So, it was very much critical to identify success critical stakeholder in order to complete the process of VRRM. The Theory of Salience applied in order to identify the Success Critical Stakeholders in both projects. Only definitive and discretionary types of stakeholders were considered as success critical stakeholder and consulted for the process of valuation due to the possession of attributes of Power and Legitimacy. On the Project-A, the identification and categorization of stakeholders was performed by project management team in close coordination with risk management team and author himself. However, on the Project-B, this exercise was performed by author and the Project Manger, due to non availability of proper project management team. The following identified as success critical stakeholders for both projects.

TABLE 4: PROJECT A - SUCCESS CRITICAL STAKEHOLDERS

Stakeholders	Type	Attributes		
		Power	Legitimacy	Urgency
Board Members	Dominant	Yes	Yes	No
President & Chief Executive Officer	Dominant	Yes	Yes	Yes
Senior Executive Vice President (Finance)	Discretionary	Yes	Yes	No
Executive Vice President (Finance)	Discretionary	Yes	Yes	No
Executive Vice President (Revenue Accounts)	Definitive	Yes	Yes	Yes
General Manager (Revenues)	Definitive	Yes	Yes	Yes
General Manager (Cost Accounts)	Discretionary	Yes	Yes	No
Senior Executive Vice President (Commercial)	Definitive	Yes	Yes	Yes
Executive Vice President (Multimedia & Broadband)	Definitive	Yes	Yes	Yes
Manager PMO (Multimedia & Broadband)	Definitive	Yes	Yes	Yes
Chief Information Officer	Definitive	Yes	Yes	Yes
Executive Vice President (Information Systems)	Definitive	Yes	Yes	Yes
General Manager (Billing Solutions)	Definitive	Yes	Yes	Yes
General Manager (Customer Care and Supported Solutions)	Definitive	Yes	Yes	Yes
Senior Executive Vice President (Operations)	Discretionary	No	Yes	No
Senior Executive Vice President (Business Zones)	Definitive	Yes	Yes	Yes
Executive Vice President (Business Zone North)	Definitive	Yes	Yes	Yes
Executive Vice President (Special Projects)	Definitive	Yes	Yes	Yes
Executive Vice President (Business Zone Central)	Definitive	Yes	Yes	Yes
Executive Vice President (Business Zone North-II)	Definitive	Yes	Yes	Yes
Regional General Manager (Central-I)	Definitive	Yes	Yes	Yes
Regional General Manager (Central-II)	Definitive	Yes	Yes	Yes
Senior Executive Vice President (Business Zone South)	Definitive	Yes	Yes	Yes
Executive Vice President (South)	Definitive	Yes	Yes	Yes
Executive Vice President (West)	Definitive	Yes	Yes	Yes
Regional General Manager(s)	Definitive	Yes	Yes	Yes
Senior Member Advisory Team	Discretionary	Yes	Yes	No
Member Advisory Team (Finance)	Discretionary	Yes	Yes	No
Member Advisory Team (Operations)	Discretionary	Yes	Yes	No
Member Advisory Team (Finance)	Discretionary	Yes	Yes	No
Member Advisory Team (Information Systems)	Discretionary	Yes	Yes	No
Member Advisory Team (Billing and Customer Care System)	Discretionary	Yes	Yes	No
Member Advisory Team (Multimedia and Broadband)	Discretionary	Yes	Yes	No
Company-A, Company-B	Definitive	Yes	Yes	Yes
Other solution providers	Definitive	Yes	Yes	Yes

TABLE 5: PROJECT B - SUCCESS CRITICAL STAKEHOLDERS

Stakeholders	Type	Attributes		
		Power	Legitimacy	Urgency
Customer	Definitive	Yes	Yes	Yes
Partner 1	Definitive	Yes	Yes	Yes
Partner 2	Definitive	Yes	Yes	Yes
Software Developer	Definitive	Yes	Yes	Yes
Channel Partners	Discretionary	No	Yes	Yes

Success Critical Stakeholders Assess Requirements' and Risks' Value

As per VRRM Process Model, requirements' value was to be assessed by success critical stakeholders in all three perspectives (Technical, Organizational & People). The stakeholders were given necessary overview, briefing and practice session prior to the exercise of value assessment in order to make the value assessments more appropriate. Net value for each requirement was calculated by aggregating the values of all success critical stakeholders. Subsequent to the requirements' value assessment, risks' values were also assessed in the same manners. The results of value assessment exercise were recorded in "Value Assessment Register" (Annexure G).

This activity was performed better for Project-A than Project-B. Although, some problems were faced due to the lack of interest from success critical stakeholders but issues were resolved due to the availability of dedicated risk management team of Project-A. But at Project-B, the problem was of lack of interest by implementation team and success critical stakeholders. The other problem was the lack of dedicated resources for risk management. The process of stakeholders' training and value assessment were highly impacted due to these issues. However, the exercise was completed through rigorous follow-ups and the results were recorded to the data store.

Calculate Net Value

The calculation of net value is done by risk management teams separately for both projects. In previous activity, values of requirements and their associated risks were assessed by success critical stakeholders. Similarly, net values for requirements and risks were calculated separately for requirements and their associated risks. As per recommendation of VRRM process model, both values were aggregated in order to get a single value for each

requirement's risk to evaluate them against the agreed threshold. The results were recorded in "Value Assessment Register" (Annexure G).

Evaluate Against Threshold

During this activity, net requirements' risk values were evaluated against the agreed threshold of five (5). In individual value assessment risk no. 5 and 18 of Project-A were having values lower than the agreed threshold, hence; not qualified for the treatments. But after aggregating the requirements' value, the net value of both risks became above the threshold level. As result of this activity all 24 risks were qualified for the treatment and their treatment planning was started.

Similarly, Project-B, three risks (5, 10 & 11) were having low values but after aggregating the requirements' value with risk's value, their value became higher than the threshold hence; all the risks were selected for treatment.

Establish Contingency

In the case of Project-A, the commercial and operations departments were negotiated to provide the kind of contingency required for the mitigation of the risks. However, in the other project the contingency could not allocated due to the non willingness of the management to mitigate the risks or execute the alternate treatments.

Place in Priority Order

This activity was a simple re-order of the risks on the basis of calculated net requirement's risk value. This was done by risk management team at Project-A and by the author himself for Project-B. Risk Assessment Registers (Annexure F) was reordered accordingly.

3.2.4. Treat

After completion of the analysis stage, all the accepted risks were passed on to the Treat group. In this group of activities, the mitigation strategies for the accepted risks were defined and executed in value based manners. This stage of implementation of VRRM process model was very crucial, as it needed too many resources and extra efforts to mitigate the risks before their occurrence. At this stage too many problems were faced at both projects due to the reluctance of companies to put extra human and material resources. Further, the issue remained to improvise the willingness of management to mitigate risks.

In the case of Project-A, the situation was satisfactory. Although, its management was reluctant to put extra resources on the process but minimum required resources were provided by the company to mitigate the risks. But in the case of Project-B, the necessary willingness was not there along with the non commitment of dedicated resources for implementation of alternate treatments. However, author tried his best to work with limited resources and the given situation. The complete process of risk treatment performed is as under:

Define Treatment Alternatives

Treatment alternatives for all risks were defined by risk management teams of both projects in close coordination with success critical stakeholders and necessary facilitation of the author. The defined alternatives were then discussed with project management team for their consent. After approval and recommendation of both project managers, the alternatives were presented to success critical stakeholders for value assessments. However, at Project-B, the alternatives were defined, analyzed and documented by the author himself with coordination of project manager (one of the company partners). Project manager's involvement was not sufficient during this activity due to the lack of interest in risk management. The identified treatment alternatives were recorded in "Risk Treatment Register" (Annexure H).

Define Measures for Effectiveness of Alternatives

The measures for effectiveness were established in terms of reaching to logical conclusion of execution of selected treatments from the defined alternates. It was notable that the alternates valued by the success critical stakeholders and their priorities defined accordingly.

Assess Value of Each Alternative

Similar to the value assessment of requirements and risks during analysis activity, values of treatment alternatives were also assessed by success critical stakeholders in Technical, Organizational and People (TOP) perspectives. Same process of value assessment was followed. Interviews and meetings with success critical stakeholders were conducted, in order to complete the activity. Same scales and measures were used and results of both projects were recorded separately in Risk Treatment Registers (Annexure H).

Calculate Net Value

Net values of treatment alternatives were calculated by aggregating the values of all success critical stakeholders for each treatment alternative. This exercise was done by risk

management team for Project-A and by the author Project-B. The results were recorded in Risk Treatment Register (Annexure H).

Evaluate Acceptability

This activity was a simple comparison of net values of treatment alternatives against the threshold of 5 established during the planning activity. In Project-A, it was analyzed that more that one alternatives for a risk qualified for the treatment of risk. In this situation, the matter was discussed with the project management team and success critical stakeholders to adopt the alternates assessed with maximum values for risk treatment.

In Project-A, the whole process of risk treatment was suffered due to lack of interest from success critical stakeholders and management of Company-B. The evaluation of acceptability was just the formality because no more than one treatment alternatives were identified for any risk. However, all the results of evaluation of both projects were recorded separately in data store of Risk Treatment Register (Annexure H).

Define Implementation Process for Selected Treatment

This step was about the planning for the treatment actions. In this activity, the steps for each selected treatment activity were defined. The resources were planned for the implementation of selected treatments. For Project-A, this activity was successfully performed by risk management team in coordination with the both project managers. However, for Project-B, as discussed in the previous sections, the author performed this planning. However; he completed this planning with little coordination of project manager, through applying his best knowledge and experiences. The recommendations for the planning were presented to project manager for consent and necessary feedback. After negotiations with him, the strategy to implement selected treatment was finalized.

Implement Treatment Alternative

Implementation of treatment alternatives was found to be the most difficult activity in the implementation of the VRRM process model. The companies and the risk management teams were reluctant to perform this activity despite agreeing to it as required extra efforts and resources. The lukewarm attitude and non-cooperation of management of both companies (Company-A & Company-B) was observed during execution of this activity.

For Project-A, the risks related to hardware sizing, integration with billing as one package and workflow for manual monitoring of new subscription cases were highlighted during early stage by the risk management team. Also, the alternate treatments were monitored rigorously for these risks in order to mitigate them. However, less importance were given by the Telecom Company for timely mitigation of these risks which resulted into their occurrence during transition phase. The business decisions were required with continuous will to execute their mitigation strategies. So, the only benefit yielded from execution of this activity was the necessary escalations earlier to the happening of uncertain events. The success critical stakeholders were having the earlier information and background knowledge. It is important to highlight that the decision making process took long time which was the main reason to respond to these risks.

For Project-B, this activity was recorded as a failure due to the lack of interest from management and the shortage of resources. The company's management did not provide necessary resources for risk treatment hence some activities were missed out from implementation. As a result of it, one risk was occurred during development and two during the support phase. The following were the highlights:

1. Due to the non-availability of requirement specification documentation, there were frequent changes in the software requirements from Web Company. The Company-B management was reluctant to incorporate those changes. So, at one stage the Web Company decided to close the project and asked for termination of contract due to this reason. However; the situation was managed by incorporating some of the requested changes to maintain relationship.

2. Hacking attempt was made to the website due to non-implementation of encryption of important contents (Risk No. 3). SSL security module was suggested for implementation during the treatment planning but licenses were not purchased which was the main reason in occurrence of the risk.

3. Critical data loss was observed during the support phase of the project due to crashing of the hosting server. This incident happened as backup strategy and responsibilities were not clearly defined for the system during planning phase.

3.2.5. Monitor & Control

Monitoring of the VRRM process model was performed on weekly basis for both the projects (Project-A & Project-B). Regular meetings were conducted with risk and project management teams for the purpose of effective tracking and monitoring to ensure the proper execution of the mitigation strategies. It was observed that some of the identified risks mitigated due to timely execution of the mitigation strategies for Project-A. However, for Project-A, the same strategy of regular meetings was applied but due to the lack of skilled and dedicated risk management team the implementation of the treatment activities suffered a lot. Time to time recommendations was also given for risk treatment but the implementation of risk treatment alternatives remained unsuccessful due to the lack of willingness to do so. The effective monitoring was also useful in order to identify the residual risks and recording of new risks into the risk register.

3.2.6. Evaluate

Define Evaluation Process

In case of Project-A, the quality assurance team was involved in order to ensure the execution of each and every activity of VRRM Process Model according to the process flow. The process execution was monitored for appropriate recording and updates in the artifacts and data stores. However, in the case of Project-B, Company-B did not have any team entrusted with quality assurance activities. Hence, the evaluation process was carried out by the author himself.

Evaluate Risk Management Process

The quality assurance (QA) team was having the mandate to monitor the activities in order to evaluate the risk management process on Project-A. The QA team engaged at various stages of execution of the VRRM Process model keeping in view the CMMI quality standards. The periodic reviews, meetings and interviews conducted to find out the variations from the VRRM process model. The variations were noted down and presented in the conclusion section along with the other results.

However, the author performed the similar evaluation for Project-B due to the non-availability of quality assurance team and quality standards. The willingness of the management was not up to the mark to study the assessment of variations from the VRRM

process model. However, the observations resulted from this activity for Project-A was used as a reference to the overall evaluation process.

