Prioritizing Control Oriented Socio-Culture Distance Risks and Mitigation Strategies in GSD Context and Sensitivity Analysis

Research Dissertation Submitted By

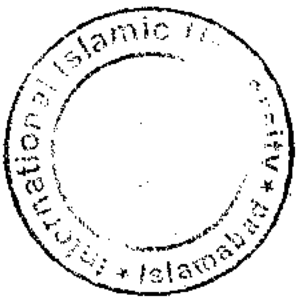
Muhammad Attique

(Reg#256-FBAS/MSSE/F09, DCS&SE, FBAS, IIUI)

Supervisor

Dr. Sajid Anwar

Assistant Professor, IM Sciences, Peshawar.



Co-Supervisor

Mr. Qaisar Javed

Assistant Professor, DCS&SE, FBAS, IIUI

DEPARTMENT OF COMPUTER SCIENCE AND SOFTWARE ENGINEERING
FACULTY OF BASIC AND APPLIED SCIENCES
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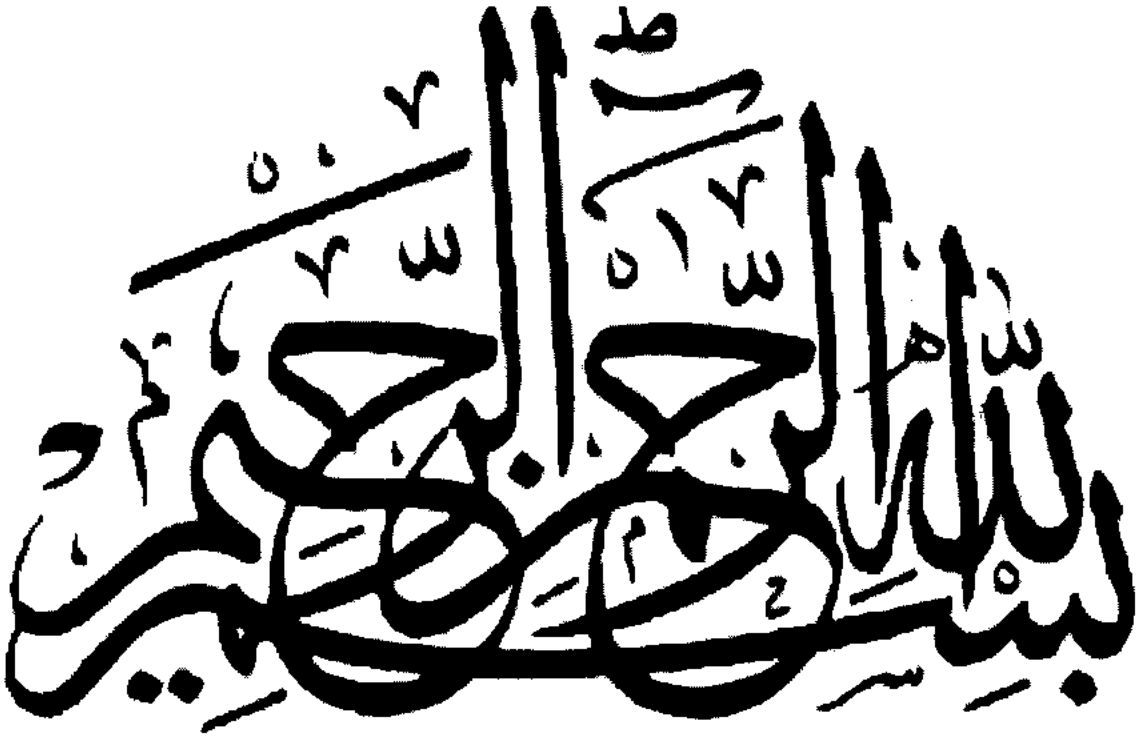

With the Name of ALLAH

The Most merciful and compassionate the most gracious and beneficent whose help and guidance we always solicit at every step and every moment

Prioritizing Control Oriented Socio-Culture Distance Risks and Mitigation Strategies in GSD Context and Sensitivity Analysis

BY

Muhammad Attique
REG.#256-FBAS/MSSE/F09

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Department of Computer Science and Software Engineering,

International Islamic University Islamabad, Pakistan

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Final Approval

This is to certify that we have read and evaluated the thesis entitled **Prioritizing Control Oriented Socio-Culture Distance Risks & Their Mitigation Strategies in GSD Context** submitted by **Muhammad Attique** under **Reg No. 256-FBAS/MSSE/F09** and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Software Engineering.

Committee
External Examiner:

Dr. Daud Awan
Dean
Faculty of Computing Science
Preston University, H-8/1, Islamabad

Internal Examiner:

Mr. Zulqarnain Hashmi
Lecturer
Department of CS&SE
IIUI

Supervisor:

Dr. Sajid Anwar
Assistant Professor
Department of CS
IM Sciences, Peshawar

Co-Supervisor:

Mr. Qaisar Javed
Assistant Professor
Department of CS&SE
IIUI

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List of Abbreviations

GSD	Global Software Development
AHP	Analytic Hierarchy Process
ANP	Analytic Network Process
C	Cost
A	Accessibility
G	Coverage
S	Security
CR	Consistency Ratio
CI	Consistency Index
OPM	Option Performance Matrix
RVV	Relative Value Vector
VFM	Value For Money

CHAPTER 1

INTRODUCTION

1.1 Global Software Development

Global software development (GSD) is paradigm shift for software development where many international organizations are now venturing. GSD utilizes the concept of globalization to its full extent. There is a rapid growth in the market globalization and production processes which increase the tendency to distribute the projects in a global valley [1]. There are diverse national and organizational cultures involved in the GSD process [2]. A number of organizations and different nations of the world are engaging in global software development since the last few decades. In a recent report, it is claimed that a huge amount of IT work is outsourced in the US by large organizations but the consuming ratio is 6.5 percent [3]. In Netherland alone 250 Dutch companies which have different size are executing some kind of offshore work. There are 50 nations in the world which are participating up to some extent in the GSD phenomenon. There are more than 1000 IT service firms which actively participating in global software development practices. The driving factors of GSD are the effortlessly recognized benefits: the most talented professionals in the globe with low cost and exponential development speed [4].

There are two strategic and critical reasons for adopting offshore software development paradigm: i.e. worldwide variance in development cost and large labor pool. Furthermore, the rethinking of the concept of GSD which exists in the mind of a firm is enabling the globalization process [3].

Similarly organizations are capable - due to enhancement in technologies, to effectively coordinate over long distances. Many organizations are investing in infrastructures in the GSD domain in order to get in hand the cost effective interests and competitive edge over collocated software development within one country, company or building [4].

Due to different communication and coordination methods and development of project management and configuration management software, it is now easy to do practices in GSD context.

1.2 Risks in Global Software Development

In spite of more economical variables, most companies realize that GSD is more risky approach. All types of projects and task of software development are not enhanced by GSD. During the contracts process in GSD domain, the cancellation rate is 20% during first year while 50% of the projects are not accessible to their objectives [5]. The distance factor in GSD mechanisms disturbs the benefits. This distance can be categorized temporal, geographical and socio-cultural [19].The question this raises in minds is that why do so many externalized development activities not succeed? There is 20% additional effort required in the outsourcing approach [5].Question mark is that how these risks can be reduced and efficiency of GSD can be improved. There is lack of attempts in order to realize the risk of GSD spatially its long term cost [4]. In case of distributed organizational design control, coordination, management, jobs and operation are scattered across different humans who are working in virtual environment.

Despite the fact that more and more companies are entering this domain, they still find increased complexity in the development process and initiation new products in the integration of scattered people which have different level of skills and processes in the diverse locations of the globe. In classical software development approaches coffee corner or white board points can be used to solve problems. But in GSD, cultural, ethical and functional diversities exist in teams. Their development sites are located in different parts of the world, and these locations have different variations in time zones which badly affect accessibility of software engineers for collaborating and discussing the different issues e.g. deciding design interface or bug removals etc. There is 30 % development ratio of embedded software in global paradigm while major part of development takes place in collocated paradigm [5] due to the knowledgeable risks with GSD. There is need for a mature approach to mitigate these risks and improve flexibility. Risk management provides a systematic mechanism to deal with management policies, practices and procedures related to the activities of analyzing, identifying, treating, evaluating and monitoring risks. On top of checklists and risk repositories, some classes of risks can be carefully evaluated for GSD projects [5]. The inadequate mechanisms for management and deficient processes are prominent risks drivers in GSD context. In order to provide a systematic approach for the identification and

evaluation of risks, we will analyze GSD major drivers and will study their impact by different GSD risks.

1.3 The Critical Challenge of Distance

It is necessary to examine the relation between organizational process complexity and distance. Communication, coordination and control are three pillars of an organizational unit to function properly. Unfortunately, distance creates serious difficulties in these three dimensions. In coordination each task can be integrated with each organizational unit, in order to achieve overall objectives. Huge and qualitative communication is necessary for orchestrating the integration. In Control process, adhering to policies, goals, quality levels or standards takes place. There is two dimensional typology of control process i.e. formal and informal. In formal type e.g. explicit guidelines and budget can be treated and in informal case e.g. peer pressure is executed [3]. Managers and engineers must consider the increase coordinating risks across different work sites which have extensive language, national and cultural barriers [7].

We recognize that in existing working environments the coordination and control have in many forms blended together for knowledge workers. Communication can be considered as mediating factor which affects control and coordination. In communication process complete and unambiguous information is exchanged in order to reach a common understanding. The negative effect of distance on communication reduces the effectiveness of coordination [3]. New tactics and approaches are being adopted due to its critical role in successful orchestration of a global software project.

1.3.1 Temporal Distance

The temporal distance represents the metric to dislocation factor in time in case when two agents want to interact with each other [8]. The differences in patterns of time shifting work or time zones are major causes of temporal distance which badly affect real time collaboration. When there is no overlap in the hours in remote locations then response time increases [2]. During organizing work patterns both temporal overlap of parties must be considered in order to ease communication and recover temporal coverage. Both increase and decrease in temporal distance is possible in patterns of time shifting work and time zone differences [2]. The one hour time zone difference within Europe can cause few overlapping hours and appears higher levels of

temporal distance than expected because of different working day routines. Conversely, a European liaising with a counterpart in India working a late shift may experience low temporal distance [2].

1.3.2 Socio-Cultural distance

Socio-cultural distance is a metric used to measure understandability of one actor about the values of another actor and their approaches toward different activities [8]. According to Kotlarsky and Oshri [9], the multiple interpretation of different situations by different people and their reaction to it, can be effected by culture. The culture may be organizational and national. The components of culture may be language, political setup, diverse individual motivations and their work ethics. When two actors have different nationalities cultural distance increases with geographical distance. And sometime cultural distance can be huge in case of low geographical distance.

1.3.3 Geographical distance

Geographical distance is a metric to measure the effort of one actor when he visit another actor and can be used to reduce the intensity of communication[8], specifically those cases where people have many media richness issues and there is not any suitable alternate for face to face communication. Ease of relocating can be considered best unit for measuring geographical distance rather than kilometers. Two locations can be considered close if there is good transport infrastructure even the geographical distance is large, but same preposition cannot be hold good about two locations where there is bad transport infrastructure but less geographical distance. Several facets can be realized due to ease of relocating, time and pattern of travel and visa and permit issues etc. Generally speaking, there are greater opportunities existing in low geographical distance for periods of collocated team work [2].

1.4 The Problem Statement

There were different studies conducted in order to highlight different issues in risk management in GSD context. Identifying different risk is the more complex activity but GSD makes it more complicated due to some of its inherent characteristics. GSD is a situation oriented paradigm, different risks can originate from one challenge depending on the context of an organization

[10].Similarly same relationship exists between risk and selecting their corresponding strategy. Selecting appropriate strategy is conflictive and depends on multiple criteria, because different risks have different supporting intensity for different strategies. So the need is a decision making model which gives relative importance of each risk with respect to each strategy.

1.5 Aims and Objectives

This study aims to do quantitative analysis of the reported Control oriented Socio-Culture distance risks which support the selection of corresponding risk mitigation strategy and similarly to that of each strategy. In order to check the relative impact under different conditions and scenarios of the reported risks, a sensitivity analysis approach was applied. To realize above aim we targeted following objectives:

Objectives:

- To quantify relative impact of each reported risk and its mitigation strategy
- To facilitate decision making and policy changing
- To enhance project manager's performance

1.6 Research Questions

In order to achieve the above objectives we investigated the following questions.

To realize above mentioned objectives we investigated the questions in below list:

Q1. What is the relative impact of Control Socio-Culture distance risks in GSD context?

Q2. What mitigation strategy is to be selected on the basis of resulting values in Q1?

Q3. Which risks are more sensitive with respect to each corresponding strategy in terms of its relative importance?

1.7 Scope

In Global Software Development, risks are related to communication, coordination and control. Further these types of risks can be divided in temporal, geographical and socio-culture distance risks. The scope of this study is limited to only control oriented socio-cultural distance risk.

1.8 Research Process

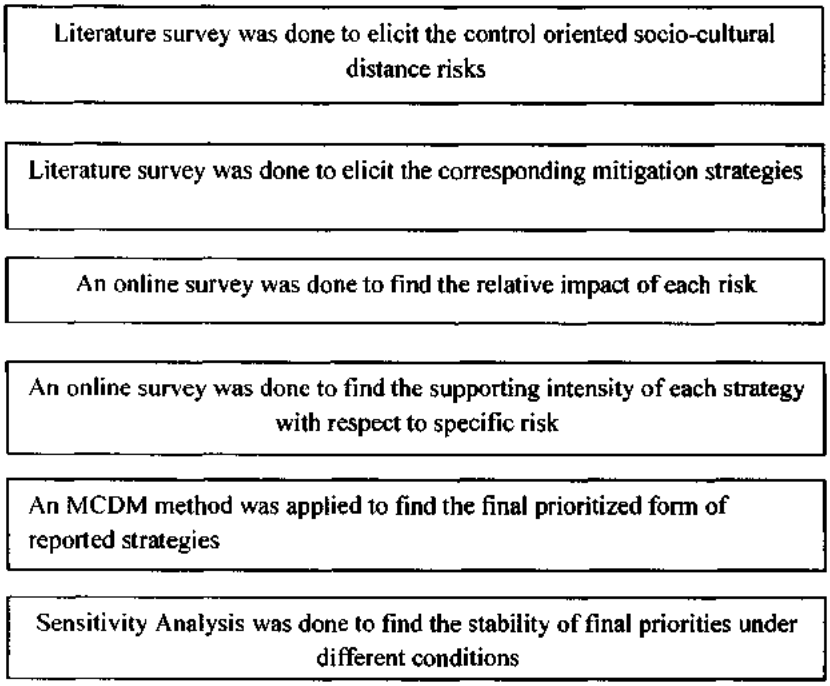


Fig1.1 process steps

1.9 Thesis Structure

This thesis consists of 7 chapters. Chapter 2 presents literature survey related to research topic. Chapter 3 gave touch to Research Methodology. Chapter 4 overview Background Study about AHP technique and reported control oriented socio-cultural risks. Chapter 5 presents the proposed Framework. Chapter 6 is about Data Analysis and results. Chapter 7 which is last chapter provides concluding remarks of the thesis.