3.3. Results

The following results are documented as a result of execution of VRRM Process Model on two separate projects.

1. The implementation of VRMM Process Model remained successful for both projects one executed by a company employing CMMI standard processes while other company was not practicing any industry standard.

2. The implementation of VRRM Process Model provided better risk management as the CMMI rated company yielded success rate of 88% while other company achieved the success rate 77%.

3. There was no conflict observed with business processes and practices of company having CMMI standards identified during the course of case study. It is important to mention that it inferred from the qualitative analysis and observance of the execution of activities by the company employing CMMI standard. Further, the quality assurance and risk management teams of the Company-A did not report any conflict.

4. The implementation of VRRM provided improved requirements risk management due to the following main reasons:

    a) Mandatory linkages of risks with the software requirements and then software requirements with the business objectives "risks – requirements – business objectives".

    b) Active involvement and ownership of success critical stakeholders as they determine and assign the value during three stages of requirements, risks and alternate treatments of risks.

    c) Concept of value embedded at main stages of the process. The success critical stakeholders assigned the values to the requirements, risks, and alternate treatments.

    d) No surprise risk identified during the course of both projects.

5. The problems faced during the implementation are:

    a) Awareness of value based risk management process

    b) Training to implementation team and success critical stakeholders about the value based risk management process

    c) Communication with success stakeholders as they determine the value three times

    d) Business priority to mitigate the identified risks

The other experiences recorded are given as under:

1. The resources engaged in the implementation process were given formal training sessions on Project-A. However, in the case of Project-B, only the project manager/owner of the company was engaged in the process of learning.

2. The concept of success critical stakeholders to value the requirements were greatly welcomed on Project-A. In fact, the success critical stakeholders never took risk management for software projects in value manners.

3. The real problems were faced in creating the awareness regarding the value based risk management process at early stage. It took less efforts in communicating its concepts and benefits on Project-A and required more push on the other project of Project-B.

4. The management on both projects convinced to employ VRRM Process Model and dedicate their resources to participate in the activities of implementation process. The influence of senior management and peers were also used before the start of implementation.

5. The timely availability of success critical stakeholders remained a challenge especially for Project-B where Company-B did not permit to talk or exchange emails with the stakeholders outside the country. However, the necessary communication was made through the owner of the company. The communication aspects should be studied more especially for Global Software Development required for implementation of VRRM.

6. It was observed that the software developers were having very little understanding about the general risk management process and especially for the concept of value in the overall software engineering.

7. The author himself involved very actively in managing the implementation process in Project-B due to the absence of risk and project management resources and awareness.

8. The alternate treatments could not be executed for three risks in Project-A and three risks for Project-B despite repeated efforts due to cumbersome negotiations of cost elements in terms of bringing the whole management to consensus.

The overall implementation of VRRM Process Model remained successful on both projects as all potential risks were identified and analyzed during early stages of the project lifecycle and no surprises were recorded at later stages. However; some risks were occurred due to the non implementation of the suggested treatment alternatives which was due to lack of cooperation from top management rather than process failure.

Table 6 describes the summary of the data recoded during the course of implementation of VRRM project on two separate projects. The data shows that implementation of VRRM yielded more percentage of success on Project-A as compared to the other project.

TABLE 6: VRRM CASE STUDY RESULT SUMMARY

Items	Project A	Project B
Identified risks	24	13
Process related risk	6	6
Product related risk	18	7
No. of requirements related to risks	10	12
No. of business objectives related to requirements	4	2
Total success critical stakeholder	31	5
Minimum value assessed for a risk	5.11	5.10
Maximum value assessed for risk	7.19	6.95
Average value assessed	6.1	6.05
No. of risks qualified for treatment	24	13
Total no of treatment alternatives identified	33	13
No. of risks mitigated	21	10
Risks occurred	3	3
Overall success rate of risk management	87.50%	76.92%

This case study on VRRM Process Model is first of its type as there are no enough efforts made in the area of evaluating the software risk management process model. While reviewing the existing literature, it was found that some good case studies have been done on Riskit Method, however; the context of those case studies is different than this particular research. Secondly, these all case studies are about a Riskit Method which is not the only available risk management method. Riskit Method uses a goal based approach based upon the stakeholders' interest. Probability and impact of each identified risk is calculated and analyzed separately for every stakeholder. On the issue of stakeholder involvement, Riskit is some how identical to VRRM Process Model but the concept of value in VRRM Process Model makes it more significant. In [2] the reported case study focuses on general advantages and disadvantages of Riskit method, while in [4] an effort is made on the same method to implement it on six different cases. This evaluation is more robust and extensive in which properly planned mechanism is used and predefined goals for the evaluation are achieved. Another research [1] is done on the evaluation of the overall risk management in four different companies using their own risk management policies, however; the high-level activities of the risk management were common. This research evaluates the overall impact of risk management on the companies' processes rather than evaluating a particular risk management model. Secondly, the cases under consideration are not the software development project which makes the comparison of this research with VRRM case study irrelevant. The case study on VRRM Process Model is of more importance with respect to any other model as:

1. VRRM Process Model introduces the value-based approach in addition to the traditional probability and impact matrix while analyzing the identified risks.

2. In VRRM, success critical stakeholders assign values to each of the requirements and their associated risk while in other risk management models probability and impacts are calculated on the expert judgment of risk management team. However; in Riskit Method, stakeholder involvement is some how similar to the VRRM.

3. In VRRM, stakeholders are consulted for evaluation at two stages: First, during risk analysis and the secondly, the risk treatment options are also evaluated by the success critical stakeholders. However, in rest of the risk management models the treatment options are decided by the risk management teams.

The only limitation of VRRM process model is that it focuses only on the requirements' related risks while Riskit Method covers the risk related to the complete project lifecycle.

Chapter 4 – Conclusion & Future Work

Value-based Requirements' Risk Management Process Model brings the innovation to the traditional risk management process, by introducing the concept of value into it. The value based management of the risks is introduced in this process model at two stages. Firstly, the risks are selected and prioritized in a value-based manner by keeping in focus all success critical stakeholders during the analysis phase. Secondly, the treatment of risks is also made value-based. During the selection of treatment alternatives, success critical stakeholders are consulted for there assessment about the treatment alternatives so that treatments having high values should be executed.

As discussed in the introduction section, this is the first of its kind of implementation in commercial environment for VRRM process model. Keeping in view the objectives of the case study, the VRRM Process Model implemented on two projects in separate companies to validate its claims and to know the practicalities and differences in its implementation between two companies one employing CMMI standards and other without practicing any industry standard.

The implementation process remained successful on two projects yielding the desired outcomes with known problems as the risk management team highlighted these risks to be occurred well before time. Few of the risks occurred as the both companies did not invest their resources timely to implement the suggested treatment alternatives. The awareness at the executive level was not realized along with the desired decisions for the purpose. The documented results show that the success rate remained high for the company employing the CMMI standard as compare to the other company which was not having the benefits realization to employ the industry standards or the standard risk management process.

The clear differences were observed on the Project B where the management was not willing to apply the resources for risk management and generally avoided the documentation necessary for this process. Further, the activities related to evaluation of VRRM Process Model should have been executed by the quality assurance team which was not available with Company-B. However, the smooth execution was experienced on Project-A where management was more keen and concerned to have successful delivery of software solution for the upcoming chartered revenue stream.

The problems faced by the practitioners have been highlighted during the proceedings presented in above sections. These problems should be used as lessons learned for future implementations of VRRM Process Model. The important observation is the non existence of formal mechanism to keep and maintain the historical project records and related data stores in software development companies. This may lead to the non-availability of historical data to these companies for future implementations.

During analysis phase, the activities of "Estimate Likelihood" and "Estimate Consequences" were observed as isolated work to be performed in the risk management process. These activities were performed and are part of risk register for both projects. However, there usage requires more clarification and linkage with the other activities of the process model. Further, the classification of risks into product and process categories requires deep considerations to be used effectively during the risk management process.

It is strongly suggested to develop a software tool for the automation of the activities of the VRRM Process Model so that it can easily adopted by the companies. The software tool shall help to minimize the management efforts required for its repeated usage by the industry. The project records and historical data shall remain available for future reference and repeatable artifacts and deliverables.

The future research should focus on further elaboration in Monitoring and Control activity to make it more robust and having controls at each stage of the abstract level-1 of the VRRM Process Model. Also, the activities of "Estimate Likelihood" and "Estimate Consequences" are somewhat isolated in the whole process.

In the end, the companies' willingness is required to amend their risk management policies and take risk management seriously in order to deliver the successful software solutions to their customers.

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Annexure

- Annexure A – Risk Policies
- Annexure B – Risk Management Plan
- Annexure C – Risk Categories
- Annexure D – Business Objectives
- Annexure E – Requirements Value Assessment Register
- Annexure F – Risk Register
- Annexure G – Risk Value Assessment Register
- Annexure H – Risk Treatment Register

Glossary

VRRM:	Value Based Requirements Risk Management
VBRM:	Value Based Risk Management
VBSE:	Value Based Software Engineering
CMMI:	Capability Maturity Model Integration
SCS:	Success Critical Stakeholders
Telecom Company:	The customer company of Project-A
Company-A:	The development company executed the Project-A
Project-A:	The first project employed the VRRM Process Model
Web Company:	The customer company of Project-B
Company-B:	The development company executed the Project-B
Project-B:	The second project employed the VRRM Process Model
B&CCS:	Billing and Customer Care System
Telecom:	Telecommunication
CCS:	Customer Care System
OSS:	Operations Support System
MS SP:	Mediation Service Provisioning
NBI:	North Bound Interface
MM&BB:	Multimedia and Broadband
QA:	Quality Assurance
IPTV:	Internet Protocol Television
PSTN:	Public Switched Telephone Network

AAA:	Authentication, Authorization, and Accounting
STB:	Set-Top Box
CA Card:	Conditional Access Card
GM:	General Manager
EVP:	Executive Vice President
SEVP:	Senior Executive Vice President
ERP:	Enterprise Resource Planning System
CPE:	Customer's Premises Equipment
SSL:	Secure Socket Layer
GSM:	Global System for Mobile Communications

Annexure A – Risk Policies

Company A

Risk management is very important to improve the Company-A business, products, services and solutions. The management aims to achieve best practices in managing all risks. To achieve this objective and aim, risk management standards involving risk identification and risk evaluation linked to practical and cost-effective risk control measures are in practice. The management is regularly evaluating and reviewing these measures and controls for the best fit for achieving strategic objectives.

The Risk management is a continuous process which requires risk awareness and proactive measures by all the resources and the partners who actively participate to eliminate the occurrence and impact of risk events.

The Risk Management Policies help the management to develop the overall program having the elements of:

- Development of risk management standards
- Assessment and prioritization of risks regularly
- Reporting to the management on risk and compliance with risk management policy

Risk management is the part of company's every day activity and considered with all customers, projects, products, services and solutions, stakeholders, partners. The risks which may affect the company are given as under:

- Reputation: The human resources, stakeholders in regard to providing the quality of all the services, products, solutions, information, recommendations worldwide
- The performance of the business priorities (milestones) agreed with the customers.
- The integrity of its decisions and processes
- The security of information of the company and customers businesses

The management's commitment to manage the risks to safeguard:

- Stakeholders
- Employees and their skills
- Quality of service, products and solutions
- Assets and intellectual property;
- Businesses
- Customers
- Timelines
- The image and repute of the company

Annexure A – Risk Policies

Company B

There is no risk policies exist for Company-B.

Annexure-B

RISK MANAGEMENT PLAN

Company-A

Document Number

Document Number	Document Date
RMP/001-01	

Document Version History

Version Number	Version Date	Summary of Changes	Remarks
Version 1.0.0	Xx		
Version 1.0.1	Xx	Risk management policy updated	
Version 1.0.2	Xx	Risk management process elaborated	

Table of Contents

1.0) Introduction

1.1 Purpose

This Risk Management Plan establishes the process for implementing proactive risk management as part of the implementation of the Company-A projects. The purpose of risk management is to identify potential problems before they occur, so that risk handling activities may be planned and invoked as needed to mitigate adverse impacts on achieving objectives. Risk management is a continuous process that addresses issues that could endanger achievement of critical objectives and includes aggressive risk identification through the collaboration and involvement of relevant stakeholders.

The document describes the process to:

- Identify risk events and risk owners
- Evaluate risks with respect to likelihood and consequences
- Access the options for the risks and develop mitigation plans
- Track risk mitigation efforts
- Conduct periodic reassessments of risks

1.2 Objectives

- To identify and prioritize potential risk events
- Help develop risk management strategies and risk management plans
- Use established risk management methods, tools and techniques to assist in the analysis and reporting of identified risk events
- Find ways to identify and evaluate risks
- Develop strategies and plans for lasting risk management strategies

1.3 When to use a risk plan?

This plan is undertaken prior to the Execution phase to ensure that any risks identified are addressed during the course of execution of project. Immediately after the plan has been agreed and signed off, the Risk Management Process will be engaged to ensure the effective risk management by the risk management team.

The Risk Management Process is terminated on the closure of the project.

1.4 Audience

The intended audience of the Risk Management Plan is given as under:

- Project steering committee
- Executive management
- Project management office
- Project and project management team
- Risk management team
- Business process owners

1.5 Definitions

Risk - A risk is defined as any event which is likely to; adversely affect the ability of the project to achieve the defined objectives.

Risk Assessment - The overall process of risk identification, risk analysis and risk evaluation.

Risk Management - The culture, processes and structures that are directed towards realizing potential opportunities, whilst managing adverse effects

Risk Reduction - Actions taken to reduce the likelihood, negative consequences or both, associated with a risk

Risk Treatment - The process of selection and implementation of measures to modify risk

Risk Transfer - The process of selection and implementation of measures to modify risk.

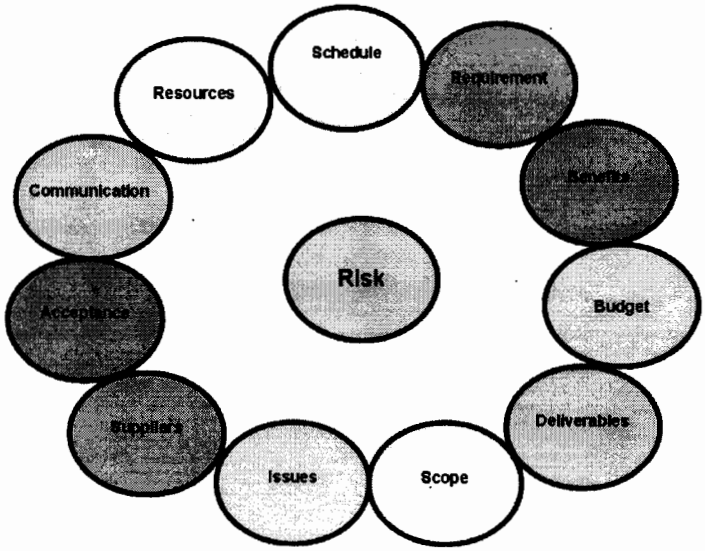
Risk Acceptance - Risk acceptance is the acknowledgement that there is a risk and of the consequences that may result, which is accepted.

2.0) Risk Management Policy

2.1 General risk area

Non-exhaustively, listed below are the likely categories of risks defined as per Risk Management Policy. Each risk category is a particular aspect of the project which is likely to experience a risk during the lifecycle of the project:

- Requirements
- Benefits
- Schedule
- Budget
- Deliverable
- Scope
- Issues
- Supplier
- Acceptance
- Communication
- Resource



2.2 Categories

The likely risks for each category provided above are allocated a unique identifier (id) number.

Category	Description	Id
Requirements	• The requirements have not been clearly specified • The requirements specified do not match the customer needs • The requirements specified are not measurable	1.1 1.2 1.3
Benefits	• The business benefits have not been identified • The business benefits are not quantifiable • The final solution delivered does not achieve the required benefits	2.1 2.2 1.3
Schedule	• The schedule does not provide enough time to complete the work • The schedule does not list all of the activities and tasks required • The schedule does not provide accurate dependencies	3.1 3.2 3.3
Budget	• The project exceeds the budget allocated • There is unaccounted expenditure on the project • There is no single resource accountable for recording budgeted spending	4.1 4.2 4.3
Deliverables	• The deliverables required by the project are not clearly defined • Clear quality criteria for each deliverable have not been defined • The deliverable produced does not meet the quality criteria defined	5.1 5.2 5.3

Scope	• The scope of the project is not clearly outlined • The project is not undertaken with the agreed scope • Project changes negatively impact on the project	6.1 6.2 6.3
Issues	• Project issues are not resolved within an appropriate timescale • Similar issues continually reappear throughout the project • Unresolved issues become new risks on the project	7.1 7.2 7.3
Acceptance	• The criteria for accepting project deliverables are not clearly defined • The customer does not accept the final deliverable on the project • The acceptance process leaves the customer dissatisfied	8.1 8.2 8.3
Communication	• Lack of controlled communication causes project issues • Key project stakeholders are left in the dark about progress	9.1 9.2
Resource	• Staff allocated to the project are not suitably skilled • Insufficient equipment is available to undertake the project • There is a shortage of materials when required	10.1 10.2 10.3

2.2 Key principals in risk management

The following key principles outline the approach to risk management as per defined policy:

- **Establishing the risk context** – the strategic and organizational context within which the risk management process will take place.

- **Risk identification, analysis and assessment** – the identification of what, why and how events may arise, the determination of existing controls, and an analysis of risks in terms of the likelihood and impact of risk in the context of those controls.

- **Risk control or treatment** – for high impact risks, risk management team will develop and implement specific risk management plans, lower impact risks may be accepted and monitored.

- **Oversight and review** - of the Risk Register and any changes that might affect it. Monitoring and review occurs throughout the risk management process.

- **Communicating and consultation** – appropriate communication and consultation will take place with internal and external stakeholders at relevant stages of the risk management process in a way that will enable to minimize losses and capitalize on opportunities.

3.0) Risk management process

The risk management process is comprised of four phases: identification, assessment, handling and monitoring. The following paragraphs describe the process used by the project to identify and manage its risks.

- **Risk Identification** – Examine all project elements in detail. Identify, describe, and document cost, schedule, technical, financial, and other risks. Begin the identification process during the capture phase and continue throughout the project life cycle.

- **Risk Assessment** – Evaluate the identified risks for probability of occurrence and potential impact. Estimate project exposure and establish risk-handling priorities. Qualitative assessments may be used as an initial filter but all Medium and high risks must be assessed quantitatively. Express quantitative assessments (e.g., rough order of magnitude [ROM], range of impact, factored impact, etc.) in terms of dollars, time, and performance impact, as applicable.

- **Risk Handling** – Identify risk-handling options (i.e., mitigation, transfer, avoidance, assumption) and action plans, including contingency actions with implementation criteria and decision dates. Assign an owner to each risk and action plan. Ensure that risk handling plans document the criteria (i.e., observable, test, data, documentation) that justify the planned, sequential reduction of quantitative risk levels over time.

- **Risk Monitoring** – Track progress against action plans and established metrics to ensure timely completion of actions. Include action plans in the project integrated master schedule (IMS). Include risk name, description,

identification date, owner, action plans, milestones, status, and contingency actions in the risk management database. Risk owners must provide status at least monthly.

3.1 Risk identification

Risk identification is the process of examining the project areas and each critical technical process to identify and document the associated risk. The identification of potential issues, hazards, threats, and vulnerabilities that could negatively affect work efforts or plans is the basis for the risk management strategy. The following methods will be used for identifying risk:

- Conductance of a risk assessment
- Interviews with subject-matter experts for the sub-store implementation
- Reviewing risk management efforts from similar products
- Examination of lessons-learned documents or databases
- Examination of design specifications and agreement requirements

Individual team members involved in the detailed day-to-day field activities of the Company-A projects are the most aware of the potential problems (i.e., risks) that need to be managed. Part of the risk assessment process will be to survey the team members for potential risk events and circumstances. The process accumulates and documents information on events or circumstances that will be evaluated to determine any potential adverse impact on the optimization activity. The following indicators should be used:

- Lack of stability, clarity or understanding of requirements
- Failure to use best practices
- New processes
- Insufficient resources
- Negative trends or forecasts

3.2 Risk assessment

Risk assessment is the process of analyzing known risks and prioritizing them based on their threat in the attainment of project goals. During the assessment phase, the project analyzes each risk to isolate its cause and to determine its effects. The project rates the risk in terms of its probability of occurrence and its severity of impact to schedule (i.e., time) and technical performance, as applicable.

The risk impact is a measure of how the project is affected if the risk issue materializes. Qualitative assessments may be used as an initial filter, but all high and Medium risks must be assessed quantitatively.

Qualitative Risk Assessment

The criterion for qualitative risk assessment is as follows:

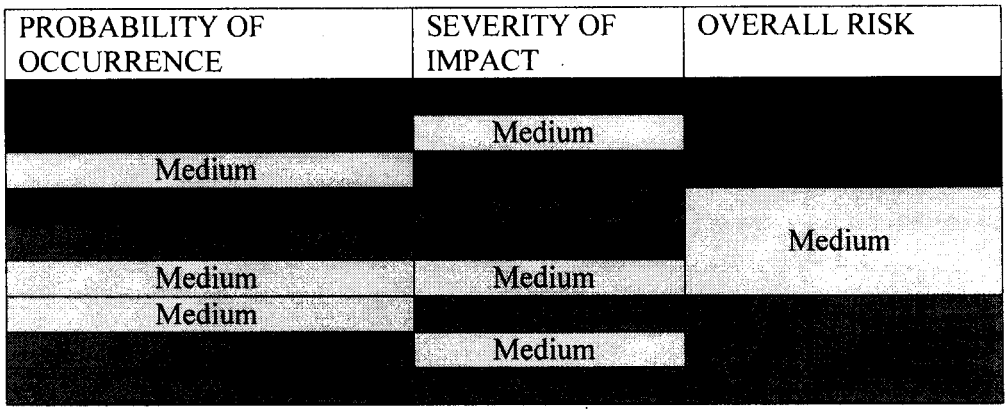
- A high-occurrence of the undesirable event will result in:
  - Inability of the system to meet primary functional requirements
  - Unacceptable system performance to the end users
  - Late system delivery
  - A project cost overrun that is not containable within management reserve

- A Medium occurrence of the undesirable event will result in:
  - Some system requirements not being met
  - A negative impact to a particular feature important to the end user
  - Major intermediate milestones not being met
  - A cost overrun that is containable within management reserves

- A low occurrence of the undesirable event will result in:
  - Some system requirements not being met
  - Minor degradation of system performance
  - Intermediate milestones not being met, therefore, putting a major milestone in jeopardy

Quantitative Risk Assessment

Overall risk assessment is the product of combining the probability of occurrence with the severity of impact as follows:



3.3 Risk handling

Risk handling is the process that identifies, evaluates, selects, and implements options to set risk at acceptable levels given project constraints and objectives. This includes the specifics on what should be done, when it should be accomplished, who is responsible, and associated cost and schedule. The handling strategy is determined by the overall risk assessment rating as indicated below.

Overall Risk	Handling Strategy
	The risk is tracked on a daily basis until the risk is closed. The risk owner documents risk avoidance actions (i.e., actions taken to avoid or eliminate the source of the risk, and reduce the probability of occurrence to zero), risk mitigation actions (i.e., actions taken to mitigate the severity of the impacts of a risk and reduce the consequence to zero), and contingency actions (i.e., actions taken to protect the attainment of the project goals and to lower risk items).
Medium	This strategy provides the same handling as that for high risks, but on a less frequent basis (i.e., periodic risk status reviews, instead of daily).
	The team lead adds the risk to the "watch list" for possible escalation.

For each of these actions, measurable tracking criteria and decision dates are documented.

The most critical component of risk handling is the development of alternative courses of action, workarounds, and fallback positions, with a recommended course of action for each critical risk. Options for handling risks typically include alternatives such as the following:

- Risk avoidance by changing or lowering requirements, while still meeting user needs
- Risk control by taking active steps to minimize risks
- Risk transfer by reallocating design requirements to lower the risks
- Risk monitoring by watching and periodically reevaluating the risk for changes to the assigned risk parameters
- Risk acceptance by acknowledging the risk but not taking any action

3.4 Risk monitoring

Risk monitoring is the process that systematically tracks and evaluates the performance of risk-handling actions against established metrics throughout the acquisition process and develops further risk-handling options, as appropriate. To effectively control and manage risks during the work effort, the project regularly monitors the risks and the status/results of risk-handling actions. This includes the establishment of a schedule for each risk-handling activity that includes the start date and anticipated completion date, a list of commitment of resources for each to allow successful execution of the risk-handling activities and the ultimate results of the actions taken.

3.5 Risk documentation

The risks identified will be documented in the "Risk Register".

3.6 Risk treatment schedule and plan

The treatment of the potential risks identified will be scheduled and planned accordingly. The risks need to be scheduled as per severity and impact.

3.7 Risk action plan

For those risks that are High, Extreme or deemed to be unacceptable, they need to be evaluated and specific action plans need to be developed to manage the risk appropriately.

Annexure-B

RISK MANAGEMENT PLAN

Company-B

Document Number

Document Number	Document Date
RMP/001-01	

Document Version History

Version Number	Version Date	Summary of Changes	Remarks
Version 1.0.0	Xx		First version of risk management plan

Table of Contents

1.0) Introduction

1.1 Purpose

This Risk Management Plan establishes the process for implementing proactive risk management as part of the implementation of the Project-B. The purpose of risk management is to identify potential problems before they occur, so that risk handling activities may be planned and invoked as needed to mitigate adverse impacts on achieving objectives. Risk management is a continuous process that addresses issues that could endanger achievement of critical objectives and includes aggressive risk identification through the collaboration and involvement of relevant stakeholders.

The document describes the process to:

- Plan
- Identify
- Analyze
- Treat
- Monitor & Control
- Evaluate

1.2 Objectives

- Identify and prioritize potential risk events
- Use established risk management methods, tools and techniques to assist in the analysis and reporting of identified risk events
- Find ways to identify and evaluate risks
- Prioritize risks
- Mitigation of identified Risk
- Develop strategies and plans for lasting risk management strategies (Contingency planning)

1.3 When to use a risk plan?

This plan is undertaken prior to the Execution phase to ensure that any risks identified are addressed during the course of execution of project. Immediately after the plan has been agreed and signed off, the Risk Management Process will be engaged to ensure the effective risk management by the risk management team.