[11] Developed a research framework from literature in order to provide base for future practice and research. In this framework existing knowledge and views are mapped to study capability of scrum practices in mitigating commonly recognized GSD challenges. This study can be used as reference by practitioners who need knowledge about scrum capabilities in GSD context.

[12] Highlight a procedure for analyzing and collecting qualitative data in case of GSD projects. Strategies have been explained for documenting and distributing work practices. Results show that fundamental problems such as local language, different cultures, political conflicts and synchronous interactions are main obstacles.

2.2 Socio-Cultural Distance

The socio-culture distance risk can be used as a metric for measuring the understanding of one actor about the norms and values of another actor [7].

[13] Studied the software development in the light of intercultural dynamics. Intensity of technical issues is much smaller than those which are related to humans in those cases where huge communication and collaboration is needed among developers which have diverse culture backgrounds. Project managers claim that software practices and artifacts can be affected by intercultural factors, and desired comprehensive study, and there is lack of analytical research in this area. This work explores GSD under the effects of intercultural factors. This work designs a framework to analyze intercultural variations by adopting several cultural models. In software development it is norm to face cross cultural issues. The work is already in continuous status in order to critically analyze intercultural issues and predict some future directions.

[14] Conducted case studies, in which agility practices were explored in GSD context. The results showed that distance i.e. geographical, temporal and socio-cultural can be decreased by applying agility practices in GSD context. From socio-cultural perspective this study claims that language is critical issue in many projects. There are also political, cultural and religious differences that can alter project performance.

2.3 Risk Identification and Risk Mitigation in Global Software Development

The success of a business or project e.g. software development project depends on Risk Management. The identification of risk and then selecting best mitigation strategy for it is more critical part of risk management. Limited knowledge about the challenges makes GSD Risk identification more complex, even for the most experienced project managers.

CHAPTER 2

LITERATURE SURVEY

2.1Global Software Development Challenges

Globalization of many organizations is most prominent concept of current decays. In software development where huge communication and coordination is exercised, the concept of globalization is utilized up to its full extent. Globally distributed teams working on the same projects face challenges of time zone difference, culture diversities i.e. different languages, social values, national traditions.

There are various economical reasons for GSD model adaptation in different organizations like accessing global labor pool, exploiting universal skills, low cost benefits and 24 hours development. [4] Analyzing the software development and studying the product quality and industry competiveness under globalization umbrella. This work highlighted the issues and discussed the potential solutions to handle these challenges to minimize the risk intensity and properly utilize the GSD benefits.

[1] Provides four dimensional approach to the research challenge i.e. elicitation and communication of requirements, software architecture, tools and environments and global development orchestrating. This work provides systematic understanding of what are coordination drivers and effective mechanisms for bringing it about.

[2] GSD provides more technological and organizational complexities for software development teams. Unlike traditional development geographical, temporal, and socio-cultural distances force problems exist within the GSD context. In this work, conclusions from a case study are presented which investigate the particular challenges linked with managing GSD. Some solutions can be extracted from this study to manipulate these challenges.

This study did an empirical study at three GSD based companies in USA operating in Ireland. It analyzes challenges related to geographical, temporal and socio-cultural distance by conducting qualitative interviews.

[16] Surveyed the challenges and their corresponding mitigation strategies in GSD projects by performing systematic literature review.

Studies reviewed with empirical evidences in GSD. From the systematic review there are 48 challenges and 42 mitigation strategies collected. Survey respondents also identified these risks and strategies. In addition, survey reported 4 additional mitigation strategies. Later a checklist approach was followed (as a risk identification and risk mitigation instrument) to compile the collected risks and associated mitigation strategies.

[15] Proposed a methodology based on multi criterion evaluation for decision makers such as managers and software experts to make strong their position in term of risks identification and mitigation strategies. Fuzzy operators i.e. two-additive Choquet integral were used in the method in order to model various interactions among risks. The case study was used to validate the potential of the proposed methodology.

2.4 Control Oriented Socio-Culture Distance Risks

[16] Explored the concern area and proposed a framework for management at global level in order to reduce the distance between the two actors. Much emphasis was given to unified framework in order to handle the issues in global project management. The results claimed that organization culture differences is the most critical risk which created difficulties due to organization structure differences, sharing of responsibilities, complex management levels and other such type of obstacles.

[44] Analyze culture effects on user preferences while using group ware applications. Culture can used to characterize individuals. In this study TAM (Technology Acceptance Model) was tailored in order to analyze the effects of culture differences on user acceptance behaviors toward groupware application acceptance as a remote collaboration tool for virtual teams in global scenarios.

Summary

In this chapter a through literature survey is made in order to analyze relevant work. The literature survey is performed from three aspects i.e. global software development challenges, Socio-Cultural Distance, Risk Identification and Risk Mitigation in Global Software Development, Control Oriented Socio-Culture Distance Risks.

CHAPTER 3

RESEARCH METHODALOGY

3.1 Research process

The concept of Interpretivism (Qualitative Research) provides base for this research, "The world is best characterized by an interpretive view" i.e. reality may exist in social components, there are many types of realties and interpretation exist, and time and context dependencies exist. Quantitative research method was most suitable for the problem at hand due to its nature.

3.1.1 Online survey and Interview

A questionnaire was designed according to AHP format in order to find the relative impact of the corresponding control oriented socio-culture distance risks and supporting intensity of corresponding strategies. Then an online Survey and Interview methods were used for collecting expert's data which have experience in GSD projects. The experts were used as primary data source in order to provide data for validation of this framework. The secondary data was collected from relevant literature which shows previous work in similar domains. The ordinal scale used was 5. The design of questionnaire was kept short using mathematical formulas such as transitive property.

The purpose of the survey is:

- To quantify relative impact of each reported risk by doing pair wise comparisons.
- And to study each strategy's support with respect to each risk.

3.1.2 Objectives of Questionnaire:

Following objective were keeping in mind while designing the questionnaire:

- To quantify the relative risk of each factor
- Quantify supporting intensity of each strategy in term of each risk

The process of expert opinion was used for determining and quantifying relative impact of each risk and supporting intensity of each strategy. The expert opinion was based on his experience and judgment.

3.1.3 Questionnaire Design

In order to design a questionnaire the following rules were followed

1. To enhance the well of respondents to entertain the questionnaire, the length of questionnaire was kept short.
2. Understandability was kept high by using simple words.
3. Much consideration was given to consistent meaning
4. Collaboration tools such emails and Skype were used for conducting the data collection process.
5. Office programs and Google applications were used in order to facilitate acknowledgement and response rate.

Following format was followed for relative comparison of different factors

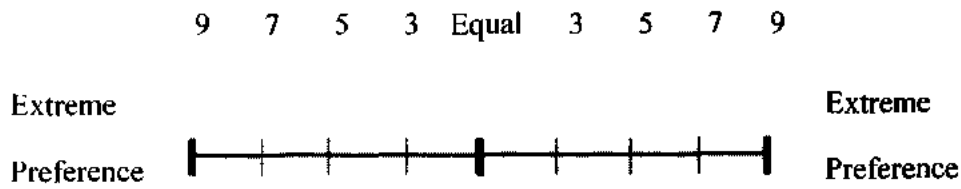


Fig 3.1 AHP standard Questionnaire

$$S = {}^{n(n-1)}/_{2} \qquad (1)$$

In (1) S denotes the size of questionnaire. The number of factors is represented by n. in our case n may be reported risks and corresponding mitigation strategies. According to limitation of AHP The accuracy of results get affected severely when n exceeds 7. To handle this issue we use transitive property in order to keep number of comparisons small and ensure all mandatory comparisons. E.g for the following case

P1<<<<P2 and *P2>> P3*

Then it is clear that *P1<<P3* and so on.

The *n*-1 rules were applied in order to find compulsory comparison. If we have *n* factor then *n*-1 compulsory comparison will be executed. The factors were compared in consecutive fashion. If we have five factors i.e. *P1, P2, P3, P4, P5*, and following mandatory comparisons will be used.

P1 vs. *P2*

P2 vs. *P3*
P3 vs. *P4*

P4 vs. *P5*

The previous studies in the same domain were used in order to decide the sample size. The different social network systems were used to find relevant exerts form the same industry and same department. To maximize the response rate the permission and time availability mail was sent to each expert. The geometric mean was used to find experts response.

3.1.4 Sample Population

AHP is a decision making method and since normally in organization decisions take place at executive levels so in our case we selected the expert pool for collecting our data. The expert pool was supported by proper profiling based on their job description, experience etc..

Following demographics parameters were considered:

- Type of Organization
- Number of Experience years
- Roles and responsibilities
- Department
- Country
- Age
- Number of Countries visited

The sample size was kept high in order to get accurate statistical analysis.

3.1.5 Data collection Sources and Method

Primary and secondary data concept was followed using data collection mechanism. Primary data was taken from the experts in the same domain and secondary data was taken from relevant literature i.e. journal, conferences etc.

A. Primary data

Primary data was extracted from the target sample using questionnaire as a tool. The process used was online, offline survey and interview. During interview the respondent was briefed before filling the questionnaire. Careless factor and subjectivity was checked using CR (consistency ratio method). The collected data was aggregated using geometric means.

B. Secondary data

Literature was used as a secondary data source in order to support primary data.

3.2 Research steps

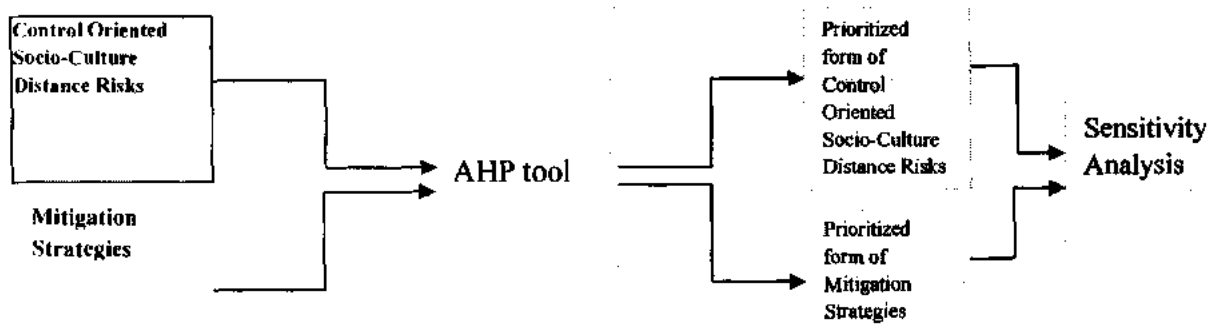


Fig 3.2 Research steps

Summary

This chapter explains the proposed research methodology for the problem at hand. Why we use and select this approach, a full justification is given. Interview and survey approaches were used for exploring the solution of the problem at hand. Questionnaire objective and the design has been explained and justified with proper argumentations.

CHAPTER 4

BACKGROUND STUDY

4.1 Analytic Hierarchy Process

4.1.1 Introduction

Analytic Hierarchy Process (AHP) is one of the most widely used MCDM i.e. Multi Criterion Decision Making methodology which was developed by Prof. Thomas L. Saaty. Using AHP Pair wise comparisons are performed in order to derive ratio scales. Actual measurement of some variable or subjective expert judgment i.e. satisfaction or preference acts as input to this method. As by human judgment is subjective or inconsistent so AHP provides some space for small inconsistency. Ration scale can be obtained from Eigen vector and CI (consistency Index) can be obtained from Principle Eigen value. There are many applications of AHP in multi contexts i.e. management sciences and decision making etc.

4.1.2 Nature of problems deal through AHP

The comparison of objects with respect to specific property is a mathematical process which can be sued to derive measurements [15]. Properties can be categorized i.e. tangible and intangible. There is not any scene in case of tangible properties but direct comparison is necessary in case of intangible properties. The value obtained for each object depends on the other object to which it is compared. Let us explain it with following scenario:

Let a Telecom company install a boaster which has three types. Suppose there are multiple criteria involved in this decision making. i.e. cost(C), accessibility (A), coverage(G), security (S). The three types of *B1, B2* and *B3* boasters have following characteristics.

B1- less cost, accessibility is not that much important issue because fault chances are rare, but less coverage and serious security are issues.

B2-less cost, accessibility is issue, maximum coverage, but serious security issue.

B3-high cost, accessibility issues, maximum coverage and not security issue.

The three devices will fulfills the company's requirements up to different extent and the selection of one dev ice is more complicated due to conflictive and multi criterion nature.

AHP is a technique which deals with such types of problems. AHP have many rich applications but with some limitations. Below we explain this technique before going to some examples.

4.1.3 The Basic Principle of AHP

Mathematics is main component of AHP. Now this is depends on company requirements; i.e. how much relative importance they gave to cost as compared to accessibility etc. These preference levels can be explained using Saaty table i.e.

Table 4.1 The Saaty Rating Scale [24]

Level of importance	Definition	Explanation
1	Equal importance	Two properties have same relative importance
3	Moderate importance of one with respect to other	Expert slightly prefers one factor over other.
5	Strong importance of one factor over other	Expert strongly preferred one factor over other
7	Very strong importance	Expert gave very strong importance to one factor over other.
9	Extreme importance	Expert gave Highest possible significance to one factor over other.
2,4,6,8	Intermediate values	When there is need of compromise

A very fundamental hypothesis is that if one factor *F1* is extremely more important than *F2* then it rate 9 and by reciprocal property *F2* will be rated 1/9. Similarly such comparisons are carried out for all considered factors. Then prioritization of factors with respect to relative importance is done (technically, this list is named as Eigen -vector). The last step is to calculate Consistency Ratio (*CR*) in order to show the consistency of judgments. If the *CR* value exceeds than .1 then results become unreliable and the exercise must be repeated. The analysis phase stops when

Eigen value is reached from the factors pair wise comparisons due to miserable use of AHP but the fact is that it is *hierarchical* process. The first Eigen vector obtained from relative comparisons shows the relative importance (impact in our case). During decision making when there are multiple decision variables and many options and each variable have different supporting intensity toward each alternative then successive matrices can be designed. These successive matrices will shows that how each requirements i.e. *B1, B2, B3* will fulfill the firm requirements. Eigen-vector and *CR* will be derived for each matrix. To derive final relative merits of B1, B2 and B3 options, standard matrix calculation will be used.