The Risk Management Process is terminated on the closure of the project.

1.4 Audience

The intended audience of the Risk Management Plan is given as under:

- Project management office
- Project and project management team
- Risk management team
- Business process owners

1.5 Definitions

Risk - A risk is defined as any event which is likely to; adversely affect the ability of the project to achieve the defined objectives.

Risk Management - The culture, processes and structures that are directed towards realizing potential opportunities, whilst managing adverse effects

Risk Identification

Risk Analysis

Risk Value Assessment

Risk Acceptance - Risk acceptance is the acknowledgement that there is a risk and of the consequences that may result, which is accepted.

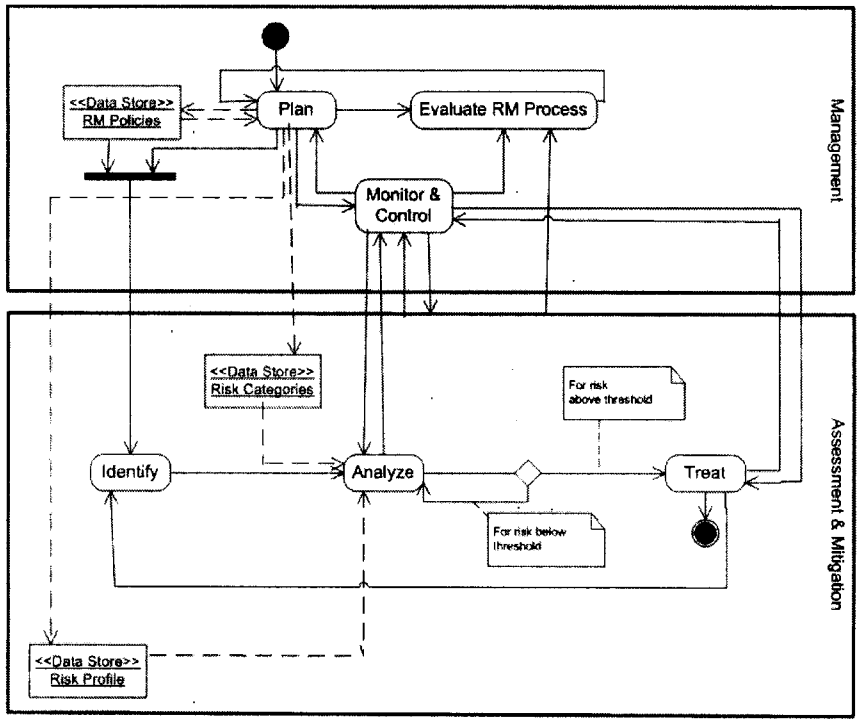
Risk Treatment - The process of selection and implementation of measures to modify risk

2.0) Risk Management Policy

2.1 General risk area

Non-exhaustively, listed below are the likely categories of risks defined as per Risk Management Policy. Each risk category is a particular aspect of the project which is likely to experience a risk during the lifecycle of the project:

- Requirements
- Benefits
- Schedule
- Scope



2.2 Categories

The risks are categorized into Product related risks and Process related risks.

Annexure C - Risk Categories

S.N.	Category	Description
1	Product	The risks associated with the resultant of the execution of the processes and project management activities.
2	Process	The risks associated with the processes require in order to produce the intended product.

Annexure D – Business Objectives

Company A

1) Vision

To be the leading Information and Communication Technology Service Provider in the region by achieving customer satisfaction and maximizing shareholders' value'.

The future is unfolding around us. In times to come, we will be the link that allows global communication. We are striving towards mobilizing the world for the future. By becoming partners in innovation, we are ready to shape a future that offers telecom services that bring us closer.

To achieve our vision by having:

1.1 An organizational environment that fosters professionalism, motivation and quality

1.2 An environment that is cost effective and quality conscious

1.3 Services that are based on the most optimum technology

1.4 "Quality" and "Time" conscious customer service

1.5 Sustained growth in earnings and profitability

2) Short Term Objectives

2.1 Development of a medium to long term strategic master plan with defined corporate KPIs, targets, timelines where the technology and the operational plans are driven by commercial requirements.

2.2 Internal restructuring of the Company whereby the Company's traditional operational regions are converted into target oriented 'business units' with prime focus being on 'customer care'.

2.3 Maintain the position of Next Generation Carrier by offering converged services to the consumers, business and carrier markets

2.4 Re-engineering and automating the existing internal processes within the Company. This is done by bringing in the automated ERP (Enterprise Resource Planning) tool,

ensuring that the processes within the Company are all made fast and efficient so as to cater for all internal and external Customers' modern needs.

2.5 Induction of a state of the art billing and customer care system. This is expected to go a long way in addressing the modern day customers' needs and offering more flexible and customer friendly service packages.

2.6 Convergence and integration of back-end systems and technology platforms for effective delivery of services to meet the customers' expectations

2.7 Strategic investment in infrastructure development and addition of network capacity with a view to enhance services and to expand its reach across the country.

2.8 Launching and strengthening of IPTV, Triple Play and Converged Services

2.9 Migration to an end to end IP based network

2.10 Investment strategies such as M&As for risk diversification and improved ROIs

2.11 Re-brand Company as a modern and 'customer centric' national carrier to reflect the commitment to our customers that will come through state of the art customer services.

3) Core Values

3.1 Professional Integrity

3.2 Customer Satisfaction

3.3 Teamwork

3.4 Company Loyalty

Company B

1. To provide superior quality software solutions to customers by understanding their business needs
2. To streamline the business operations by providing 24x7 system's operation support.
3. To have a partnerships with our clients to devise solutions that impact business goals
4. To focus on boosting the profitability and enhancing the productivity of the Company B
5. To enhance the business opportunities by resolving the business problems through best technologies
6. To maximize the business profits by offering the cutting edge software products and services in international market

Annexure-I: Project-A Requirements' Value Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				Net Stakeholder's Value
			Technical	Organization	People	Agg	
1.2	Company-A proposed a best-fit "Supply/Provision, Installation, Implementation and Support of Project-A on B&CC Platform" that should meet the requirements of the Telecom Company to provide Real-time or near real-time billing and customer care functions	SEVP Finance	5	5	4	4.67	5.56
		Chief Information Officer	3	5	1	3.00	
		SEVP Commercial	9	8	3	6.67	
		EVP MM&BB	2	8	3	4.33	
		EVP Information Systems	8	5	2	5.00	
		EVP Finance	10	8	6	8.00	
		Senior Member Advisory Team	4	7	4	5.00	
		GM Billing Solution	4	9	3	5.33	
		GM CC& SS	9.5	8	4	7.17	
		Manager PMO MM&BB	9	7	5	7.00	
		Company-A	9	4	2	5.00	
2.1	New PSTN, New Broadband, New IPTV	SEVP Commercial	7	7	2	5.33	6.36
		SEVP Business Zone North	5	9	6	6.67	
		SEVP Business Zone South	6	8	5	6.33	
		Chief Information Officer	8	7	3	6.00	
		EVP Information Systems	9	9	6	8.00	
		GM Billing Solution	8	8	5	7.00	
		GM CC& SS	7	7	3	5.67	
		EVP MM&BB	9	8	4	7.00	
		Manager PMO MM&BB	7	6	4	5.67	
		Regional General Manager(s)	7	6	5	6.00	
		Company-A	8	5	6	6.33	
2.2	Existing PSTN, New Broadband, New IPTV	SEVP Commercial	4	6	4	4.67	5.94
		SEVP Business Zone North	5	8	5	6.00	
		SEVP Business Zone South	4	7	3	4.67	
		Chief Information Officer	9	9	6	8.00	
		EVP Information Systems	8	8	5	7.00	
		GM Billing Solution	7	7	3	5.67	
		GM CC& SS	9	8	4	7.00	
		EVP MM&BB	7	6	4	5.67	
		Manager PMO MM&BB	7	6	5	6.00	
		EVP HR&A	5	8	4	5.67	
		Regional General Manager(s)	4	6	5	5.00	

Annexure E: Project-A Requirements Valite Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				Net Stakeholder's Value
			Technical	Organization	People	Agg	
		Company-A	7	5	6	6.00	
2.4	Post Installation Services	SEVP Commercial	4	9	5	6.00	6.67
		SEVP Business Zone North	5	7	5	5.67	
		SEVP Business Zone South	4	8	5	5.67	
		Chief Information Officer	8	7	4	6.33	
		EVP Information Systems	8	5	4	5.67	
		GM Billing Solution	5	8	7	6.67	
		GM CC& SS	6	7	7	6.67	
		EVP MM&BB	9.5	7	5	7.17	
		Manager PMO MM&BB	8	8.5	7	7.83	
		EVP HR&A	10	8	8	8.67	
		Regional General Manager(s)	9	6	6	7.00	
		Company-A	8	7	5	6.67	
2.4.2	Permanent Close	Chief Information Officer	3	7	3	4.33	5.07
		EVP Information Systems	6	6	5	5.67	
		GM Billing Solution	6	7	3	5.33	
		GM CC& SS	5	7	3	5.00	
		Company-A	6	5	4	5.00	
2.4.3	Temporary Close due to non payment	Chief Information Officer	4	6	3	4.33	4.86
		EVP Information Systems	5	6	7	6.00	
		GM Billing Solution	4	5	8	5.67	
		GM CC& SS	3	7	6	5.33	
		EVP MM&BB	5	4	6	5.00	
		Manager PMO MM&BB	3	4	4	3.67	
		Company-A	4	5	3	4.00	
2.4.4	Temporary close on customer request	Chief Information Officer	4	5	8	5.67	4.73
		EVP Information Systems	3	7	6	5.33	
		GM Billing Solution	5	4	6	5.00	
		GM CC& SS	3	4	4	3.67	
		Company-A	4	5	3	4.00	

Annexure E: Project-A Requirements' Value Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				Net Stakeholder's Value
			Technical	Organization	People	Agg	
2.6	Packages	Chief Information Officer	7	8	4	6.33	6.00
		EVP Information Systems	8	7	3	6.00	
		GM Billing Solution	7	6	4	5.67	
		GM CC& SS	9	8	3	6.67	
		EVP Revenue Accounts	8	6	4	6.00	
		GM Revenue	7	7	5	6.33	
		GM Cost Accounts	6	7	3	5.33	
		Company-A	7	6	4	5.67	
2.9	Inventory Management	SEVP Commercial	5	6	5	5.33	6.13
		SEVP Business Zone North	7	7	3	5.67	
		SEVP Business Zone South	6	9	2	5.67	
		EVP Business Zone Centeral	9	8	2	6.33	
		EVP Business Zone North	5	7	6	6.00	
		EVP Revenue Accounts	6	9	5	6.67	
		GM Revenue	5	7	2	4.67	
		EVP Finance	6	7	2	5.00	
		EVP MM&BB	4	10	6	6.67	
		Manager PMO MM&BB	4	9.5	5	6.17	
		Chief Information Officer	7	9	4	6.67	
		EVP Information Systems	8	8	7	7.67	
		GM Billing Solution	9	8	4	7.00	
		GM CC& SS	8	7	5	6.67	
		Regional General Managers	7	6	6	6.33	
		Senior Member Advisory Team	8	5	3	5.33	
		Company-A	7	7	5	6.33	
2.11	B&CC-OSS External Interface	Chief Information Officer	8	7	5	6.67	6.33
		EVP Information Systems	9	8	3	6.67	
		GM Billing Solution	7	8	6	7.00	
		GM CC& SS	8	7	3	6.00	
		Other solution provider	6	5	5	5.33	
		Company-A	9	6	4	6.33	

Annexure E: Project-A Requirements Value Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				Net Stakeholder's Value
			Technical	Organization	People	Agg	
	Over all Requirements for Project-A	EVP Revenue Account	6	7	5	6.00	6.17
		GM Revenue	7	7	3	5.67	
		SEVP Commercial	6	9	2	5.67	
		EVP MM&BB	9	8	2	6.33	
		Manager PMO MM&BB	8	7	6	7.00	
		Chief Information Officer	8	9	5	7.33	
		EVP Information Systems	8	7	2	5.67	
		GM Billing Solution	6	7	2	5.00	
		GM CC& SS	7	8	6	7.00	
		SEVP Business Zones	7	9.5	5	7.17	
		EVP Business Zones ITR & RTR	7	9	4	6.67	
		EVP Special Projects	5	8	7	6.67	
		EVP Business Zone	6	8	4	6.00	
		EVP Business Zone	5	7	5	5.67	
		RGM Centeral-I	5	7	6	6.00	
		RGM Centeral-II	7	8	3	6.00	
		SEVP Business Zone South	4	7	6	5.67	
		EVP South	5	7	5	5.67	
		EVP West	7	8	6	7.00	
		Regional General Manager(s)	8	7	3	6.00	
		Company-A	8	5	5	6.00	
		Other solution provider	7	6	4	5.67	