4.1.4 Worked Example

As in our case the company has four requirements angles in minds i.e. cost(C), accessibility (A), coverage (G), security (S). The will be not any interdependency in the considered factors according to Saaty's mathematics. The table 4.2 is the first table in pair wise comparisons of four criteria. The table shows 1 in diagonal entries which mean that each criterion have equal relative importance to itself.

Table 4.2 Diagonal Entries

	C	A	G	S
C	1			
A		1		
G			1	
S				1

There is not any standard mechanism followed but normally expert opinions in the same domain are used to determine relative importance of each criterion. Let company have following ground realities.ie

Cost vs. accessibility=3

Cost vs. coverage=1/7

Cost vs. security= 1/5

Accessibility vs coverage=1/9

Accessibility vs. security=1/7

Coverage vs. security=3

Company's requirements: The Company needs a telecom boaster which has maximum coverage, securable and up to some extent have reachable cost and accessibility.

Then below table can be filled as:

Table 4.3 Inserting values using Transitive, reciprocal property and Expert Judgment

	C	A	G	S
C	1	3	1/7	1/5
A	1/3	1	1/9	1/7
G	5	9	1	3
S	3	7	1/3	1

This forms the completed matrix, which can be referred as Overall Preference Matrix (OPM).

Table 4.4 4th root and Eigen Vector

	C	A	G	S	4rth Root	Eigen Vector
C	1	3	1/7	1/5	0.541	0.093
A	1/3	1	1/9	1/7	0.270	0.046
G	5	9	1	3	3.409	0.583
S	3	7	1/3	1	1.627	0.278

Sum= 1.000

The vector (0.093, 0.046, 0.583, and 0.278) is called Eigen vector which is called Relative Value Vector (RVV). These four numbers are the relative values of *C, A, G,* and *S*. The 0.583 means that the company values coverage most of all; 0.278 shows that they need security. Now we find the value of λ_{max} to determine Consistency Index and Consistency Ratio. From above table blow equations can be derived:

1*0.093+3*0.046+1/7*0.583+1/5*0.278 =0.370

1/3*0.093+1*0.046+1/9*0.583+1/7*0.278 =0.181

5*0.093+9*0.046+1*0.583+3*0.278 =2.296

3*0.093+7*0.046+1/3*0.583+1*0.278 =1.073

Now these numbers are divided by their corresponding Eigen Value to get:

0.370/0.093 =3.978

0.181/0.046 =3.935

2.296/0.583 =3.938

1.073/0.278 =3.860

Now the mean of these four values is determined which is 3.928. The 3.928 is actually the value of λ_{max} From this value the Consistency Index and Consistency Ratio can be determined.

Using the formula $CI= (\lambda_{max}-n)/ (n-1)$ and putting values in it we get $CI= (3.928-4)/3=0.024$ and $CR=0.024/0.90=0.027$. This figure shows that pair wise comparison can be trusted.

Table 4.5 Index of consistency for random judgments

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

The *CR* is 0.027. Then relative importance of three potential machines is calculated i.e. *B1, B2* and *B3*. The four tables were designed in order to show the performance of three machines with respect to each criterion (factor).

The first table is designed with respect to *P*, performance, and ranks the three given machines as:

Table 4.6 Pair wise comparison of alternatives w.r.t cost

	B1	B2	B3	3rd root	Eigen Vector
B1	1	7	9	3.979	0.785
B2	1/7	1	3	0.754	0.149
B3	1/9	1/3	1	0.333	0.066
Total				5.066	1.000

Now value of λ_{max} is determined as:

1*0.785+7*0.149+9*0.066 =2.359

1/7*0.785+1*0.149+3*0.066 =0.459

1/9*0.785+1/3*0.149+1*0.066 = 0.203

All these values can now be divided by their associated Eigen values

2.359/0.785 =3.005

0.459/0.149 =3.081

0.203/0.066 =3.076

Then the mean of these values is determined. So $\lambda_{max.}$ =3.054and *CI*=0.027 and

CR= .027/.58=.046

It means that *B1* is more supportive in term of cost than *B2* and *B3*.

Table 4.7 Pair wise comparison of alternatives w.r.t accessibility

	B1	B2	B3	3rd root	Eigen vector
B1	1	9	5	3.557	0.735
B2	1/9	1	1/5	0.281	0.058
B3	1/5	5	1	1.000	0.207
Total				4.838	1.000

1*.735+9*.058+5*.207 =2.292

1/9*.735+1*.058+1/5*.207 =0.181

1/5*.735+5*.058+1*.207 =0.644

All these values can be divided now by their associated Eigen values i.e.

2.292/.735 =3.118

.181/.058 =3.121

.644/.207 =3.111

Then the means of these values can be determined which is value of λ_{max} =3.117 and *CI*=.059 and *CR* =0.101 which means that data is consistent.

Table 4.8 Pair wise comparison of alternatives w.r.t coverage

	B1	B2	B3	3rd root	Eigen Vector
B1	1	1/5	1/9	0.281	0.058
B2	5	1	1/5	1.000	0.207
B3	9	5	1	3.557	0.735
Total				4.838	1.000

1*.058+1/5*.207+1/9*.735 = 0.181

5*.058+1*.207+1/5*.735 =0.644

9*.058+5*.207+1*.735 =2.292

The resulted values can be divided by their associated Eigen values

0.181/.058=3.121

0.644/.207=3.111

2.292/.735=3.118

Now the mean of these values is determined which is λ_{max}=3.117 and *CI*=0.059 and *CR*=0.102

Table 4.9 Pair wise comparison of alternatives w.r.t security

	B1	B2	B3	3rd root	Eigen vector
B1	1	3	1/9	0.693	0.138
B2	1/3	1	1/7	0.362	0.072
B3	9	7	1	3.979	0.790
Total				5.034	1.000

1*.138+3*.072+1/9*.790 =0.259

1/3*.138+1*.072+1/7*.790 =0.231

9*.138+7*.072+1*.790 =2.536

The resulted values can be divided by their associated Eigen values i.e.

0.259/0.138 =1.877

0.231/0.072 =3.208

2.536/.790 =3.210

The figure 3.206 represents the mean of the resulted values which represents λ_{max}. The *CI* =0.103 and *CR*=0.177

Now at the final stage matrix is designed for the Eigen Vectors of *B1, B2* and *B3* as:

Table 4.10 Option Performance Matrix (OPM)

	C	A	G	S
B1	0.785	0.735	0.058	0.138
B2	0.149	0.058	0.207	0.072
B3	0.066	0.207	0.735	0.790

The resulted matrix is called *OPM* (option performance matrix) which rank the different machines in term of their performance under different selection criteria. The above shows that *B1* have better performance level in tern of cost then *B2* is best choice. *B1* is also best choice in term of accessibility. Similarly in term of coverage *B3* have best performance level after it *B2*. In term of security *B3* have best performance before *B1*. The results obtained are not absolute but relative. These results are case oriented. If in other relative values of the criterion are changed then results will be obtained in different form. In this case the company has conflicting and multi criterion objectives. Then the Relative Value Vector (*RVV*) is combined with Option Performance Matrix (*OPM*). There should be post multiplication of *OPM* by *RVV* to obtained final results for the firm's i.e.

In matrix algebra we have

$$OPM*RVV=VFM$$

Or, in words,

Performance*Requirement= Value for money.

Value for money=*OPM*RVV*

$$\text{Value for money} = \underset{3\times4}{\begin{pmatrix} 0.785 & 0.735 & 0.058 & 0.138 \\ 0.149 & 0.058 & 0.207 & 0.072 \\ 0.066 & 0.207 & 0.735 & 0.790 \end{pmatrix}} * \underset{4\times1}{\begin{pmatrix} 0.093 \\ 0.046 \\ 0.583 \\ 0.278 \end{pmatrix}}$$

$$\text{Value for money} = \begin{pmatrix} 0.785*0.093+0.735*0.046+0.058*0.583+0.138*0.278 \\ 0.149*0.093+0.058*0.046+0.207*0.583+0.072*0.278 \\ 0.066*0.093+0.207*0.046+0.735*0.583+0.790*0.278 \end{pmatrix}$$

$$\text{Value for Money} = \begin{pmatrix} B1 \\ B2 \\ B3 \end{pmatrix} = \begin{pmatrix} 0.179 \\ 0.157 \\ 0.664 \end{pmatrix}_{3\times1}$$

4.1.5 Judgments in AHP

The four selection variables used in this example are *C, A, G* and *S* which provide base for whole calculation. The question mark is that which mechanisms are used to select such factors? . No formal method exists, but focus group approach should be used to discuss these factors with small group members who have expertise in relevant domain.

4.1.6 Strengths and Weaknesses of AHP

There are some strengths and weaknesses of AHP. The major application of AHP is to rank the different alternates on the basis of their relative importance in case of multi criterion and conflictive situations. If there is a case to execute judgments about the relative importance of, in this example, the objectives of cost, accessibility, coverage and security, and those about the competing different types of boasters' capability in order to fulfill the organization objectives, have been prepared in good confidence, then the AHP calculations guide certainly to the rational consequence of the corresponding judgments. It is somewhat tough – due to huge mathematical prepositions but there is not any impossibility, to 'fiddle' the judgments in order to obtain predetermined results. Similarly AHP have capability to check inconsistencies in case human

judgment. The matrices obtained in AHP should be of same type i.e. same mathematical form which is referred as positive reciprocal property. This reciprocal property in matrices is the limitation of AHP domain. The reasons have been explained by Saaty's book i.e. there is no need any high profile skills needed in mathematics. Let we have two properties i.e. *P1* and *P2* and if *P1* have extreme importance as compare to *P2* then 9 will be assign to it. Similarly *P2* will be assigned 1/9 to show the relative importance between *P1* and *P2*. According to some people it makes sense but others are not so happy about it. Similarly the other big disadvantage of the AHP is the variation in the scale i.e. if we change the scale from 1 --- 9 to 1 ---29 then the final results are altered. To explain the *VFM* concept i.e. it shows the relative importance of some variables as compare to other variables. But it does not show the ratio of importance i.e. in our case the *VFM* (0.179, 0.157, and 0.664) shows that *B3* is better than *B1* and *B2* but it does not mean that *B3* is *X* times better than *B1* and *B2*. In those case where less precise data is needed then it would be no terrible thing to change the rating scale and check the variation in the final results. If continuously better score has been generated by one option then that is very energetic option. AHP is better techniques if there is competency involved between different variables in meeting objectives of some organizations. There is not any complex mathematics in the AHP, it just show the relative concept of different factors.

4.1.7 The General AHP Theory

In AHP we have number of elements and we want to compare them in order to find relative importance of one element as compare to other element. Let we have list E_1, $E2$.....E_n. Let we find relative importance of E_i with respect to E_j then we get a square matrix $A=A_{ij}$ with constrain that $A_{ij}=1/A_{ij}$ for $i \neq j$, and $A_{ij}=1$ for all $i=j$. a matrix obtained by such procedure is referred as reciprocal matrix. In order to check the consistency we have to use the transitive property, i.e. A_{ij} $A_{ij}*A_{jk}$ for all i,j,k. such a matrix will be obtained if exactly measured data were used for calculating the A_{ij} Then ω will be calculated by using expression $A\omega = \lambda\omega$. In this preposition the ω will be Eigen vector and λ represent the Eigen value. If a matrix satisfy the equation $\lambda = n$ then it will be consistent. If there is touch of human judgment then the condition A_{ij}. $A_{ij}*A_{jk}$ cannot be obtained perfectly, because there is some incocnsistency exist in human oriented processes. So in situations the equations $A\omega= \lambda_{max}\omega$ and $\lambda_{max} \geq n$ should be satisfied. There will be 100% consistency if $\lambda_{max} = n$ but as we know that there is some inconsistency exist

in human judgment so according to Saaty the value of *CR* is acceptable up to .1 , but if it exceeds than .1 then the exercise will be revised. . The relation $(\lambda_{max}-n)/(n-1)$ used to find consistency index and consistency ratio where n shows the number of criteria.

4.2 Corresponding Mitigation Strategies

Strategy is an activity to ease the impact or occurrence of risk which is associated with problem or risk [19]. It is an umbrella activity and all well known development methodologies and effort have touch with it. Risk management is hard during collocated software development but in GSD this activity become more complicated due to issue of diverse cultures and other variables. The question is that how we can do it. One of the methods is to design a warehouse of critical level incidents which can be analyzed using methodological approach. This analysis will give a pattern language which will support risk management process to analyze, palliate and/or mitigate cultural mishaps [11]. Different studies prove the statement that language and vocabulary is not the main problem but to translate each phrase in different contexts is an issue. To communicate in English is an excellent approach. It is important to know that members in virtual teams are typically from diverse countries with varying cultural values regarding what to say, how to say it and when to say it. Different cultures respond in dissimilar ways; e.g. the Japanese professionals will responds slowly because of different communication culture and it represent the wholeness in replying mode but on other hand Indian professionals will execute quick response due to past collaborations with US schools.

The interpretation remains a challenge due to fact that long time in response is considered thought through while some time fast response is preferable. The different structures of diverse cultures must be understood which allow project managers in distributed context to identify and internalize common thinking ways [2].

To care for the risk identified i.e. (missing language competence) above by company A, the following actions are suggested:

- There should be training arrangement in order to get common understanding about language and modeling skills.
- Requirements should be professionally translated
- Do interchange of humans for the associated language skills needed.

In GSD the risks and particular problems are not underestimated and known at beginning of the project and most of the risks are not very important in case of GSD projects but in some special situations[44]. Both at macro and micro level number of risks are linked with software development. Numerous researchers have focused on abrogating these risks by advocating various mitigation strategies at organizational and technological levels [18].

The following list of mitigation strategies is reported from literature in order to mitigate control socio-culture distance risks in GSD context:

- Acknowledge cultural difference acknowledgement
- During project management ensuring the upper management support
- Arrangement of employee rewards
- Provide Training
- Cross-skilling

4.2.1 Acknowledge cultural difference

The flows of experts and developers within firms between different countries are a continuous process for the global software development organizations. The labor movements are temporary solutions than overall structure of development and organization business strategy. The management of these networks where huge flows of labor occur, and designing global corporate culture is a big challenge for industry especially for US and Indian organizations [26]. Practitioner articles (cf., [20]) claims that differences in culture stemming the misapprehension and many issues are prevalent in global software development industry , as 51 % of CIOs reported that the prominent challenge I outsourcing industry is culture differences. According to the claim in recent work, that during decision making about outsourcing their work, the culture differences is significant driver of uncertainty [21]. Even during an economic activity, [27] the culture differences between two partners can affect the economic output in international scenarios like joint ventures [22]. Project managers have serious implications about these culture differences in order to control development activities. Ideology of vital equality and contractual agreements are important drivers of Western hierarchical relationships, while hierarchical relationships in Indian context tend toward closely internalized hope in both subordinate and superiors for mutual obligations and reciprocity in a more strongly linked exciting relationship

[23]. Similarly, the amount of guidance provided by American managers is not enough for Asian subordinates [24]. Research claims that work patterns are affected by culture differences [25]. It is evident from experiments that teams which belong to cultures of low uncertainty may be more risk seeking and susceptible to escalation of commitment behavior [26].This scattering in values and attitudes can cause conflict between vendor and client in offshore projects. The inefficiencies are imposed due to due to above diverse culture differences which are proved by anecdotal evidence, Overby [27] noted: "*One reason for that is the American workers' comfort level with speaking up and offering suggestions. A good American programmer will push back and say 'what you're asking for doesn't make sense, you idiot.' Indian programmers have been known to say, 'this doesn't make sense, but this is the way the client wants it*".