Annexture E: Project-B Requirements' Value Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				
			Technical	Organization	People	Agg	Net Req. Value
1	**Online shopping** • This feature should be similar to www.shopping.com • Visitor to be able to browse through various categories of products and see the appropriate details and related description	Customer	6	10	6	7.33	7.33
		Partner 1	9	8	4	7.00	
		Partner 2	9	9	5	7.67	
2	**Cellular Library** • Online manufacturer wise product catalogues • Product descriptions along with the images • Management of the contents	Customer	5	8	8	7.00	7.00
		Partner 1	8	7	6	7.00	
		Partner 2	9	7	5	7.00	
3	**Phone's unlocking (GSM & Others)**	Customer	4	7	7	6.00	5.33
		Partner 1	6	4	5	5.00	
		Partner 2	7	5	3	5.00	
4	**News**	Customer	2	4	6	4.00	4.33
		Partner 1	4	3	7	4.67	
		Partner 2	5	3	5	4.33	
5	**World clock**	Customer	4	5	7	5.33	5.56
		Partner 1	7	4	5	5.33	
		Partner 2	5	5	8	6.00	
6	**Products description and highlights**	Customer	3	8	7	6.00	4.89
		Partner 1	4	5	4	4.33	
		Partner 2	5	4	4	4.33	
7	**Channel Partners Links** • Jobs • Travels • Travel sims • Ringtones	Customer	3	7	5	5.00	4.42
		Partner 1	2	5	5	4.00	
		Partner 2	2	5	4	3.67	
		Channel Partners	4	8	3	5.00	

Annexure E: Project-B Requirements' Value Assessment Register

S.N.	Requirements	Stakeholders	Stakeholders-Requirement's Value				
			Technical	Organization	People	Agg	Net Req. Value
8	**Maintenance of main and admin site**	Customer	5	8	3	5.33	5.67
		Partner 1	9	6	4	6.33	
		Partner 2	8	7	3	6.00	
		Software Developer	8	5	2	5.00	
9	**Manage Discounts**	Customer	5	9	6	6.67	6.33
		Partner 1	7	7	5	6.33	
		Partner 2	6	7	5	6.00	
10	**Shipping Methods Management**	Customer	7	8	5	6.67	6.33
		Partner 1	7	7	5	6.33	
		Partner 2	8	6	4	6.00	
11	**PAYMENT GATEWAY INTEGRATION** Payment gateway information to be provided by you would be integrated for taking payments from your site's customers.	Customer	4	9	6	6.33	6.78
		Partner 1	8	8	4	6.67	
		Partner 2	9	7	6	7.33	
12	**Estimated Total Time**	Customer	5	8	6	6.33	6.67
		Partner 1	8	9	4	7.00	
		Partner 2	7	8	5	6.67	
13	**Overall Requirements for Project-B**	Customer	6	8	6	6.67	5.93
		Partner 1	8	7	4	6.33	
		Partner 2	7	8	5	6.67	
		Channel Partners	4	5	5	4.67	
		Software Developer	6	6	4	5.33	

Annexure F: Project-A Risk Register

Impact Scale

Low:	*0.1 to 0.3*
Medium:	*0.4 to 0.6*
High:	*0.7 to 1.0*

S.N.	Risk	Category	Req. Ref	Bus Obj Ref	Likelihood (1-10)	Impact (Low/Med/High)	Magnitude (Likelihood x Impact)	Net Requirement's Risk Value
1	The integration of "Project-A" billing with the other system of "Billing and Customer Care System (B&CC)" feared to be major problem due to its non maturity in terms of packaging the value added services having different price parameters.	Product	2.11	2.6	8	0.9	7.2	6.95
2	Software development team lacks in knowledge and necessary experience require for understanding the complexity of heterogeneous network elements. It was further examined that the Telecom Company team coupled with the software development team also has little knowledge of Telecom Company network elements. So, it was feared that software applications may have inconsistent performance when deployed in various cities of Pakistan.	Process	All	2.8	7	0.9	6.3	6.87
3	The requirements were missing the interfaces with Complaint Management System for managing the customer complaints, their tracking and resolution.	Product	2.11	2.6	8	1	8	6.60
4	The integration of IPTV System with North Bound Interface (NBI) of third party was identified as a major risk due to the conflicting business interests between two companies and close nature of both systems.	Product	2.11	2.8	9	0.9	8.1	6.56
5	The requirements were missing the interfaces with ERP System in terms of managing the inventories of Customer Premises Equipment (CPE) and receivables from subscribers especially when packaged on monthly installments. The requirements also ignored the management of inventories of CPEs returned to Telecom Company as faulty or at the time of discontinuation of services by subscribers.	Product	2.9	2.6	9	0.8	7.2	6.31
6	The requirements missing the adequate details about the billing of IPTV services when packaged with PSTN and Broadband Services. The impact on revenues was feared due to this critical risk.	Product	2.11	2.5	8	0.75	6	6.31
7	The integration of "Project-A" with Operational Support System (OSS) due to non-availability of updated technical specifications and documentation.	Product	2.11	2.6	8	0.7	5.6	6.17

Annexure F: Project-A Risk Register

Impact Scale

Low:	*0.1 to 0.3*
Medium:	*0.4 to 0.6*
High:	*0.7 to 1.0*

S.N.	Risk	Category	Req. Ref	Bus Obj Ref	Likelihood (1-10)	Impact (Low/Med/High)	Magnitude (Likelihood x Impact)	Net Requirement's Risk Value
14	The system users were not estimated and documented with requirements leading to improper regression and stress test of the software application.	Process	All	2.8	9	0.8	7.2	6.04
15	The initially gathered software requirements feared to vary/ change as the operation's line staff (linemen, CPE installers and broadband officers) was not consulted during the whole process. It was also identified it as a major risk as it may bring the changes in requirements and eventually change the scope of work.	Process	All	2.11	8	0.7	5.6	6.00
16	The requirements do not cover the necessary management of quality metrics with regards to the performance. This was noted with care that the Project-A will be deployed in the environment containing heterogeneous systems by different manufacturers.	Process	All	2.8	8	0.7	5.6	5.92
17	The requirements were missing the end-to-end definition of business processes leading to the non-management of process exceptions. This was feared piling up the pending cases for new subscriptions and other services to subscribers.	Product	2.2	2.6	9	0.8	7.2	5.91
18	The requirements do not cover the effective workflow or alert system with regards to new subscriptions and discontinuation of service at the stage of interface with "Radius".	Product	2.1.2.4	2.8	8	0.8	6.4	5.88
19	The necessary details with regards to billing of Project-A services as a single product were missing in the requirements. Some un-documented assumptions were noted in order to streamline its billing process.	Product	2.6	2.6	7	0.7	4.9	5.82
20	An extra step was introduced in the process of new subscriptions or change in the existing subscriptions at the stage of Line Qualification Testing leading to the delays in providing services to subscribers. This extra step could have been avoided easily.	Product	2.1	2.6	6	0.8	4.8	5.78

Annexure F: Project-A Risk Register

Impact Scale

Low:	*0.1 to 0.3*
Medium:	*0.4 to 0.6*
High:	*0.7 to 1.0*

S.N.	Risk	Category	Req. Ref	Bus Obj Ref	Likelihood (1-10)	Impact (Low/Med/High)	Magnitude (Likelihood x Impact)	Net Requirement's Risk Value
21	Mandatory fields were not identified at the stage of Line Qualification Testing (LQT) leading to the extra efforts required at input screen of Resource Management.	Product	2.1	2.8	7	0.7	4.9	5.58
22	The requirements do not cover the dimensioning of hardware required to run the software applications. The undocumented assumption was that these software applications shall operate on the same hardware landscape dedicated for overall suite of products of "Billing & Customer Care System". Further, the hardware was not planned to be segregated virtually even on the same landscape. This risk was declared as a critical risk keeping in view the spread of geography of System roll out and number of subscribers.	Product	1.2	2.8	9	0.7	6.3	5.54
23	The requirements and policies regarding the disconnection of Project-A services were not chalked out in detail. This was feared as a major problem at the stage of User's Acceptance Testing and issuance of Final Acceptance Certificates require for closure of project in connection with Complaint Management System. This might lead to the decisions based upon the individuals' judgments rather to be driven through a formal process in the System.	Product	2.4.2, 2.4.3, 2.4.4	2.8	8	0.9	7.2	5.33
24	In the area of entering the subscriber's information, the field lengths and their types were not clearly documented that may lead to the failure in accepting the data during its usage.	Product	2.1	2.8	7	0.6	4.2	5.10

Annexure F: Project B Risk Register

Impact Scale

Low:	*0.1 to 0.3*
Medium:	*0.4 to 0.6*
High:	*0.7 to 1.0*

S.N.	Risk	Category	Req. Ref	Bus Obj Ref	Likelihood (1-10)	Impact (Low/Med/High)	Magnitude (Likelihood x Impact)	Net Requirements' Risk Value
1	The requirement document does not contain any information regarding encryption of sensitive information related to processing of electronic payments.	Product	2, 32	1	7	0.9	6.3	7.19
2	The System may face the compatibility problems as the site is being revamped from static contents to database driven contents with induction of many critical features.	Product	4	1	6	1	6	6.94
3	The requirements of Maintenance of Static Contents are open in nature and may lead to additions in scope of work.	Product	4	1	7	0.8	5.6	6.94
4	The schedule may slip as the deliverables are not clearly marked with the timelines.	Process	34	2	8	0.8	6.4	6.67
5	It is feared that changes in the online shopping module as it contains the vague requirements in the form of reference with www.shopping.com.	Process	2	1	7	0.8	5.6	6.33
6	The back up strategy is not agreed with customer that may lead to eventual loss of critical data and finance loss.	Process	All	2	8	1	8	6.30
7	The requirement document is vague in nature and do not provide the complete information regarding the architecture of the System.	Process	All	1	9	0.7	6.3	6.18
8	The requirements are vague about the features for phone's unlocking (GSM & Others), news, world's clock and products description.	Product	13, 14, 15, 16	1	8	0.7	5.6	6.13
9	The requirement related to business conditions given in the Admin Module are not mentioned that may lead to additions in scope of work.	Product	25, 27	1	8	0.9	7.2	5.56
10	The requirements are assumed to be communicated on phone or online messengers instead of the formal documentation.	Process	All	2	9	0.75	6.75	5.52
11	The scope of work regarding the integration of web sites of channel partners is not clearly identified.	Product	17	1	7	0.65	4.55	5.25
12	The graphic design requirements are not mentioned in the requirement document hence may leading to extra rework.	Product	All	1	8	0.7	5.6	5.19

Annexure F: Project B Risk Register

Impact Scale

Low:	*0.1 to 0.3*
Medium:	*0.4 to 0.6*
High:	*0.7 to 1.0*

S.N.	Risk	Category	Req. Ref	Bus Obj Ref	Likelihood (1-10)	Impact (Low/Med/High)	Magnitude (Likelihood x Impact)	Net Requirements' Risk Value
13	The requirement document does not clarify the key information related to maintenance and operations as Company-B have taken its responsibility.	Process	18	2	7	0.75	5.25	5.11

Annexure G: Project A Risks' Value Assessment Register

Risk Acceptonce Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Stakeholder's Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
4	The requirements were missing the end-to-end definition of business processes leading to the non-management of process exceptions. This was feared piling up the pending cases for new subscriptions and other services to subscribers.	SEVP Commercial	3	7	2	4.00	5.88	5.91
		SEVP Business Zone North	2	10	6	6.00		
		SEVP Business Zone South	4	9.5	5	6.17		
		Chief Information Officer	7	9	4	6.67		
		EVP Information Systems	8	8	7	7.67		
		GM Billing Solution	9	8	4	7.00		
		GM CC& SS	8	7	5	6.67		
		EVP MM&BB	7	6	6	6.33		
		Manager PMO MM&BB	8	5	3	5.33		
		EVP HR&A	3	8	5	5.33		
		Regional General Manager(s)	3	7	5	5.00		
		Company-A	7	4	2	4.33		
5	Mandatory fields were not identified at the stage of Line Qualification Testing (LQT) leading to the extra efforts required at input screen of Resource Management.	Chief Information Officer	4	6	2	4.00	4.80	5.58
		EVP Information Systems	5	5	7	5.67		
		GM Billing Solution	7	5	4	5.33		
		GM CC& SS	5	5	6	5.33		
		Company-A	7	2	2	3.67		
6	An extra step was introduced in the process of new subscriptions or change in the existing subscriptions at the stage of Line Qualification Testing leading to the delays in providing services to subscribers. This extra step could have been avoided easily.	Chief Information Officer	5	6	5	5.33	5.19	5.78
		EVP Information Systems	5	6	7	6.00		
		GM Billing Solution	4	5	8	5.67		
		GM CC& SS	3	7	6	5.33		
		EVP MM&BB	5	4	6	5.00		
		Manager PMO MM&BB	3	4	4	3.67		
		Company-A	6	5	5	5.33		
7	Software development team lacks in knowledge and necessary experience require for understanding the complexity of heterogeneous network elements. It was further examined that the Telecom Company team coupled with the software development team also has little knowledge of Telecom Company network elements. So, it was feared that software applications may have inconsistent performance when deployed in various locations.	Chief Information Officer	7	8	8	7.67	7.57	6.87
		EVP Information Systems	8	9	9.5	8.83		
		GM Billing Solution	7	8	9	8.00		
		GM CC& SS	7	7	8	7.33		
		Company-A	5	6	7	6.00		

Annexure G: Project A Risks' Value Assessment Register

Risk Acceptance Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Stakeholder's Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
8	The documented use cases missing the interfaces of software application processes with the overall environment leading to the missing links especially in providing the after installation support to the subscribers. The scope of work also missing the governing policies or standard operating procedures outside the software application but interfacing with the system.	Chief Information Officer	7	9	4	6.67	5.83	6.08
		EVP Information Systems	8	8	7	7.67		
		GM Billing Solution	9	8	4	7.00		
		GM CC& SS	8	7	5	6.67		
		EVP Revenue Accounts	3	6	6	5.00		
		GM Revenue	5	5	3	4.33		
		GM Cost Accounts	4	8	5	5.67		
		Company-A	6	3	2	3.67		
9	The initially gathered software requirements feared to vary/ change as the operation's line staff (linemen, CPE installers and broadband officers) was not consulted during the whole process. It was also identified it as a major risk as it may bring the changes in requirements and eventually change the scope of work.	SEVP Commercial	4	8	3	5.00	6.34	6.00
		SEVP Business Zone North	3	9	4	5.33		
		SEVP Business Zone South	5	8	5	6.00		
		EVP BZ Lahore	5	7	5	5.67		
		EVP BZ Peshawar	4	8	5	5.67		
		EVP Revenue Accounts	4	7	4	5.00		
		GM Revenue	7	5	4	5.33		
		EVP Finance	5	8	7	6.67		
		EVP MM&BB	6	7	7	6.67		
		Manager PMO MM&BB	9.5	7	5	7.17		
		Chief Information Officer	8	8.5	7	7.83		
		EVP Information Systems	10	8	8	8.67		
		GM Billing Solution	9	6	6	7.00		
		GM CC& SS	9	7	5	7.00		
		Regional General Managers	7	8	5	6.67		
		Senior Member Advisory Team	4	9	4	5.67		
		Company-A	9.5	7	3	6.50		
10	The integration of Project-A with North Bound Interface (NBI) of Huwaei was identified as a major risk due to the conflicting business interests between two companies and close nature of both systems.	Chief Information Officer	8	9	3	6.67	6.78	6.56
		EVP Information Systems	8	9	3	6.67		
		GM Billing Solution	7	8	6	7.00		
		GM CC& SS	8	7	6	7.00		
		Other solution provider	8	8	5	7.00		
		Company-A	7	8	4	6.33		
11	The integration of "Project-A" billing with the other system of "Billing and Customer Care System (B&CC)" feared to be major problem due to its non maturity in terms of packaging the value added services having different price parameters.	Chief Information Officer	7	8	8	7.67	7.57	6.95
		EVP Information Systems	8	9	9.5	8.83		
		GM Billing Solution	7	8	9	8.00		
		GM CC& SS	7	7	8	7.33		
		Company-A	5	6	7	6.00		

Annexure-C: Project-A Risks' Value Assessment Register

Risk Acceptance Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Stakeholder's Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
12	The integration of "Project-A" with Operational Support System (OSS) due to non-availability of updated technical specifications and documentation.	Chief Information Officer	7	9	4	6.67	6.00	6.17
		SEVP (Operations)	8	8	7	7.67		
		EVP Information Systems	9	8	4	7.00		
		GM Billing Solution	8	7	5	6.67		
		GM CC& SS	3	6	6	5.00		
		Other solution provider	5	5	3	4.33		
		Company-A	4	5	5	4.67		
13	The requirements were missing the interfaces with Complaint Management System for managing the customer complaints, their tracking and resolution.	Chief Information Officer	7	9	4	6.67	6.87	6.60
		EVP Information Systems	8	8	7	7.67		
		GM Billing Solution	9	8	4	7.00		
		GM CC& SS	8	7	5	6.67		
		Company-A	7	6	6	6.33		
14	The requirements were missing the interfaces with ERP System in terms of managing the inventories of Customer Premises Equipment (CPE) and receivables from subscribers especially when packaged on monthly installments. The requirements also ignored the management of inventories of CPEs returned to Telecom Company as faulty or at the time of discontinuation of services by subscribers.	Chief Information Officer	8	5	3	5.33	6.50	6.31
		EVP Information Systems	9	8	4	7.00		
		GM Billing Solution	8	7	5	6.67		
		GM CC& SS	7	6	6	6.33		
		GM ERP	9	8	4	7.00		
		Company-A	8	7	5	6.67		
15	The requirements related to integration with Customer Care System (CCS) were vague in nature and CCS Team showed their reservations on confirmation.	Chief Information Officer	7	6	6	6.33	5.78	6.06
		EVP Information Systems	8	5	4	5.67		
		GM Billing Solution	7	6	5	6.00		
		GM CC& SS	6	4	6	5.33		
		EVP Customer Care	8	7	3	6.00		
		Company-A	8	4	4	5.33		
16	The requirements missing the adequate details about the billing of Project-A services when packaged with PSTN and Broadband. The impact on revenues was feared due to this critical risk.	Chief Information Officer	7	7	4	6.00	6.29	6.31
		EVP Information Systems	9	8	5	7.33		
		GM Billing Solution	8	7	4	6.33		
		GM CC& SS	7	7	4	6.00		
		EVP Revenue Accounts	3	7	6	5.33		
		GM Revenue	4	9	5	6.00		
		Company-A	8	7	6	7.00		

Annexure G: Project A Risks' Value Assessment Register

Risk Acceptonce Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Stakeholder's Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
17	The requirements and policies regarding the disconnection of Project-A services were not chalked out in detail. This was feared as a major problem at the stage of User's Acceptance Testing and issuance of Final Acceptance Certificates require for closure of project in connection with Complaint Management System. This might lead to the decisions based upon the individuals' judgments rather to be driven through a formal process in the System.	SEVP Commercial	3	8	4	5.00	5.78	5.33
		SEVP Finance	4	7	4	5.00		
		Chief Information Officer	6	8	3	5.67		
		EVP Information Systems	7	9	4	6.67		
		GM Billing Solution	9	8	3	6.67		
		GM CC& SS	8	6	4	6.00		
		EVP MM&BB	7	7	5	6.33		
		Manager PMO MM&BB	6	7	3	5.33		
		Company-A	5	8	3	5.33		
18	In the area of entering the subscriber's information, the field lengths and their types were not clearly documented that may lead to the failure in accepting the data during its usage.	EVP Information Systems	3	4	4	3.67	3.83	5.10
		GM Billing Solution	4	3	5	4.00		
		GM CC& SS	4	5	4	4.33		
		Company-A	3	4	3	3.33		
19	The requirements did not cover the management of application users especially in the context of its overlapping with Billing and Customer Care System. The individuals using the both system have to maintain two Users' / Passwords even in the common areas. The detailed policy for this purpose was also missing in the scope of work.	EVP Information Systems	8	7	6	7.00	6.58	6.13
		GM Billing Solution	9	8	5	7.33		
		GM CC& SS	8	8	5	7.00		
		Company-A	8	4	3	5.00		
20	The requirements did not cover the necessary management of roll out of various systems' components and their deployment across the country.	EVP Information Systems	4	8.5	8	6.83	6.53	6.10
		GM Billing Solution	5	8	8	7.00		
		GM CC& SS	6	8	7	7.00		
		EVP MM&BB	6	7	8	7.00		
		Manager PMO MM&BB	5	6	7	6.00		
		Company-A	4	6	6	5.33		
21	The requirements do not cover the necessary management of quality metrics with regards to the performance. This was noted with care that the Project-A will be deployed in the environment containing heterogeneous systems by different manufacturers.	EVP Information Systems	6	8	6	6.67	6.17	5.92
		GM Billing Solution	5	6	5	5.33		
		GM CC& SS	5	7	6	6.00		
		Company-A	7	6	7	6.67		

Annexure G: Project A Risks' Value Assessment Register

Risk Acceptance Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Stakeholder's Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
22	The system users were not estimated and documented with requirements leading to improper regression and stress test of the software application.	EVP Information Systems	8	7	5	6.67	6.42	6.04
		GM Billing Solution	8	8	5	7.00		
		GM CC& SS	9	7	5	7.00		
		Company-A	6	5	4	5.00		
23	The necessary details with regards to billing of Project-A services as a single product were missing in the requirements. Some un-documented assumptions were noted in order to streamline its billing process.	EVP Information Systems	8	8	4	6.67	5.65	5.82
		GM Billing Solution	8	8	5	7.00		
		GM CC& SS	7.5	8	3	6.17		
		EVP MM&BB	8	7	5	6.67		
		Manager PMO MM&BB	6	6	4	5.33		
		EVP Revenue Accounts	5	5	3	4.33		
		GM Revenue	4	8	2	4.67		
		Company-A	3	6	4	4.33		
24	The methodology with regard to communicating requirements from business domain functionaries to Company-A and then to the Company-A in other country was observed as leading risk in the whole process of software development.	EVP Information Systems	7	8.5	6	7.17	6.63	6.15
		GM Billing Solution	6	7	6	6.33		
		GM CC& SS	7	8	8	7.67		
		Company-A	3	6	7	5.33		

Annexure-G: Project-B Risks' Value Assessment Register

Risk Acceptonce Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)				Net Risk Value	Net Req's Risk Value
			Technical	Organization	People	Agg		
1	The System may face the compatibility problems as the site is being revamped from static contents to database driven contents with induction of many critical features.	Customer	3	9	7	6.33	6.89	6.94
		Partner 1	8	8	6	7.33		
		Partner 2	7	8	6	7.00		
2	It is feared that changes in the online shopping module as it contains the vague requirements in the form of reference with www.shopping.com.	Customer	4	7	3	4.67	5.33	6.33
		Partner 1	7	7	5	6.33		
		Partner 2	6	6	3	5.00		
3	The requirement document does not contain any information regarding encryption of sensitive information related to processing of electronic payments.	Customer	7	10	6	7.67	7.33	7.19
		Partner 1	9	9	4	7.33		
		Partner 2	7	9	5	7.00		
4	The schedule may slip as the deliverables are not clearly marked with the timelines.	Customer	3	8	7	6.00	6.67	6.67
		Partner 1	6	9	8	7.67		
		Partner 2	5	8	6	6.33		
5	The requirement document does not clarify the key information related to maintenance and operations as Company-B have taken its responsibility.	Customer	3	5	6	4.67	4.56	5.11
		Partner 1	3	5	4	4.00		
		Partner 2	4	6	5	5.00		
6	The requirements are vague about the features for phone's unlocking (GSM & Others), news, world's clock and products description.	Customer	4	9	6	6.33	7.22	6.13
		Partner 1	9	8	6	7.67		
		Partner 2	8	7	8	7.67		
7	The requirements of Maintenance of Static Contents are open in nature and may lead to additions in scope of work.	Customer	6	8	4	6.00	6.89	6.94
		Partner 1	8	8	6	7.33		
		Partner 2	9	8	5	7.33		

Annexure G: Project B Risks' Value Assessment Register

Risk Acceptance Threshold = 5

S.N.	Risk	Stakeholders	Stakeholders (Requirements' Risk Value)					Net Req's Risk Value
			Technical	Organization	People	Agg	Net Risk Value	
8	The requirement document is vague in nature and do not provide the complete information regarding the architecture of the System.	Customer	3	7	4	4.67	6.42	6.18
		Partner 1	8	6	6	6.67		
		Partner 2	9	8	5	7.33		
		Software Developer	9	7	5	7.00		
9	The scope of work regarding the integration of web sites of channel partners is not clearly identified.	Customer	3	8	5	5.33	6.08	5.25
		Partner 1	8	7	6	7.00		
		Partner 2	8	6	5	6.33		
		Channel Partners	6	7	4	5.67		
10	The requirement related to business conditions given in the Admin Module are not mentioned that may lead to additions in scope of work.	Customer	3	6	3	4.00	4.78	5.56
		Partner 1	7	5	4	5.33		
		Partner 2	6	6	3	5.00		
11	The graphic design requirements are not mentioned in the requirement document hence may leading to extra rework.	Customer	3	7	3	4.33	4.44	5.19
		Partner 1	4	5	2	3.67		
		Partner 2	5	6	5	5.33		
12	The requirements are assumed to be communicated on phone or online messengers instead of the formal documentation.	Customer	3	6	5	4.67	5.11	5.52
		Partner 1	5	5	7	5.67		
		Partner 2	5	4	6	5.00		
13	The back up strategy is not agreed with customer that may lead to eventual loss of critical data and finance loss.	Customer	5	9	6	6.67	6.67	6.30
		Partner 1	8	8	4	6.67		
		Partner 2	9	8	3	6.67		