People working in this domain have still norms and cultural values which rose from their particular and social system. The design of overseas development center can be considered a useful tool for synching and, thus, for raising project success rates and moving up the GSO value chain, but it has its limits [28]. [29] employed Engagement theory in order to assists students to work on a real-life software development project; to understand the expectations of the business client for whom the software system is to be designed ; to apply data base design and software engineering methodologies to the design and implementation of a complete system; to tackle developers daily basis issues, such as working in team, liaison with clients, documenting the project; to get experience in translating their knowledge into practice; and to obtain progress feedback from intensive reviews of their work.

4.2.2 Ensure upper management support through the Project

The Willingness of higher management to provide the necessary support and authority or power is vital component for project success [30]. According to research claim top management support can be considered as critical factor for project success [31].

The research suggests that top management must be encouraged in order to identify and focus most strategic areas of investment for organizations. Also literature justified that operational managers must take responsibility to deliver the expected benefits. When distance is involved during different activities then organizational context present many obstacles. To overcome these obstacles there should be innovative support structures, control systems for performance, new coordination approaches and variation in performance goals are to be considered. It is most

important factors to make sure top management support but there is little knowledge that how this support can be attributed from perspective of top managers and team members.

Factors that Determine Top Management Support

Factors that characterize the top management support are:

The nature of the project determines the level of top management support. Those projects which have solid ROI, high strategic importance are candidates for top management support. Also project complexity or time lines are necessary variables for getting top management support. Top management is willing for support in those projects which have expected positive results in case of possible worse conditions.

Stage of the Project:

The level of top management support also depends on stage of the project. The level of support for projects is not always constant. During different stages of the project, the top management support varies depending on the nature of particular stage. The top management support can be elevated to emerging strategic projects. The project itself might hit roadblocks that change top management's expectations for project success and outcomes.

Project team member's nature:

The characteristics of project team members is deciding factor for top management support.

The attributes which make conditional top management support can be:

- Team performance in the past
- The team members' tenures on the team and in the organization
- Experience of the teams with similar initiatives
- The team's level (rank) in the organization.

Organizational Factors:

The organizational factors such as firm strategy, culture, organizational slack resources and innovativeness can condition top management support. The firm strategy shows the alignment of projects with tactical objectives. The organization slack i.e. the availability of resources which is

beyond normal operation of the business operations also is a serious matter because it affects top management support.

Industry Factors:

An organization industry type also influences the top management support. The situation becomes more critical if competitors are implementing similar strategic technology. For purposes of legitimacy, organizations have a tendency toward adopting 'copycat' strategies. Furthermore, the level of managerial judgment (sense about decision making) also changes in different industries and influence top management support. There also variations exist in top management support spatially in worst cases i.e. project overruns the necessary support beyond initial values.

Top Management Team Attributes:

At the same time many issues are handled by top management which limits their engagement in full rational processes. So during decision making they rely in part on experience and background.

Suppose following characteristics of top management are considered for supporting project.

- It's personal relationships with team members of the project
- Their understanding ability about technology
- Their experience and tenure with the firm

4.2.3 Apply appropriate rewards to employees

The global diverse work styles, expectations ,performance goals and individual time needs of today's work force must be understand by project managers. Managers must be very careful and should get best effort from every team members, while keeping in mind the culture norms and honor in work styles [32].

Organizations should adopt different approaches like Strategic recognition programs of employees which aid in personalizing the employee rewards programs and appealing diverse cultures which represent the main characteristics of the of current market workforce. Every country and cultures have different types of personalities, and well defined work ethics and his

own procedures, norms and values associated to employees and different approaches towards their jobs and professions. The leaders and executive should have very clear understanding about different work force parameters and how their culture beliefs can affects their approaches towards performing their daily work activities [32].

4.2.4 Provide Training

Cross-Cultural Training (CCT) is very important parameter which develops culture competences of organizations and individuals which underpins the social capital and cohesion [33]. This program should be evaluated in the context of Globe in relation to governance, social cohesion, work force development and emerging globalization. The development of social cohesion and human resources mainly depends on social capital of society, described as the networks and norms of reciprocity and trust that enhance productivity. Social cohesion and social capital are culture competence variables which show the aptitude of the system, organization, individual and professions to work efficiently in diverse culture and situations. Cross culture training is an important variable in the development of culture competence which aims to develop knowledge, awareness and skills needed to interact effectively and appropriately with customers and co-workers of diverse cultures.

4.2.5 Cross-skilling

Cross skilling is an effective way to optimize talent, build teamwork, and keep people stimulated. When people have much knowledge about various roles and functions, they not only amplify their own skills, also become source of expectations for other people needs and they come to worth each other more. They also gain a fresh perspective about their own roles. The quality of the experience depends on interpersonal dynamics and politics. If some organization tailor this learning model then it should develop atmosphere of trust and mutual respect, otherwise people will not ready to share knowledge openly. The organization's intentions have to be clear and they can't change mid-stream or trust will be broken - and it can take years to get it back.

Summary

This chapter explains the concept of AHP and its context i.e. which type of problems are handled by this tool. An example is given to clear the topic domain regarding this research thesis. Similarly the reported mitigation strategies to mitigate communication oriented socio-cultural distance risks are also explained and justified with the help of previous studies available in literature.

CHAPTER 5

PROPOSED FRAMEWORK

5.1 Introduction

Risk management in software development is more critical activity, if it is not handled carefully, it can lead to time and cost overruns. Today many organizations are adopting the global software development paradigm for exponentiation of their business values. Global Software development brings some inheriting issue of distance. These triangular issues i.e temporal, geographical and socio-cultural affect process of communication, coordination and control. In GSD developers have diverse cultures, have different languages, social values and norms. Project managers must have in depth knowledge about these dimensions. The literature reports different risks and mitigation strategies in this corner of GSD. Which strategy is more valuable on the basis of existing ground realities is challenging problem. This study attempts to devise a frame work to assist project managers in decision making.

5.2 Corresponding Risks

In GSD, distance can be classifies in three forms i.e. temporal, geographical and socio-cultural. The people working in GSD have different organizational and national cultures and different time zones are involved during development [34].

In GSD, stakeholders from different national and organizational cultures and time zones are involved in developing software [34]. The issues concerning culture such as attitudes toward hierarchy, time sensitivity, communication and coordination styles, and need for structure, are different. GSD exploits these differences, but it also originates misunderstandings among people. Communication problems are arises due to cultures differences, and as software development requires rich communication, so rework and misalignment occur in the case of absence of this variable.

The benefits of GSD cannot be fully benefited, if there are not proper knowledge and information sharing mechanisms [34]. In order to succeed in today's dynamic market, there must be proper procedures for managing the GSD risks and useful steps should be used in order to design the development process in more detail and keep culture in mind in general[4]. Socio-

culture variables represent fundamental differences in system values which guide our lives. It represents a complex and different culture dimension like business, political and language culture and organizational as well as different work ethics and personals motivations. Actually variables like social values, norms, manners of expression and different style of communications can be defined by culture. Organization structure can also be affected by this factor.

Software is one of the most critical factors of today's business environment and there is superior and mature risk management effort is needed to adeptly steer software development projects [15].

According to previous research, socio-culture distance is a metric for measuring for one actor the understandability and acceptance of the social values and norms of another actor. There is not always a reciprocal property existing between the culture proximity of the two people as people are quick to accept the customs and ways of each other [35]. All the above issues magnify the magnitude of risk in GSD context which needs a knowledge-based approach to mitigate these risks. The relationship between two members can originate due to conflicting values when they do not share a culture similarity. These conflicting values can minimize the trust levels which badly impact their relationship [36].

The project performance can also decrease due to culture differences. Budget overruns, time overruns, low quality and high cost are main affecters of culture differences. In the real world scenario, it is very common that in a project there are so many risks identified that it takes a long time in investigating all of them. This is the reason that the actual need of risk analysis and risk prioritization is realized to the project managers. But project stakeholder's distribution in GSD projects is often characterized by temporal, geographical and socio-cultural distance and creates a number of challenges that may impact the project's communication, coordination and collaboration processes [17].

Therefore, the most effective and the efficient technique for it is risk exposure but the problem associated with it is the accurate estimation of the probabilities and the loss associated with the unsatisfactory outcome during project management. The complete risk analysis activity involves benchmarking, prototyping, simulation which provides the better probability estimates as compared to the others but the disadvantage associated with it is that they are too expensive and extremely time consuming activities [37]. Software development in distributed scenario must handle the remote management of people, the geographical and temporal distances, socio-culture

obstacles, communication issues and distributed workforce integration [38]. Therefore; global software development characteristics can have a significant impact on software cost, product quality, project schedule, and developers' productivity [39].

Clearly a lot of complexity arises due to socio-culture distance risk. Companies at both sides express their confusion and misunderstanding which results from the problems related to language and interpretation. Due to this reality the concepts of control, communication and coordination becomes more complex and intensify the risk of low understanding between teams [34]. Business globalization pen the new road for software development i.e. the GSD paradigm has been adopted by many organizations in order to model their business process. The GSD paradigm assure certain benefits i.e. reducing time to market, proximity to market, 24/7 development, and accessibility to cheaper and more skill people.

The benefits of GSD are coupled with challenges due to distance involved i.e. temporal distance which represent differences in time zones, geographical distance b/s team members are located in different part of the world and socio-cultural distance i.e. team members have different organizational and national cultures. These aspects badly suffer the mode of coordination, communication and control. Such type of challenges makes GSD more risky. Risk may be considered as the probability of suffering loss while pursuing goals due to factors that are unpredictable [6].

To develop project in GSD umbrella, there is need additional effort in case of project management. The organizations enter into this paradigm may face emerging challenges as compared to collocation development. The risk management should be tailored according to GSD nature because it offers specialized type of risks and challenges. Actually the risk management is an important phase of every project development including software projects. The core activity in project risk management is to identify the risks and then selecting best strategy for it.

Selection of best strategy is dependent on many criteria when multiple strategies exist. There exist conflictive factors among the selection of criteria. One criterion favor one strategy and other criteria support the other strategy. Also there is limited knowledge existing about GSD challenges so risk identification in risk management becomes complex [6]. Similarly GSD brings a long spectrum of challenges related to three pillars of communication, control and coordination. For example the developers have lack of required competencies i.e. lack of domain

knowledge to implement taxation laws etc. we use different mechanisms for modeling the process such as XML nets where we can assure with help of edge label that when the quality or quantity of input artifact have some level of quality then an activity which have input the artifact, will be executed.

Following are some communication oriented socio-culture distance risks surveyed from literature.

- The surety of equal domain knowledge
- Minimize staff- turnover and its management
- Inadequate skill set

5.2.1 Ensure equal domain knowledge

Knowledge intensive activities are performed during software development in order to device coherent solutions for a business problem. In this process, two types of knowledge exist:

- Domain knowledge
- Technical knowledge

This process depends on formal requirements in order to transfer knowledge related to design problem to development organization from customers. If the formal requirements can accurately capture the needs of the customer, the benefits of the vendor having in-depth knowledge of business domain or the customer technical level about software i.e. development methodologies, programming language and process for software development is limited, then customer and vendor feel comfortable and get advantages from their specialization and show less tendency towards the knowledge of each other's activities in order to execute successful software development [41]. However, some time, this absence of knowledge leads to poor design which cannot fulfill customer's expectations.

5.2.2 Minimize and manage staff- turnover

The hottest and most discussed issue in much organization in recent decades is employee turnover. The discussion becomes more intensive since economic crisis of 2008. Employee turnover rate is considered more serious issue for a country because it offers huge resistance in the organizational process development. The employee turnover rate cannot be terminated but it

can be minimized up to a large extent. There are many strategies used for achieving such goals, e.g. policies of compensations and benefits. All type of organizations encounter this issue so it is unavoidable but can be managed. The employee turnover can be classified as voluntary and involuntary. In voluntary turnover the employee intentionally leaves the organization, but on other hand there is firing or laid off of employees in involuntary case. These compensation type ideas have multiple views (stakeholders, managerial, societal, employee and even global) and have multiple meanings i.e. rewards, returns, entitlement etc) add richness to this topic. That is the reason why compensation and benefits are more emphasized by the employers because it is essential in minimizing the employee turnover.

Abassi and Hollman (2000) highlighted five reasons for employee turnover in the organization:

- Hiring practices
- Managerial style
- Lack of recognition
- Lack of competitive compensation systems
- Toxic workplace environments

In summary, this three dimensional model of commitment tries too gave details related to cumulative power individuals in an organizations they want to (affective), they need to (continuance), and they ought to (normative) remain in the organization.

5.2.3 Inadequate skill set

The big issue in collocate development and main reasons and driver for outsourcing the software components across the border is limited personals and their restricted skill set. Insufficient resources or lack of particular expertise can jeopardize the value of information systems in business domain. These variables can be considered while outsourcing the software development work. The target side should have the required domain and technical expertise. A business synergy can be established by combining the core competencies in order to provide value added services to customers.

5.3 Proposed Framework

The output of this study will be a decision making frame work which assists project managers. This frame work is a hierarchical structure which consists of three layers. The first layer is about objective of the problem i.e. evaluation of reported risks and their corresponding strategies. The

second layer represents the criteria (in our case risks) and the third layer is alternatives (i.e. mitigation strategies). The lines shows that each risk can be mitigated using any strategy but with different extent. The objective of this study to find that how much value.

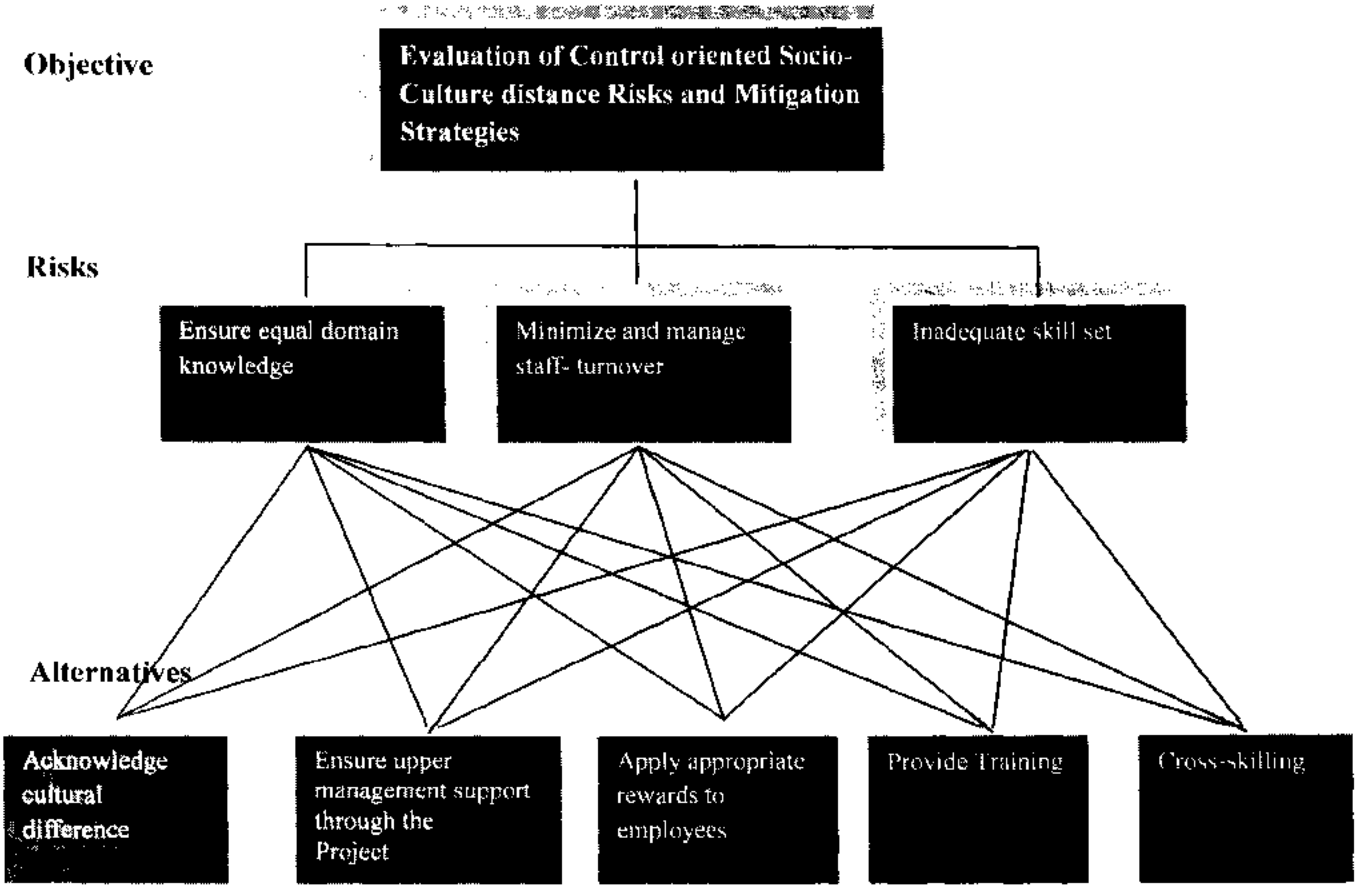


Fig 5.1 AHP decision Tree

Summary

This chapter presents the general evaluation criteria for analysis of m-payment business models. It also presents the hierarchical structure of the problem in hand. There are three layers. First layer represents the objective i.e. evaluation of m-payment business models and second layer represents the evaluation criteria and similarly third layer represents the alternative.

CHAPTER 6

DATA ANALYSIS

6.1 Introduction

The AHP is decision making approach when we have many criteria and these criteria are conflicting with each other. Suppose we have a selection model having multiple criteria and alternates. If different criteria favors different alternates with different intensity then selection process become more complex. AHP is best candidate for such type of situations. It model human subjectivity during decision making. There have many application which uses AHP tool for solving their problems.

6.2 AHP calculation

AHP is mathematical procedure where many mathematical propositions used. In order to get final results, this method passes through many mathematical steps. The first step is pair wise comparison. The input for this step is survey results which are extracted from experts using online and offline survey and interview. This input data passes through so many steps and resulted in final ranks of reported factors and corresponding strategies.

6.3 Pair wise comparison

In case of comparisons of two factors, when we are finding dominance of one factor over other specially on the basis of intangible properties then we have to use scale of absolute number to determine ratio scales[13]. The data from survey was aggraded using geometric means and resulted values are entered in the corresponding cells. Reciprocal positions are filled by reciprocal values. Mathematical transitive property was used in order to fill remaining positions. These values were used to do pair wise comparisons between the reported risks in order to their relative dominance over each other. After getting Eigen values for each table the CI(consistency index) and CR (consistency ratio) was find out to validate the accuracy of these results.

Table 6.1 Pair wise comparison of reported risks

	Ensure equal domain knowledge(C1)	Minimize and manage staff-turnover(C2)	Inadequate skill set(C3)	3th root	Eigen vector	% Intensity
Ensure equal domain knowledge	1	2	3	1.82	0.54	54%
Minimize and manage staff-turnover	½	1	2	1.00	.30	30%
Inadequate skill set	1/3	1/2	1	.550	0.16	16%
				3.37		

Description: The Eigen vector shows the pair wise comparisons of the factor (i.e. criteria) , according to which the " ensure equal domain knowledge" is serious risk according to industry expert then "minimize and manage staff turnover" and then "inadequate skill set".

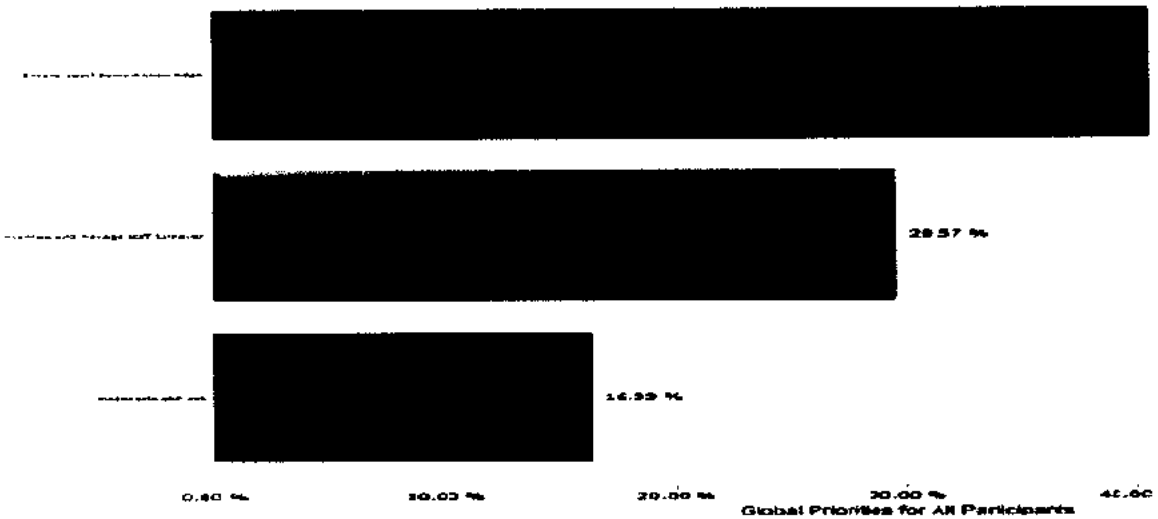


Fig 6.1 Prioritization of criteria

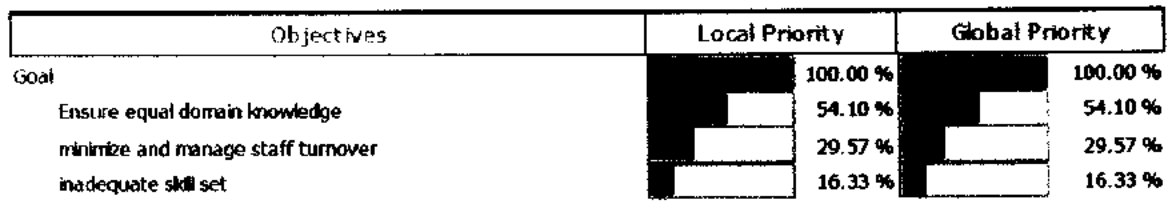


Fig 6.2 Local and Global prioritization

1*0.54+2*0.30+3*0.16= 1.62

½(0.54)+1*0.30+2*0.16=0.89

1/3(.54)+1/2(.30)+1*0.16=0.49

The numbers obtained will divide by their Eigen values i.e.

1.62/.54=3

0.89/.30=2.97

0.49/.16=3.06

The mean is= λ_{max}= 3.01

CI= (λ_{max} -n)/(n-1)

CI= (3.01-3)/ (3-1)

CI=0.005

CR=.005/.58=0.008

Table 6.2 Relative performance of alternatives with respect to C1

	Acknowledge cultural difference	Ensure upper management support through the Project	Apply appropriate rewards to employees	Provide Training	Cross-skilling	5th root	E.V	% Impact
Acknowledge cultural difference	1	1	3	2	5	1.98	0.36	36%
Ensure upper management support through the Project	1	1	1	1/3	1/5	0.58	0.11	11%
Apply appropriate rewards to employees	1/3	1	1	1	1	0.80	0.15	15%
Provide Training	½	3	1	1	1	1.08	0.20	20%
Cross-skilling	1/5	5	1	1	1	1	0.18	18%
						5.44	1.000	

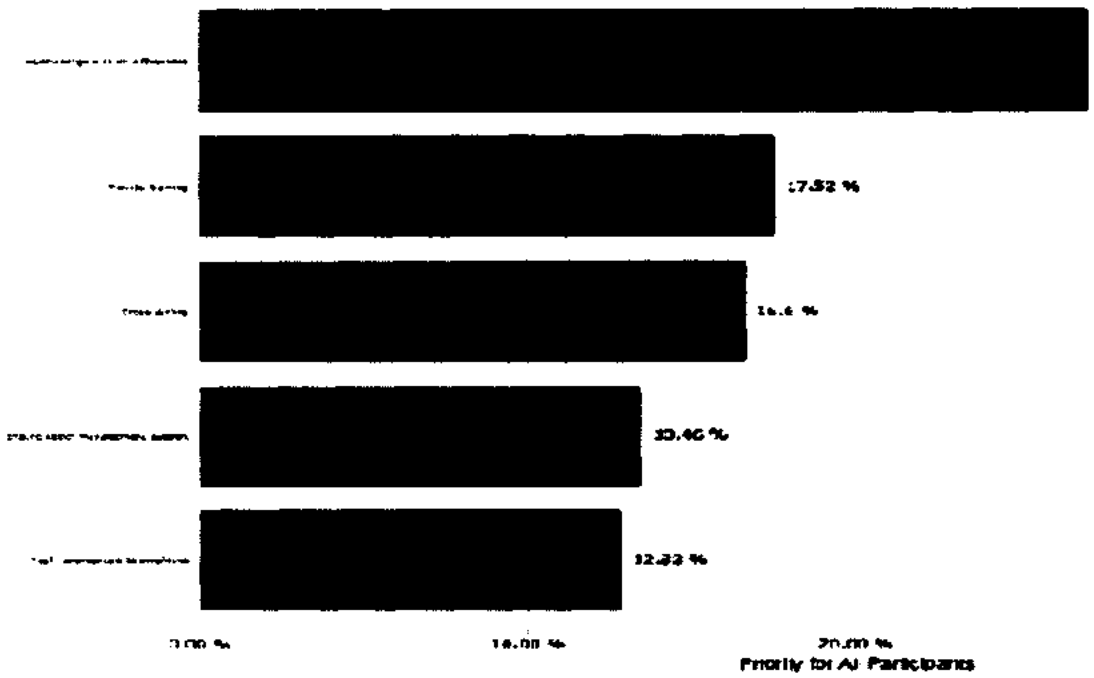


Fig 6.3 Prioritization of alternative w.r.t 1st creteria

Description: Eigen vector claims that "acknowledge culture differences are best alternate for with respect to "ensure equal domain knowledge" risk.

1*0.36+1*0.11+3*0.15+2*0.20+5*0.18= 2.22

1*0.36+1*0.11+1*0.15+1/3*0.20+1/5*0.18=0.722

1/3*0.36+1*0.11+1*0.15+1*0.20+1*0.18=0.76

1/2*0.36+3*0.11+1*0.15+1*0.20+1*0.18=1.04

1/5*0.36+5*0.11+1*0.15+1*0.20+1*0.18=1.16

Now divide the resultant values by their corresponding Eigen values

0.22/.36= 0.62

0.722/.11= 6.56

0.76/.15=5.06

1.04/.20=5.2

1.16/.18=6.44

λ_{max} =4.78

$CI= (\lambda max_{-n)/(n-1)}$

CI= (4.78-5)/4= 0.056

CR=.056/1.12=0.05

The 0.05 value of CR shows that results are satisfactory. According to results, the "acknowledge culture differences" criteria have more importance than other criteria according to industry experts and similarly "provide training" and "cross skilling" respectively have relative impact.