Annexure H: Project Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
1	The requirements do not cover the dimensioning of hardware required to run the software applications. The undocumented assumption was that these software applications shall operate on the same hardware landscape dedicated for overall suite of products of "Billing & Customer Care System". Further, the hardware was not planned to be segregated virtually even on the same landscape. This risk was declared as a critical risk keeping in view the spread of geography of System roll out and number of subscribers. **Treatement:** The hardware dedicated for disaster recovery site for Billing & Customer Care (B&CC) System shall be used for interim period till the decision on any one of the alternates. It is important to mention that the equipment for disaster recovery site is not yet installed and operational.	Regular process should be adopted to mitigate this risk. It may includes: 1. Assessment of the number of users 2. Sizing of the hardware based upon number of users and transactions 3. Evaluation of the existing computing workload 4. Segregation of computing resources	SEVP Finance	5	3	3	3.67	5.03	5.27
			Chief Information Officer	8	8	3	6.33		
			SEVP Commercial	3	8	3	4.67		
			EVP MM&BB	5	8	2	5.00		
			EVP Information Systems	7	8	6	7.00		
			EVP Finance	6	7	4	5.67		
			Senior Member Advisory Team	4	7	3	4.67		
			GM Billing Solution	6	6	4	5.33		
			GM CC& SS	6	7	5	6.00		
			Manager PMO MM&BB	4	5	2	3.67		
			Company-A	5	3	2	3.33		
		Virtualization of the existing computing infrastructure with the introduction of capability to expand horizontally and vertically.	SEVP Finance	3	5	1	3.00	4.73	
			Chief Information Officer	6	8	3	5.67		
			SEVP Commercial	4	3	5	4.00		
			EVP MM&BB	8	3	2	4.33		
			EVP Information Systems	6	8	3	5.67		
			EVP Finance	4	7	4	5.00		
			Senior Member Advisory Team	3	6	4	4.33		
			GM Billing Solution	8	8	4	6.67		
			GM CC& SS	9	7	5	7.00		
			Manager PMO MM&BB	3	3	2	2.67		
			Company-A	6	4	1	3.67		
		Separate provision of dedicated computing infrastructure with necessary integration with data network for this software applications	SEVP Finance	5	6	1	4.00	5.27	
			Chief Information Officer	4	8	3	5.00		
			SEVP Commercial	5	8	3	5.33		
			EVP MM&BB	8	5	2	5.00		
			EVP Information Systems	8	8	6	7.33		
			EVP Finance	5	6	4	5.00		
			Senior Member Advisory Team	4	9	3	5.33		
			GM Billing Solution	7	8	4	6.33		
			GM CC& SS	9	6	5	6.67		
			Manager PMO MM&BB	9	4	2	5.00		
			Company-A	5	3	1	3.00		
	The introduced process does not cover the effective monitoring and resolution of cases related to new subscriptions at the stage of "Radius Construct". It was assumed that human intervention will handle the cases of new subscriptions stuck with "Radius Construct" that appears to be potential failure especially when handled in the environment containing heterogeneous Systems in place belongs to multiple vendors.	The software should consolidate the failed requests reported from "Radius Construct" process and send them again for construction. This should be repeated till the construction in Radius Server. The application should also have the capability to build a pattern of reasons for failure for remedial actions.	SEVP Commercial	5	8	5	6.00	5.30	
			SEVP Business Zone North	4	7	3	4.67		
			SEVP Business Zone South	3	4	3	3.33		
			Chief Information Officer	8	8	2	6.00		
			EVP Information Systems	8	6	3	5.67		
			GM Billing Solution	5	7	4	5.33		
			GM CC& SS	7	9	3	6.33		
			EVP MM&BB	6	7	4	5.67		
			Manager PMO MM&BB	8	5	3	5.33		
			Regional General Manager(s)	6	8	2	5.33		
			Company-A	7	5	2	4.67		
		The "Radius Construct" should be monitored by the dedicated System Administrators. The System Administrators shall analyze the failed requests and coordinate with operational teams for timely resolution.	SEVP Commercial	3	7	4	4.67		
			SEVP Business Zone North	4	8	3	5.00		
			SEVP Business Zone South	5	9	3	5.67		
			Chief Information Officer	8	5	4	5.67		
			EVP Information Systems	9	7	3	6.33		

Annexure H: Project A Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
2			GM Billing Solution	7	6	4	5.67	5.52	5.88
			GM CC& SS	8	7	3	6.00		
			EVP MM&BB	9	9	2	6.67		
			Manager PMO MM&BB	6	5	5	5.33		
			Regional General Manager(s)	6	8	2	5.33		
			Company-A	5	5	3	4.33		
		Combination of both given alternates till the maturity of business process by using the software application.	SEVP Commercial	4	8	5	5.67	5.88	
			SEVP Business Zone North	4	7	3	4.67		
			SEVP Business Zone South	5	9	6	6.67		
			Chief Information Officer	7	8	2	5.67		
			EVP Information Systems	8	4	6	6.00		
			GM Billing Solution	8	7	5	6.67		
			GM CC& SS	9	6	2	5.67		
			EVP MM&BB	6	6	5	5.67		
			Manager PMO MM&BB	8	6	5	6.33		
			Regional General Manager(s)	6	8	4	6.00		
			Company-A	7	5	5	5.67		
3	The requirements do not cover the effective workflow or alert system with regards to new subscriptions and discontinuation of service at the stage of interface with "Radius".	The software application should have the effective workflow to route the requests for Radius Constructs through the engineers deployed in exchanges and System's operation team.	SEVP Commercial	3	6	4	4.33	5.11	5.64
			SEVP Business Zone North	5	8	1	4.67		
			SEVP Business Zone South	3	7	3	4.33		
			Chief Information Officer	6	6	2	4.67		
			EVP Information Systems	7	8	4	6.33		
			GM Billing Solution	8	9	2	6.33		
			GM CC& SS	5	7	3	5.00		
			EVP MM&BB	6	5	2	4.33		
			Manager PMO MM&BB	8	6	2	5.33		
			EVP HR&A	5	7	6	6.00		
			Regional General Manager(s)	6	6	5	5.67		
			Company-A	5	5	3	4.33		
		The dedicated staff to be deployed to generate manual alerts, messages and escalations. The dedicated staff should keep track of each request and involve appropriate.	SEVP Commercial	2	6	1	3.00	5.17	
			SEVP Business Zone North	3	5	4	4.00		
			SEVP Business Zone South	5	8	5	6.00		
			Chief Information Officer	9	6	2	5.67		
			EVP Information Systems	6	7	3	5.33		
			GM Billing Solution	7	8	2	5.67		
			GM CC& SS	8	9	3	6.67		
			EVP MM&BB	6	5	4	5.00		
			Manager PMO MM&BB	8	6	2	5.33		
			EVP HR&A	5	7	6	6.00		
			Regional General Manager(s)	6	6	5	5.67		
			Company-A	5	4	2	3.67		
		The capability at Radius Server should be enhanced in order to handle the process exceptions.	SEVP Commercial	2	6	1	3.00	5.36	
			SEVP Business Zone North	4	8	4	5.33		
			SEVP Business Zone South	5	8	5	6.00		
			Chief Information Officer	8	6	2	5.33		
			EVP Information Systems	9	9	3	7.00		
			GM Billing Solution	7	8	5	6.67		
			GM CC& SS	8	7	3	6.00		
			EVP MM&BB	6	5	2	4.33		

Annexure H: Project A Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
			Manager PMO MM&BB	9	6	2	5.67		
			EVP HR&A	5	7	6	6.00		
			Regional General Manager(s)	6	6	5	5.67		
			Company-A	5	3	2	3.33		
		Combination of first two alternates should be opted.	SEVP Commercial	5	6	5	5.33		
			SEVP Business Zone North	6	6	4	5.33		
			SEVP Business Zone South	5	7	5	5.67		
			Chief Information Officer	8	5	2	5.00		
			EVP Information Systems	10	8	4	7.33		
			GM Billing Solution	7	8	2	5.67	5.64	
			GM CC& SS	7	7	5	6.33		
			EVP MM&BB	6	5	2	4.33		
			Manager PMO MM&BB	9	6	4	6.33		
			EVP HR&A	5	7	6	6.00		
			Regional General Manager(s)	8	6	5	6.33		
			Company-A	6	4	2	4.00		
4	The requirements were missing the end-to-end definition of business processes leading to the non-management of process exceptions. This was feared piling up the pending cases for new subscriptions and other services to subscribers.	The exceptions in processes should be effectively monitored by the operations team by using the system logs and reports. The remedial actions should be documented and sent to System Requirements & Development Team for necessary improvements in the System. Further, the engineers deployed in exchanges should be engaged in order to ensure the swift handling of exceptions.	SEVP Commercial	5	7	2	4.67	5.81	5.81
			SEVP Business Zone North	2	10	6	6.00		
			SEVP Business Zone South	4	9	5	6.00		
			Chief Information Officer	7	9	4	6.67		
			EVP Information Systems	8	8	7	7.67		
			GM Billing Solution	9	8	4	7.00		
			GM CC& SS	4	5	5	4.67		
			EVP MM&BB	7	5	6	6.00		
			Manager PMO MM&BB	8	5	3	5.33		
			EVP HR&A	5	8	5	6.00		
			Regional General Manager(s)	4	7	5	5.33		
			Company-A	7	4	2	4.33		
5	Mandatory fields were not identified at the stage of Line Qualification Testing (LQT) leading to the extra efforts required at input screen of Resource Management.	The mandatory fields must be identified and programmed as such in consultation with Process Owners and System's Requirements Team.	Chief Information Officer	5	6	3	4.67	5.40	5.40
			EVP Information Systems	6	5	7	6.00		
			GM Billing Solution	8	4	6	6.00		
			GM CC& SS	7	5	6	6.00		
			Company-A	7	4	2	4.33		
6	An extra step was introduced in the process of new subscriptions or change in the existing subscriptions at the stage of Line Qualification Testing leading to the delays in providing services to subscribers. This extra step could have been avoided easily.	The process owners should be consulted again for decision to keep the extra step in the business process. The extra step should be eliminated, if agreed by process owners.	Chief Information Officer	5	6	5	5.33	5.19	5.19
			EVP Information Systems	5	6	7	6.00		
			GM Billing Solution	4	5	8	5.67		
			GM CC& SS	3	7	6	5.33		
			EVP MM&BB	5	4	6	5.00		
			Manager PMO MM&BB	3	4	4	3.67		
			Company-A	6	5	5	5.33		
7	Software development team lacks in knowledge and necessary experience require for understanding the complexity of heterogeneous network elements. It was further examined that the Telecom Company team coupled with the software development team also has little knowledge of Telecom Company network elements. So, it was feared that software applications may have inconsistent performance when deployed in various cities of the country.	Necessary training should be given to the development teams with regards to existing landscape of network elements and deployed systems. The awareness may involve field visits and examination of network switches of various other manufacturers of telecom systems.	Chief Information Officer	7	8	8	7.67	6.87	7.13
			EVP Information Systems	5	6	9	6.67		
			GM Billing Solution	5	7	9	7.00		
			GM CC& SS	6	6	8	6.67		
			Company-A	6	6	7	6.33		
		The business domain experts should be included in the development team to mitigate this risk. These experts	Chief Information Officer	8	8	7	7.67		
			EVP Information Systems	8	9	5	7.33		

Annexure-H: Project-A Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
		should remain with deployment till the completion of successful roll out.	GM Billing Solution	9	8	6	7.67	7.13	
			GM CC& SS	8	7	7	7.33		
			Company-A	5	5	7	5.67		
8	The documented use cases missing the interfaces of software application processes with the overall environment leading to the missing links especially in providing the after installation support to the subscribers. The scope of work also missing the governing policies or standard operating procedures outside the software application but interfacing with the system.	The scope of work should include the component to develop the governing policies and standard operating procedures especially with regards to after implementation support. The risk management team agreed that operations team or business process owners may not be able to develop such documents by themselves.	Chief Information Officer	8	8	4	6.67	5.46	5.46
			EVP Information Systems	6	8	5	6.33		
			GM Billing Solution	7	8	4	6.33		
			GM CC& SS	8	7	5	6.67		
			EVP Revenue Accounts	5	6	4	5.00		
			GM Revenue	5	5	3	4.33		
			GM Cost Accounts	4	5	5	4.67		
			Company-A	6	3	2	3.67		
9	The initially gathered software requirements feared to vary/ change as the operation's line staff (linemen, CPE installers and DSL officers) was not consulted during the whole process. It was also identified it as a major risk as it may bring the changes in requirements and eventually change the scope of work.	The special workshops should be conducted to re-affirm and settle the software requirements. However, these workshops should be represented by all business functions and departments to ensure the completion of objectives.	SEVP Commercial	4	6	6	5.33	5.86	5.86
			SEVP Business Zone North	3	4	4	3.67		
			SEVP Business Zone South	5	8	5	6.00		
			EVP BZ Centeral-I	5	4	5	4.67		
			EVP BZ Centeral-II	6	8	5	6.33		
			EVP Revenue Accounts	4	4	4	4.00		
			GM Revenue	7	5	4	5.33		
			EVP Finance	5	8	7	6.67		
			EVP MM&BB	6	7	6	6.33		
			Manager PMO MM&BB	8	7	5	6.67		
			Chief Information Officer	8	8	4	6.67		
			EVP Information Systems	9	8	4	7.00		
			GM Billing Solution	9	6	3	6.00		
			GM CC& SS	9	7	5	7.00		
			Regional General Managers	7	8	5	6.67		
			Senior Member Advisory Team	4	9	4	5.67		
			Company-A	7	7	3	5.67		
10	The integration of Project-A with North Bound Interface (NBI) was identified as a major risk due to the conflicting business interests between two companies and close nature of both systems.	Telecom Company should continue with existing contract signed with Company-A. However, an amendment should be introduced in contract to bring the visibility into responsibilities transferred to other solution provider by Company-A. Company-A may share non-financial information with Telecom Company to provide the comfort in this regards.	Chief Information Officer	7	6	3	5.33	5.83	6.50
			EVP Information Systems	9	5	4	6.00		
			GM Billing Solution	6	6	4	5.33		
			GM CC& SS	5	7	6	6.00		
			Other solution provider	8	5	5	6.00		
			Company-A	7	8	4	6.33		
		Telecom Company should have a separate contract with other solution providers to provide its services with regards to North Bound Interface (NBI).	Chief Information Officer	7	9	4	6.67	6.50	
			EVP Information Systems	8	7	3	6.00		
			GM Billing Solution	7	8	5	6.67		
			GM CC& SS	6	7	6	6.33		
			Other solution provider	8	8	5	7.00		
			Company-A	7	8	4	6.33		
11	The integration of "Project-A" billing with the other system of "Billing and Customer Care System (B&CC)" feared to be major problem due to its non maturity in terms of packaging the value added services having different price parameters.	The Revenue and Tariff Departments should be involved to ensure the proper packaging of Project-A services for billing to the customers. Further, the same customer's bill dedicated for PSTN services should be used for this purpose for revenue collection and its eventual management.	Chief Information Officer	7	8	6	7.00	6.60	6.60
			EVP Information Systems	5	6	5	5.33		
			GM Billing Solution	7	7	9	7.67		
			GM CC& SS	7	7	7	7.00		
			Company-A	5	6	7	6.00		