Table 6. 3 Relative performances of alternatives with respect to C2

	Acknowledge cultural difference	Ensure upper management support through the Project	Apply appropriate rewards to employees	Provide Training	Cross-skilling	5th root	E.V	% Impact
Acknowledge cultural difference	1	2	1	1/5	1/7	0.57	0.11	11%
Ensure upper management support through the Project	1/2	1	1	1	1/3	0.7	0.13	13%
Apply appropriate rewards to employees	1	1	1	1	1	1	0.18	18%
Provide Training	5	1	1	1	1	1.4	0.26	26%
Cross-skilling	7	3	1	1	1	1.8	0.33	33%
						5.51		

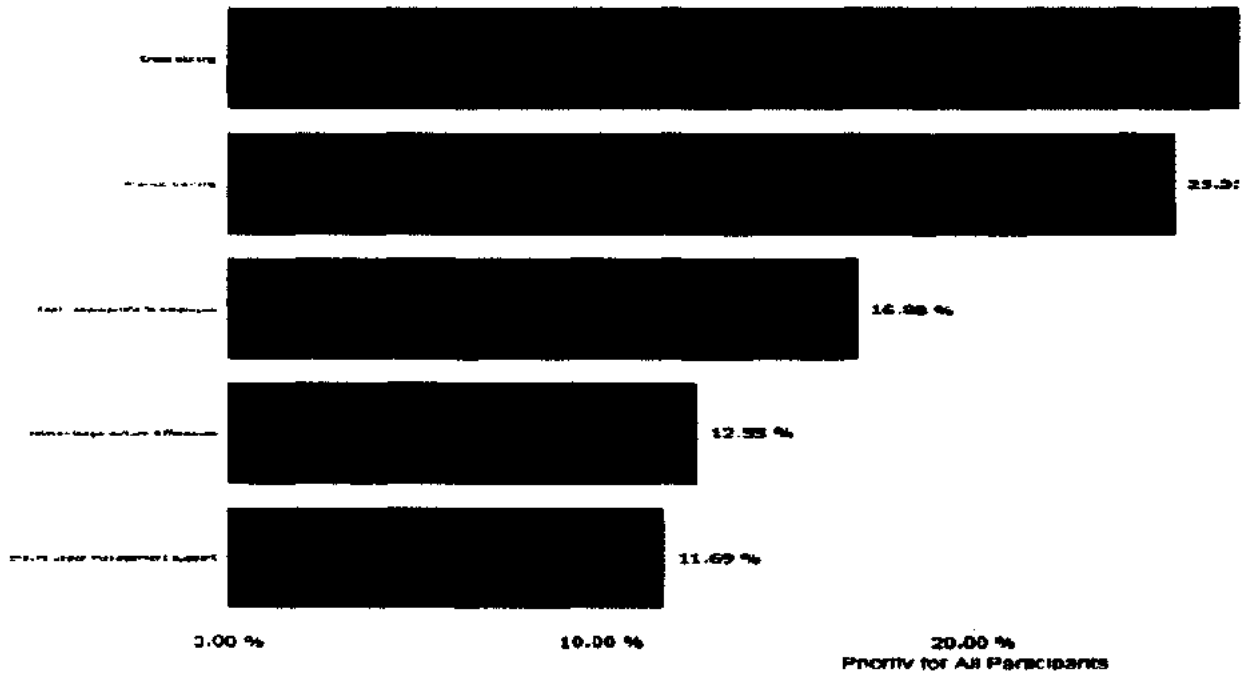


Fig 6.4 Prioritization of alternative w.r.t 2nd creteria

Description: The Eigen value shows that cross skilling is best alternate with respect to "minimize and manage staff turnover".

1*.11+2*.13+1*.18+1/5*.26+1/7*.33= 0.64

1/2*.11+1*.13+1*.18+1*.26+1/3*.33=0.735

1*.11+1*.13+1*.18+1*.26+1*.33=1.01

5*.11+1*.13+1*.18+1*.26+1*.33=1.45

7*.11+3*.13+1*.18+1*.26+1*.33=1.93

Now do division *y* corresponding Eigen Values

.64/ .11= 5.81

.735/.13=5.65

1.01/.18 =5.61

1.45/.26 =5.57

1.93/.33 =5.84

λ_{max} =5.69

$CI=(\lambda_{max-n)/(n-1)}$

CI=(5.69-5)/4= .172

CR=.17/1.12=.15

Table 6.4 Relative performance of alternatives with respect to C3

	Acknowledge cultural difference	Ensure upper management support through the Project	Apply appropriate rewards to employees	Provide Training	Cross-skilling	5th root	E.V
Acknowledge cultural difference	1	3	7	7	7	4	0.503
Ensure upper management support through the Project	1/3	1	5	7	7	2.41	0.303
Apply appropriate rewards to employees	1/7	1/5	1	1/3	1/5	0.29	0.036
Provide Training	1/7	1/7	3	1	1/3	0.46	0.057
Cross-skilling	1/7	1/7	5	3	1	0.79	0.10
						7.95	1.000

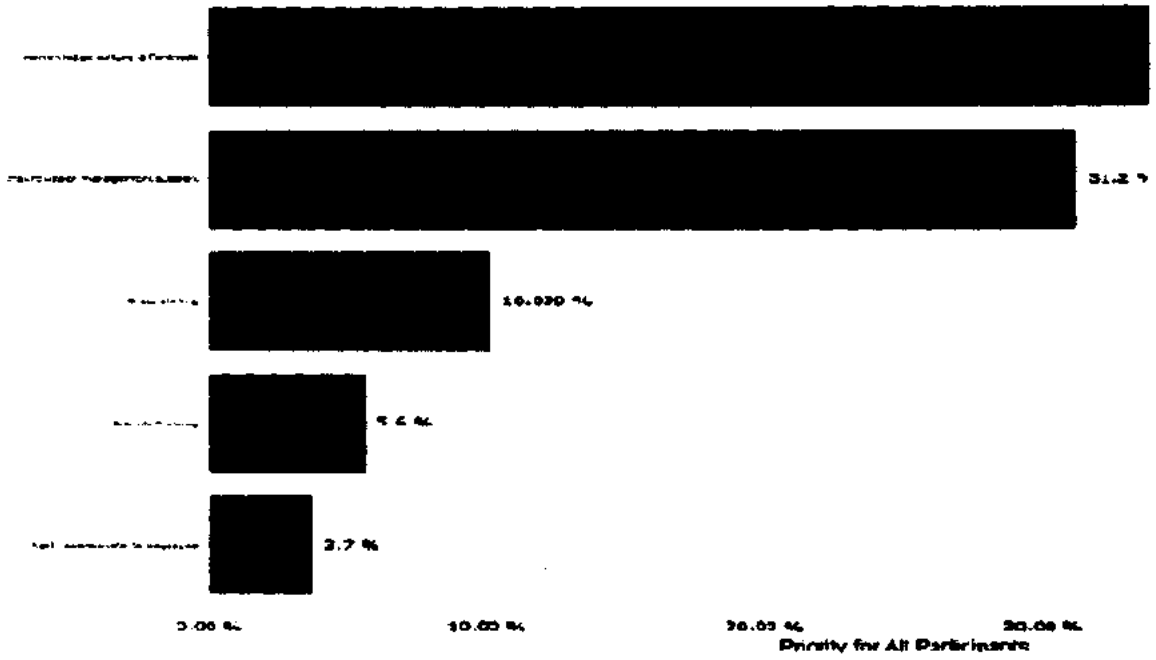


Fig 6.5

Description: The Eigen vector shows that "acknowledge the culture differences are the best alternate with respect to inadequate skill set.

1*.503+3*.303+7*.036+7*.057+7*.10= 2.763

1/3*.503+1*.303+5*.036+7*.057+7*.10=1.75

1/7*.503+1/5*.303+1*.036+1/3*.057+1/5*.10=0.207

1/7*.503+1/7*.303+3*.036+1*.057+1/3*.10=0.3

1/7*.503+1/7*.303+5*.036+3*.057+1*.10=0.452

Now division by corresponding Eigen values

2.763/.503=5.6

1.75/.303=5.8

.207/.036=5.2

.3/.057=5

.452/.1=5

λ_{max}=5.32

CI=.32/4=.0.08 and *CR*= .08/1.12=0.071

OPM:

Table 6.5 OPM (Option Performance Matrix)

	Ensure equal domain knowledge(C1)	Minimize and manage staff turnover(C2)	[illegible](C3)
Acknowledge cultural difference	0.36	0.11	0.503
Ensure upper management support through the Project	0.11	0.13	0.303
Apply appropriate rewards to employees	0.15	0.18	0.036
Provide Training	0.20	0.26	0.057
Cross-skilling	0.18	0.33	0.10

VFM= OPM*RVV

$$\text{VFM} = \begin{pmatrix} .36 & .11 & .503 \\ .11 & .13 & .303 \\ .15 & .18 & .036 \\ .20 & .26 & .057 \\ .18 & .33 & .10 \end{pmatrix} \begin{pmatrix} .54 \\ .30 \\ \\ .16 \\ \end{pmatrix}$$

$$\text{VFM} = \begin{pmatrix} .308 \\ .147 \\ .141 \\ .195 \\ .212 \end{pmatrix}_{5\times1}$$

Table 6.6 Final Prioritized Form:

Priority	Mitigation Strategies
1	Acknowledge culture differences
2	Cross skilling
3	Provide training
4	Ensure upper management support
5	Apply appropriate awards

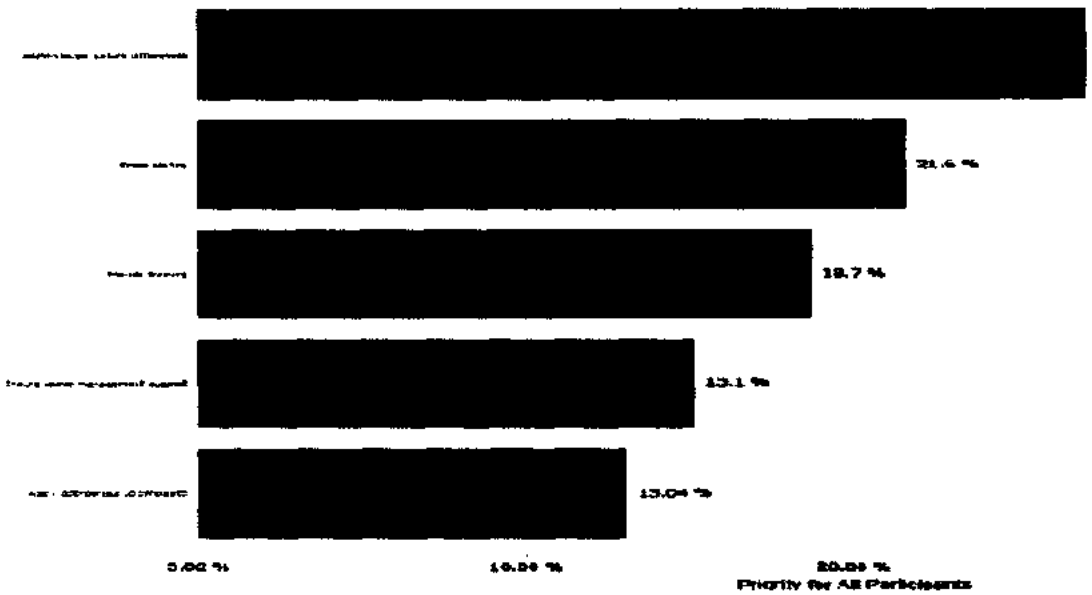


Fig 6.6 Final prioritization of alternatives

Description: This figure shows the final result of thesis. Culture differences and cross skilling are the more sensitive risks in case of GSD.

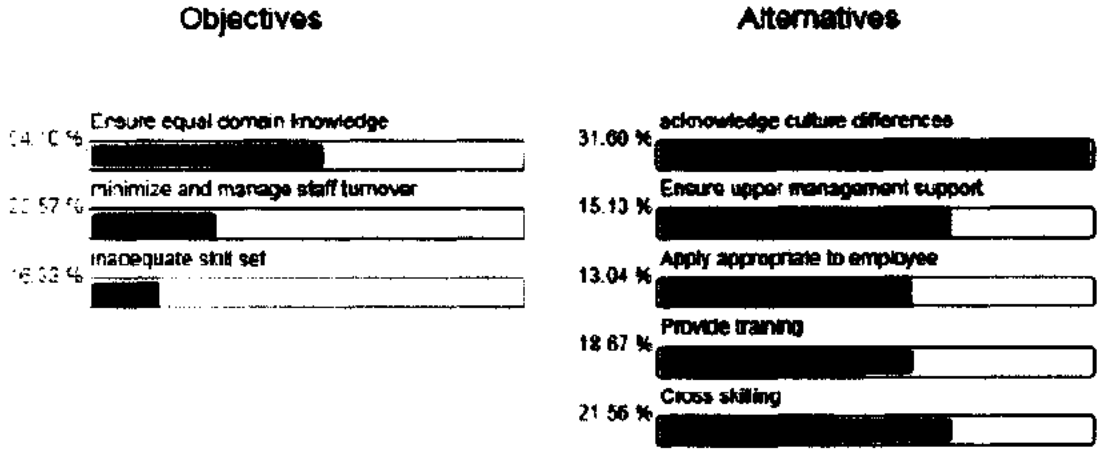
6.4 Sensitivity Analysis

The final ranking of the mitigation strategies is well dependent on the relative dominancy of the reported risks. These strategies have different supporting values for these risks. In case of small changes in the relative dominancy of these risks, the major alterations are expected in the final ranking of the strategies. These dominance values are dependent on the expert judgment and

naturally human judgments subjective. So it is important and necessary to check the sustainability of these results under varying conditions. Sensitivity analysis is a procedure applied in above scenario.

From applying sensitivity analysis we get knowledge about the sensitivity of different values under different conditions. Then care must be taken while changing the values of the reported factors in order to get desired ranking of the corresponding strategies.

A) Dynamic sensitivity



6.7 Original results

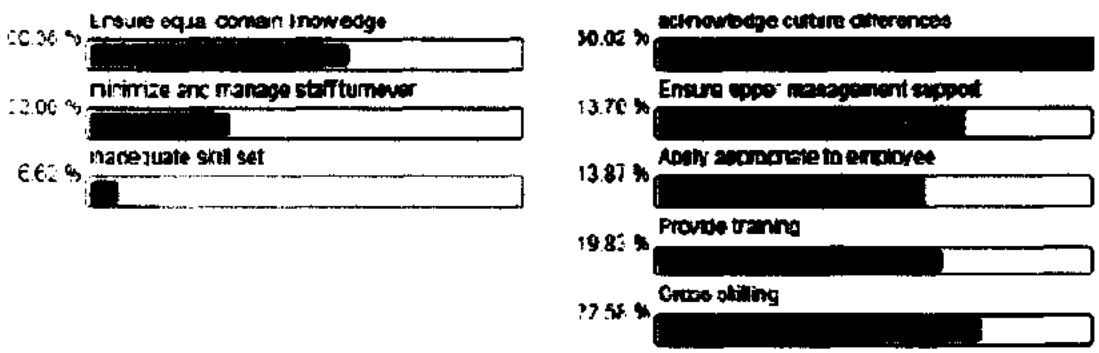


Fig 6.8 10% change in C1

Description: if we change C1 10 % then results may changes as shown.

B) Performance sensitivity

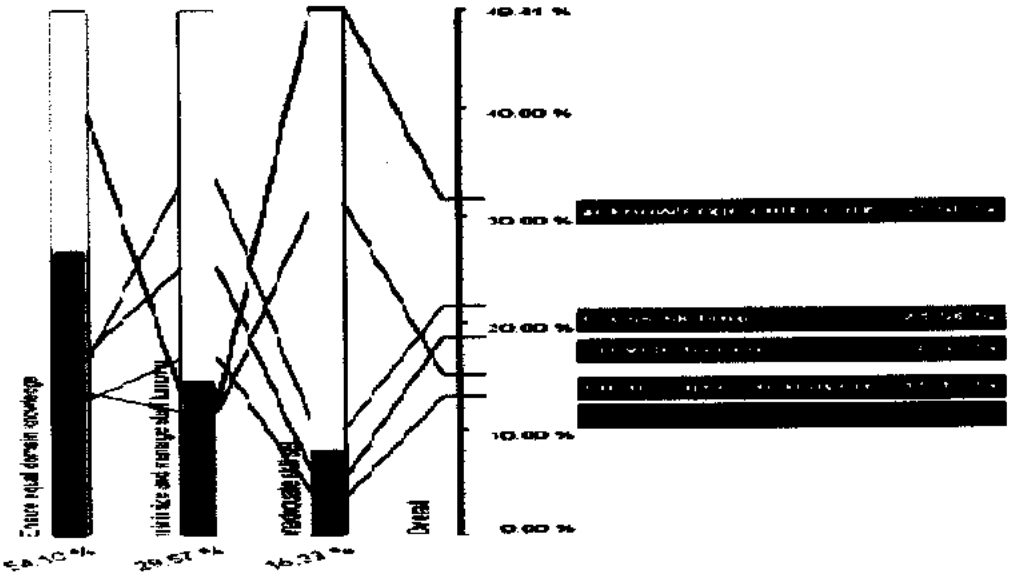


Fig 6.9 Normal mode

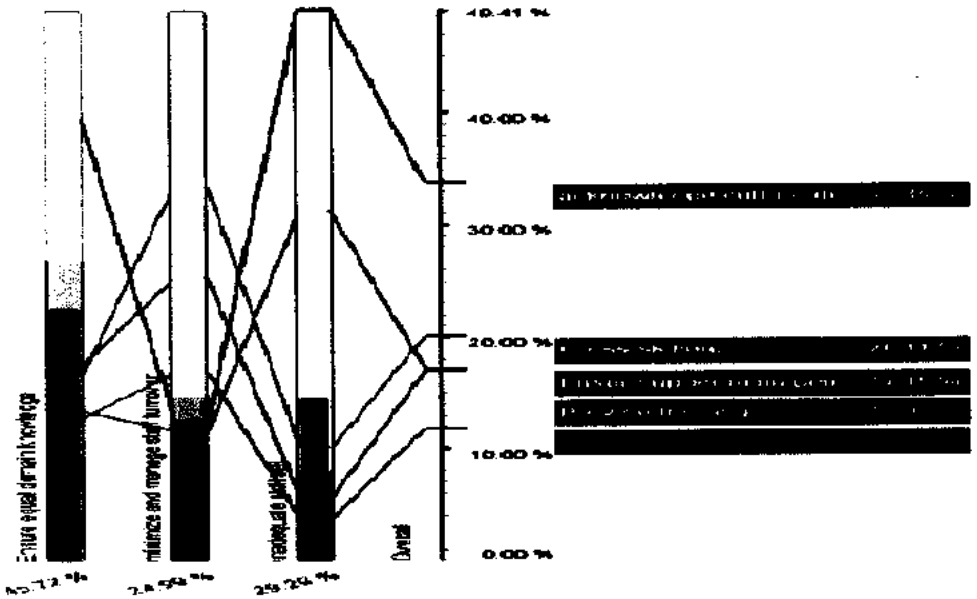


Fig 6.10 9% decrease in C1

Description: Fig 6.9 shows the normal mode. Fig 6.10 shows the scenario if we do 9 % decrease in C1. The strategy "acknowledge culture differences" changes from **31.60 to 33.64** and similarly other strategies (alternates) changes in similar manner.

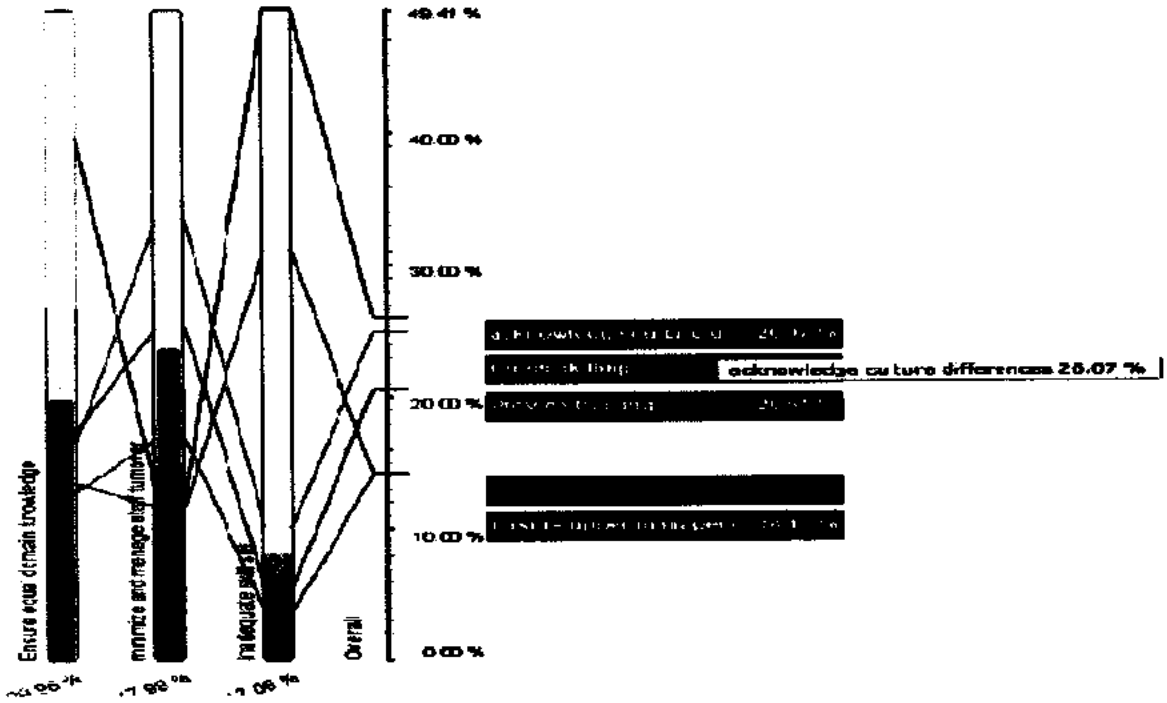


Fig 6.11 4% Decrease in C3

Description: The maximum range for change in C3 is 4%. If we try to change the relative importance beyond this limit then final results may changes. For example the supporting intensity of "acknowledge culture differences" have 31.60 supporting intensity and become 26.07 if we do 4% change in C3 i.e. criteria 3. Similarly the supporting intensities can be changed in same manner.

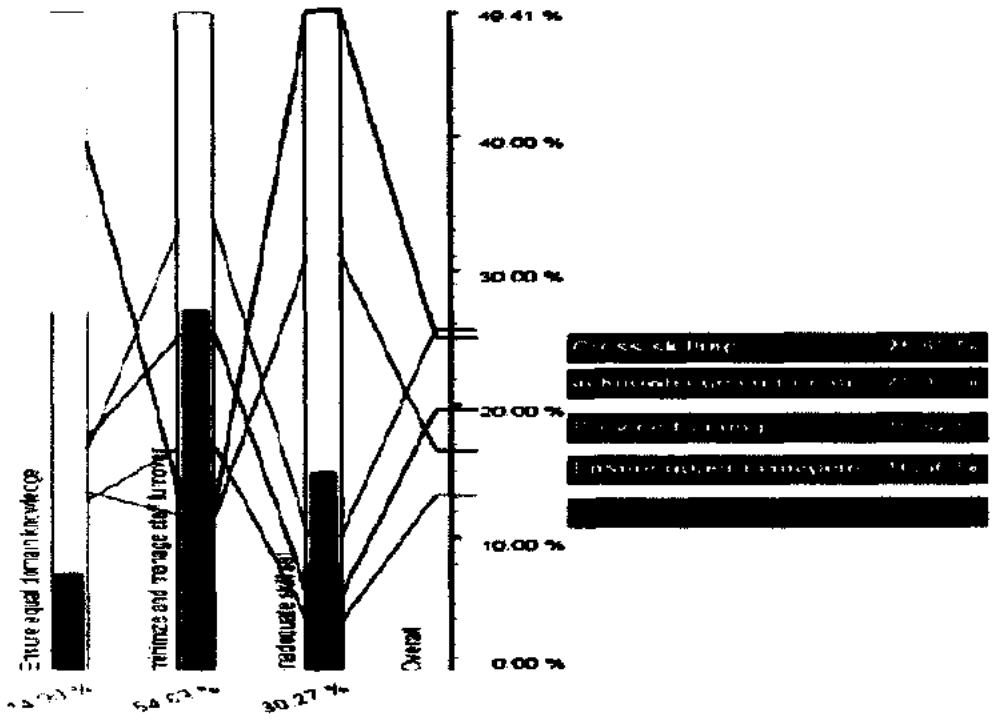


Fig 6.12 40% decrease in C1 and 14% increases in C2

Description: The 6.12 figure shows the effects on final results when C2 is changed to 14 %. For this value the percentage of "cross skilling" become 25.63 and "acknowledge culture differences" become 25.03.

C) Gradient sensitivity

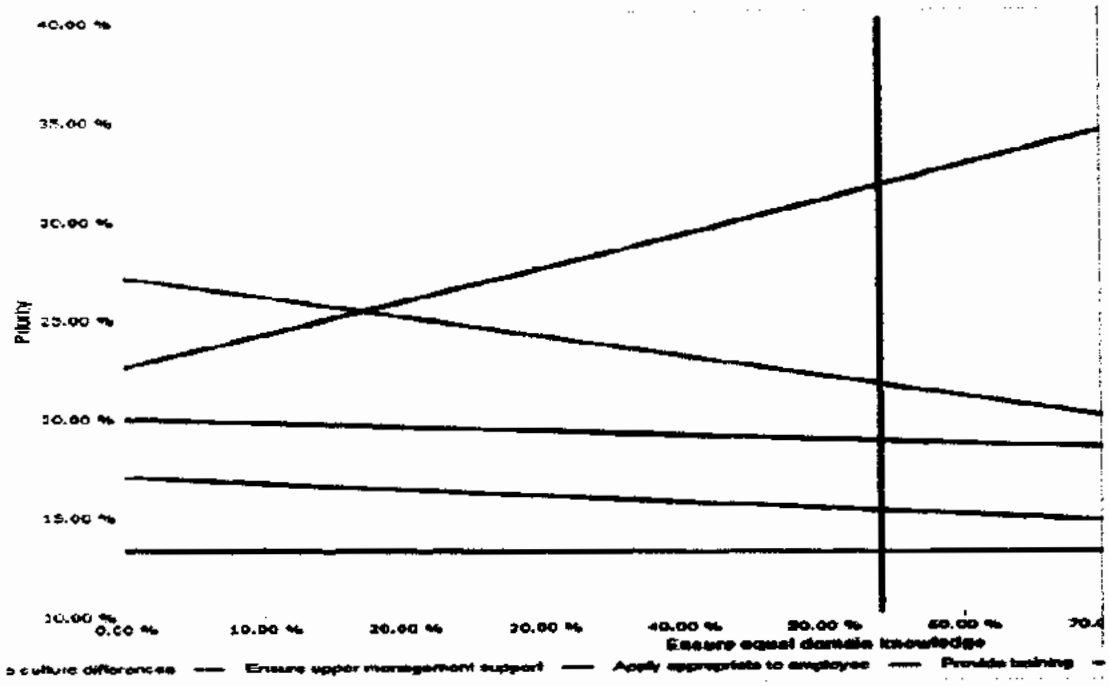


Fig 6.13 gradient w.r.t "ensure equal domain knowledge"

Description: Dynamic behavior of different strategies under "Ensure equal domain knowledge". This diagram shows the dynamic (instantaneous) behavior of different alternates under the "ensure equal domain knowledge "criteria. E.g. the curve of "acknowledge culture differences" is increases in ascending form from 22% to 34 %. The other alternates behave differently under the same criteria.

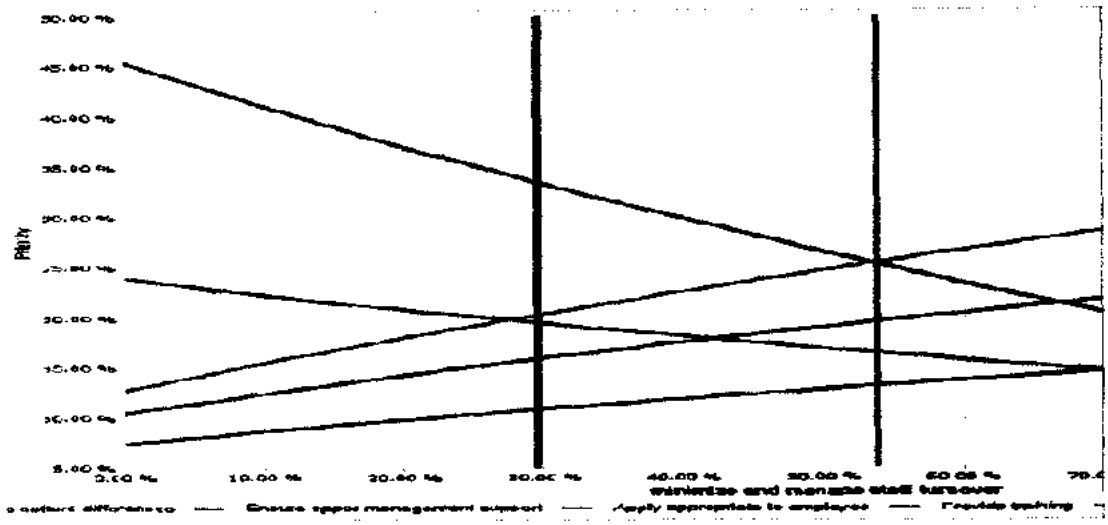


Fig 6.14 Gradient show w.r.t "minimizes and manage staff turnover"

Description: The figure 6.14 shows the dynamic behavior of different alternates under the criteria "minimize and manage staff turnover" criteria. The figure shows the decrease in gradient of acknowledge culture differences which is from 45 % to 19 %. And similarly other alternated behaves differently as shown in figure.