Annexure H: Project-A Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
12	The integration of "Project-A" with Operational Support System (OSS) due to non-availability of updated technical specifications and documentation.	The experienced staff member from OSS should be deployed with development team for 6-8 times to ensure the proper integration of both systems.	Chief Information Officer	7	5	4	5.33	5.33	5.33
			SEVP (Operations)	4	8	5	5.67		
			EVP Information Systems	6	8	4	6.00		
			GM Billing Solution	8	5	4	5.67		
			GM CC& SS	6	6	5	5.67		
			Other solution provider	5	5	3	4.33		
			Company-A	4	5	5	4.67		
13	The requirements were missing the interfaces with Complaint Management System for managing the customer complaints, their tracking and resolution.	The System's requirement team should be delegated this task to ensure the seamless integration with Complaint Management System.	Chief Information Officer	9	4	4	5.67	5.40	5.40
			EVP Information Systems	8	4	2	4.67		
			GM Billing Solution	7	6	4	5.67		
			GM CC& SS	8	7	3	6.00		
			Company-A	7	6	2	5.00		
14	The requirements were missing the interfaces with ERP System in terms of managing the inventories of Customer Premises Equipment (CPE) and receivables from subscribers especially when packaged on monthly installments. The requirements also ignored the management of inventories of CPEs returned to Telecom Company as faulty or at the time of discontinuation of services by subscribers.	The ERP and Multimedia & Broadband Departments should be involved in this process for managing the inventories through ERP System. The CPEs should be issued from Regional Stores Depots to operational staff in the regions. The safety stock levels should be maintained at field regions in the form of sub-stores managed by the business zones EVPs and RGMs. However, the issuance to customers should be managed through Billing & Customer Care System. Further, the faulty CPEs should be returned back to main stores for necessary repairs or replacements.	Chief Information Officer	8	4	6	6.00	5.22	5.22
			EVP Information Systems	6	8	4	6.00		
			GM Billing Solution	5	5	5	5.00		
			GM CC& SS	7	4	3	4.67		
			GM ERP	5	3	4	4.00		
			Company-A	5	7	5	5.67		
15	The requirements related to integration with Customer Care System (CCS) were vague in nature and CCS Team showed their reservations on confirmation.	The Customer Care Department should be involved for its integration with the overall System for call centers and help lines. The necessary data sharing should be identified and executed in consultation with Operations team.	Chief Information Officer	6	6	6	6.00	5.33	5.33
			EVP Information Systems	6	6	4	5.33		
			GM Billing Solution	7	6	4	5.67		
			GM CC& SS	6	4	6	5.33		
			EVP Customer Care	8	4	3	5.00		
			Company-A	6	4	4	4.67		
16	The requirements missing the adequate details about the billing of Project-A services when packaged with PSTN and Broadband. The impact on revenues was feared due to this critical risk.	The critical analysis should be done with Revenue and Internal Audit Department to ensure the effective management of revenue and avoid possible leakages.	Chief Information Officer	7	7	4	6.00	5.95	5.95
			EVP Information Systems	7	8	5	6.67		
			GM Billing Solution	6	7	6	6.33		
			GM CC& SS	6	6	4	5.33		
			EVP Revenue Accounts	4	7	6	5.67		
			GM Revenue	4	8	5	5.67		
			Company-A	5	7	6	6.00		
17	The requirements and policies regarding the disconnection of Project-A were not chalked out in detail. This was feared as a major problem at the stage of User's Acceptance Testing and issuance of Final Acceptance Certificates require for closure of project in connection with Complaint Management System. This might lead to the decisions based upon the individuals' judgments rather to be driven through a formal process in the System.	The Internal Audit, Regulations and Commercial Departments should be involved for defining a comprehensive policy with regards to disconnection of Project-A services.	SEVP Commercial	3	8	4	5.00	5.78	5.78
			SEVP Finance	4	7	4	5.00		
			Chief Information Officer	6	8	3	5.67		
			EVP Information Systems	7	9	4	6.67		
			GM Billing Solution	9	8	3	6.67		
			GM CC& SS	8	6	4	6.00		
			EVP MM&BB	7	7	5	6.33		
			Manager PMO MM&BB	6	7	3	5.33		
			Company-A	5	8	3	5.33		
	In the area of entering the subscriber's information, the field lengths and their types were not clearly	The development teams should provide the necessary documentation before the start of development.	EVP Information Systems	9	6	4	6.33		
			GM Billing Solution	7	5	5	5.67		

Annexure H: Project A Risk Treatment Register

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value	Selected Treatement
				Technical	Organization	People	Agg		
18	documented that may lead to the failure in accepting the data during its usage.		GM CC& SS	7	5	4	5.33	5.33	5.33
			Company-A	5	4	3	4.00		
19	The requirements did not cover the management of application users especially in the context of its overlapping with Billing and Customer Care System. The individuals using the both system have to maintain two Users' / Passwords even in the common areas. The detailed policy for this purpose was also missing in the scope of work.	The scope of work should include the development of standard operating procedure with clear responsibilities and timelines for effective user's profile management. The development team should provide enhancement in the software to synchronize the common users profile for both applications.	EVP Information Systems	8	7	6	7.00	6.08	6.08
			GM Billing Solution	7	5	5	5.67		
			GM CC& SS	8	8	4	6.67		
			Company-A	8	4	3	5.00		
20	The requirements did not cover the necessary management of roll out of various systems' components and their deployment across the country.	The development team should build a roll out strategy and get it approved from the Project Steering Committee. The roll-out strategy should contain the periodic review and clearly identified responsibilities in the field regions.	EVP Information Systems	6	7	5	6.00	5.56	5.56
			GM Billing Solution	5	8	4	5.67		
			GM CC& SS	6	8	6	6.67		
			EVP MM&BB	7	7	4	6.00		
			Manager PMO MM&BB	5	6	3	4.67		
			Company-A	4	6	3	4.33		
21	The requirements do not cover the necessary management of quality metrics with regards to the performance. This was noted with care that the Project-A will be deployed in the environment containing heterogeneous systems by different manufacturers.	The nominated team to carry out the Provisional Acceptance Testing and Final Acceptance Testing should build the quality metrics with the help of development team. This may result into the degraded performance experienced by subscribers.	EVP Information Systems	7	9	3	6.33	5.67	5.67
			GM Billing Solution	7	6	4	5.67		
			GM CC& SS	5	6	4	5.00		
			Company-A	7	6	4	5.67		
22	The system users were not estimated and documented with requirements leading to improper regression and stress test of the software application.	The user's authorization matrix should be build by development team to ensure the desired system's performance before its roll out.	EVP Information Systems	7	7	3	5.67	5.92	5.92
			GM Billing Solution	8	8	4	6.67		
			GM CC& SS	7	7	5	6.33		
			Company-A	6	5	4	5.00		
23	The necessary details with regards to billing of Project-A services as a single product were missing in the requirements. Some un-documented assumptions were noted in order to streamline its billing process.	The billing requirements should be ironed out and implemented accordingly.	EVP Information Systems	8	8	4	6.67	5.69	5.69
			GM Billing Solution	7	6	5	6.00		
			GM CC& SS	7.5	8	3	6.17		
			EVP MM&BB	8	7	5	6.67		
			Manager PMO MM&BB	8	6	6	6.67		
			EVP Revenue Accounts	5	5	3	4.33		
			GM Revenue	4	8	2	4.67		
			Company-A	3	6	4	4.33		
24	The methodology with regard to communicating requirements from business domain functionaries to Company-A and then to the Company-A main development center in other country was observed as leading risk in the whole process of software development.	The account manager from development team at main development cneter on other country should be designated and formally announced. Further, the project managers should ensure the important communication to be made through email. Also, the weekly conference call should be arranged to avoid possible risks with regards to improper communication.	EVP Information Systems	6	8.5	4	6.17	5.38	5.38
			GM Billing Solution	6	6	4	5.33		
			GM CC& SS	5	8	5	6.00		
			Company-A	3	6	3	4.00		

Annexure H: Project-B Treatment Alternatives

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value
				Technical	Organization	People	Agg	
1	The System may face the compatibility problems as the site is being revamped from static contents to database driven contents with induction of many critical features.	The System's development and deployment landscape should be thoroughly analyzed and documented. This should be signed-off by the customer.	Customer	4	7	5	5.33	5.78
			Partner 1	6	8	3	5.67	
			Partner 2	7	8	4	6.33	
2	It is feared that changes in the online shopping module as it contains the vague requirements in the form of reference with www.shopping.com.	The requirements should be clearly identified and documented according to the standard format. This should be formally agreed with customer.	Customer	7	8	4	6.33	6.22
			Partner 1	8	8	5	7.00	
			Partner 2	7	6	3	5.33	
3	The requirement document does not contain any information regarding encryption of sensitive information related to processing of electronic payments.	The customer should be communicated this risk and asked to purchase the SSL security module like "verisign". Further, the development team should implement the SSL and necessary encryption of data in the database.	Customer	5	8	3	5.33	6.11
			Partner 1	7	9	5	7.00	
			Partner 2	7	6	5	6.00	
4	The schedule may slip as the deliverables are not clearly marked with the timelines.	The activity plan should be developed and monitored. This should also contain the clearly identified milestones and deliverables.	Customer	4	7	5	5.33	5.67
			Partner 1	5	7	6	6.00	
			Partner 2	6	6	5	5.67	
5	The requirement document does not clarify the key information related to maintenance and operations as Company-B have taken its responsibility.	The scope of work with regards to operations and maintenance to be documented and agreed with customer.	Customer	7	6	6	6.33	5.78
			Partner 1	6	7	4	5.67	
			Partner 2	4	6	6	5.33	
6	The requirements are vague about the features for phone's unlocking (GSM & Others), news, world's clock and products description.	The requirements should be elicited and agreed with customer.	Customer	6	8	4	6.00	6.89
			Partner 1	8	8	6	7.33	
			Partner 2	9	8	5	7.33	
7	The requirements of Maintenance of Static Contents are open in nature and may lead to additions in scope of work.	The requirements should be elicited and agreed with customer.	Customer	6	8	4	6.00	6.89
			Partner 1	8	8	6	7.33	
			Partner 2	9	8	5	7.33	

Annexure H: Project B Treatment Alternatives

Alternative Acceptance Threshold = 5

S.N.	Risk	Treatment Alternatives	Stakeholders	Alternate's Value				Net Alternate's Value
				Technical	Organization	People	Agg	
8	The requirement document is vague in nature and do not provide the complete information regarding the architecture of the System.	The architecture should be developed along with necessary support information. The architecture should be in synchronization with needs of customers and development.	Customer	5	8	8	7.00	7.25
			Partner 1	10	6	6	7.33	
			Partner 2	8	8	5	7.00	
			Software Developer	9	7	7	7.67	
9	The scope of work regarding the integration of web sites of channel partners is not clearly identified.	The scope of work should be documented and agreed with customer.	Customer	5	8	5	6.00	6.58
			Partner 1	9	7	6	7.33	
			Partner 2	9	6	5	6.67	
			Channel Partners	8	7	4	6.33	
10	The requirement related to business conditions given in the Admin Module are not mentioned that may lead to additions in scope of work.	The requirements should be documented and agreed with customer.	Customer	5	7	6	6.00	6.89
			Partner 1	9	8	4	7.00	
			Partner 2	9	9	5	7.67	
11	The graphic design requirements are not mentioned in the requirement document hence may leading to extra rework.	The requirements with regards to graphical interface should be documented and agreed with customer.	Customer	5	7	6	6.00	6.89
			Partner 1	9	8	4	7.00	
			Partner 2	9	9	5	7.67	
12	The requirements are assumed to be communicated on phone or online messengers instead of the formal documentation.	The assumptions should be documented. Further, all the telephone calls and chat sessions should be recorded for future reference and resolution of disputes.	Customer	5	7	6	6.00	6.89
			Partner 1	9	8	4	7.00	
			Partner 2	9	9	5	7.67	
13	The back up strategy is not agreed with customer that may lead to eventual loss of critical data and finance loss.	The backup strategy should be documented and agreed with customer.	Customer	7	9	6	7.33	8.00
			Partner 1	9	9	6	8.00	
			Partner 2	10	8	8	8.67	