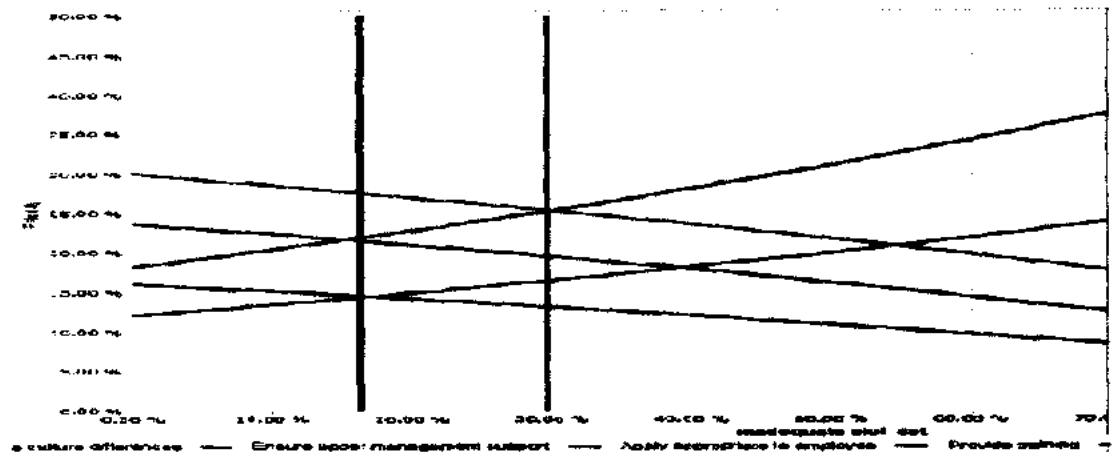


Fig 6.15 Gradient show w.r.t "Inadequate skills set"

Description: The figure 6.15 shows the dynamic behavior of alternates under the "inadequate skills set". This figure shows the gradient behavior of alternates.

D) 2D sensitivity

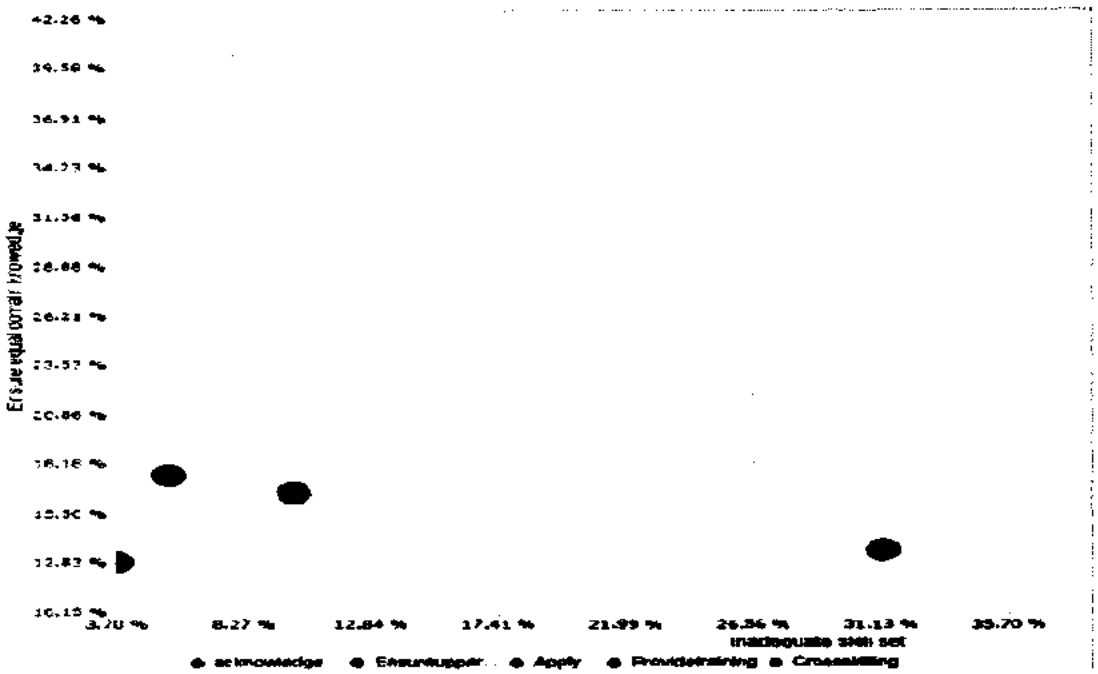


Fig 6.16

Description: Fig 6.16 shows 2D sensitivity of the criterion and corresponding strategies. There is pictorial representation of each corresponding strategy with respect to "ensure equal domain knowledge". The small spheres with different colors show mitigation strategies which describe the inter-competency with respect to given criterion.

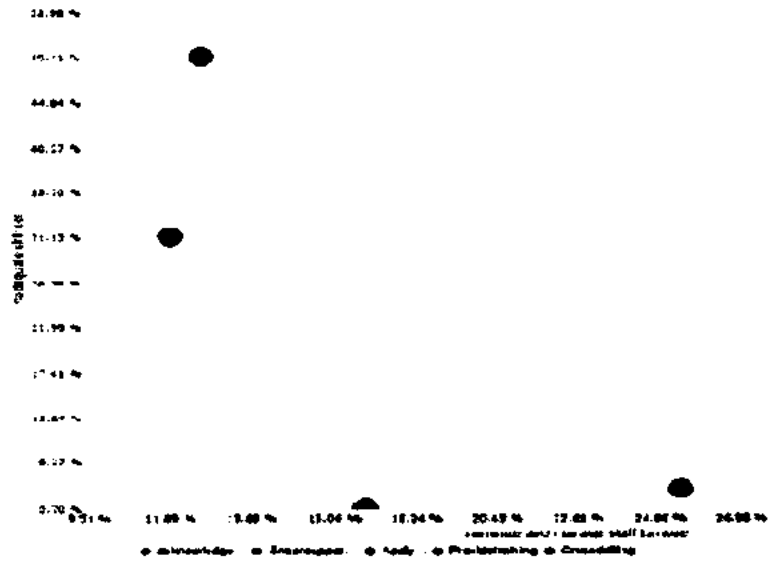


Fig 6.17

Description: Fig 6.17 shows the 2D sensitivity with respect to inadequate skills set. This figure model inter-competency among different mitigation strategies with respect to given criterion.

Summary:

This chapter presents the data analysis. The relative impact of the corresponding risk is identified and according to these results the supporting strategy of each strategy is determined. Similarly sensitivity analysis is done to find sustainability in different conditions.

CHAPTER 7

CONCLUSION AND FUTURE WORK

7.1 Conclusion

Risk management becomes more critical due to nature of GSD. The nature of GSD can be characterized by geographical distance, temporal distance and socio-culture distance. Project managers use different mitigation strategies for the corresponding risks. The selection of these strategies have multi criterion and conflictive nature i.e. one strategy favors one risk while other strategy favors other type of risks. Similarly subjective opinions exist. To handle all these issue this study uses the MCDM mechanism to prioritize the risks in hand and then rank the mitigation strategies accordingly.

The results shows that "ensure equal domain knowledge" is the most prominent risk according to experts from relevant industry. The project managers should select a mitigation strategy which is specialized for such type of risks.

According to these relative impact of the risks at hand, the "acknowledge culture differences" is to be considered best strategy. This fact validates the results in previous studies. Similarly "cross skilling" and "provide training" are next favorable strategies to mitigate these risks.

7.2 Future work

In future work the other MCDM approaches should be tested to validate these results. Similarly in future a case study should be conducted to validate these results in practical context.

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Appendix-I Associated information:

Questionnaire

Description:

The purpose of this questionnaire is to find relative importance of control oriented socio-culture risks and their mitigation strategies in Global Software Development Projects. There are three such risks and five mitigation strategies. First I want to find relative intensity (impact) of each risk through **your experience and judgment** then how much each strategy mitigates each risk.

Example:

1	Ensure equal domain knowledge	9 7 5 3 Equal 3 5 7 9	Minimize and manage staff-turnover
2	Ensure equal domain knowledge	9 7 5 3 Equal 3 5 7 9	Inadequate skills set

In above example "ensure equal domain knowledge" is compared with "minimize and manage staff turnover" and "inadequate skills set".

The numbers can be translated as:

9= extreme preference of one factor over other or vise versa

7=very strong preference

5= Strong preference

3= Moderate preference

Suppose you gave extreme preference to "ensure equal domain knowledge" over "minimize and manage staff turnover" then tick 9 on left side at row 1.

Confidential certificate

I---------- student of International Islamic university Islamabad Pakistan, Reg #---------- certify that I will this data only for educational purposes. I will keep this data if necessary private and secure from any unauthorized source.

Name:

Organization type:

Experience duration:

Roles and responsibilities:

Department:

Country:

Age:

Number of Countries visited:

Part I

Q1	Ensure equal domain knowledge	9 7 5 3 Equal 3 5 7 9 	Minimize and manage staff-turnover
Q2	Ensure equal domain knowledge	9 7 5 3 Equal 3 5 7 9 	Inadequate skill set
Q3	Minimize and manage staff-turnover	9 7 5 3 Equal 3 5 7 9 	Inadequate skill set

Part II

In this part we will find effectiveness of each strategy with respect to each risk.

With respect to " Ensure equal domain knowledge"			
Q1	Acknowledge cultural difference	9 7 5 3 Equal 3 5 7 9	Ensure upper management support through the Project
Q2	Ensure upper management support through the Project	9 7 5 3 Equal 3 5 7 9	Apply appropriate rewards to employees
Q3	Apply appropriate rewards to employees	9 7 5 3 Equal 3 5 7 9	Provide Training
Q4	Provide Training	9 7 5 3 Equal 3 5 7 9	Cross-skilling
With respect to " minimize and manage staff turnover"			
Q5	Acknowledge cultural difference	9 7 5 3 Equal 3 5 7 9	Ensure upper management support through the Project
Q6	Ensure upper management support through the Project	9 7 5 3 Equal 3 5 7 9	Apply appropriate rewards to employees
Q7	Apply appropriate rewards to employees	9 7 5 3 Equal 3 5 7 9	Provide Training
Q8	Provide Training	9 7 5 3 Equal 3 5 7 9	Cross-skilling

			
With respect to "Inadequate skill set"			
Q9	Acknowledge cultural difference	9 7 5 3 Equal 3 5 7 9 	Ensure upper management support through the Project
Q10	Ensure upper management support through the Project	9 7 5 3 Equal 3 5 7 9 	Apply appropriate rewards to employees
Q11	Apply appropriate rewards to employees	9 7 5 3 Equal 3 5 7 9 	Provide Training
Q12	Provide Training	9 7 5 3 Equal 3 5 7 9 	Cross-skilling

APPENDIX-II List of people who responded to the survey

S.no	Name	Designation	Experience (years)	Organization Type	No. of countries visited	Country
1	Ali Noor	Project Manager	8	Software House	3	Pak
2	Yaqub Bhatti	IT Architect	21	Software & Services	16	Pak
3	Shafaat Ali Yasir	Program Manager	14	Software & Services	10	Pak
4	Wasim Ismail	Technical Lead	8	Software & Services	1	Pak
5	Parwaz Kamal	Project Manager	16	Software & Services	8	Pak
6	Shahzad Quraishi	Program Manager	15	Software & Services	2	Pak
8	Osman Ahmad Khan	Project Manager	7	Software & Services	10	Pak
9	Wajahat Kamal Pasha	Technical Lead	10	Software & Services	4	Pak
10	Afsheen Saadat	Project Lead	8	Software & Services	9	Pak
11	Imran Latif	Team Lead	10	Software & Services	5	Pak
12	Muhammad Attique	Team Lead	7	Software & Services	1	Pak
13	Yasir Rao	Team Lead	5	Telecom	1	Pak
14	Arif Najaf	Project Lead	9	Software House	3	Pak
15	Muhammad Ismail	Team Lead	8	Software House	3	Pak
16	Rashid Idris	Team Lead	8	Software House	7	Sweden
17	Syed Zain	Technical Lead	10	Software & Services	6	Pak
18	Eldon Barrows	Project Manager	5	Software & Services	3	UAE
19	Adeel Quraishi	Technical Lead	9	Software & Services	4	UAE
20	M Asif Razzaq	Manager	10	Banking	1	Pak
21	Saleem Iqbal Kiyani	Manager	10	Banking	1	Pak
22	Asim Jadoon	Product Architect	6	Geo-IT	3	Pak
23	Syed Ali Raza Zaidi	Team Lead	6	Geo-IT	1	Pak
24	Shahbaz	Project Lead	12	Oil & Gas	2	Pak
25	Toqeer Khan	Dev Lead	9	GEO-IT	1	Pak
26	Hassan Hanif	Team Lead	6	Software & Services	7	Pak
27	Muhammad Amir Daud	Team Lead BI	12	Banking	6	Pak
	Imran Baig	Team Lead	9	Banking	1	Pak

28						
29	Wamigul Sarwar	Team Lead BI	15	Banking	2	Pak
30	Muhammad Shabir	Analyst	16	Banking	1	Pak
31	Muhammad Ali Shaikh	Delivery Center Leader	14	Software & Services	12	Pak
32	Rizwan Malik	Technical Team Lead	10	Geo-IT	3	Pak
33	Adeel Shahzad	Team Lead	7	Geo-IT	2	Pak
34	Usman Ali	Team Lead	8	Geo-IT	1	Pak
35	Zahid Karim Quraishi	Project Manager	12	Petroleum	4	Saudia
36	Muhammad Mateen	Team Lead	8	Telecom	5	Saudia
37	Mahmood Khan	Team Lead	8	Software House	4	Pak
38	Azmat Shair	Team Lead	10	Software House	3	Pak
39	Shahzad Ahsan	Manager Development	12	Software House	5	Pak
40	Mujahid Rashid	Team Lead	7	Software House	1	Pak
41	Abid Shahzad	Team Lead	6	Petroleum	1	Pak
42	Waheed Murad	Technical Team Lead	7	Banking	4	Canada
43	Adeel Arshad	Project Lead	9	Software House	7	Pak
44	Yashir Khan	Manager	12	Banking	6	UAE
45	Jawad Khan	Project Manager	8	Software House	5	Pak
46	Hina Amir	Project Manager	8	Software & Services	1	Pak
47	Syda Qirat Fatima	Scrum Master	7	Geo-IT	1	Pak
48	Syed Fawaz	Technical Lead	7	Software & Services	6	UAE
49	Fariha Tariq	Manager	13	Software & Services	9	Pak
50	Shahzeen Juma	Project Manager	6	Telecom	1	Pak
51	Nabeel Abid	Project Manager	9	Telecom	5	Saudia
52	M Shahzad Khan	Team Lead	7	IT Consultancy	2	UAE
53	Saiful Islam Khan	Dev Manger	11	IT Consultancy	7	UAE
54	Farooq Zubairi	Dev Lead	9	IT Consultancy	5	UAE
55	Maraab Hanif	QA Lead	8	IT Consultancy	5	UAE
56	Khaqan Mahmood	Manager	14	Software House	7	Pak
57						
58	Sarfraz Khan	Manager Software Development	13	Telecom	6	Pak
59	Hina ambreen	Program Manager FMS	8	Telecom	4	Canada
60	Nida Altaf	Project Manager	7	Telecom	2	Pak
61	Iftikhar Ahmad	Technical Lead	7	Telecom	1	Pak
62	Jahanzaib Yousuf	Team Lead	5	Geo-IT	1	Pak
63	Husnain Waraich	QA Lead	5	Telecom	3	Pak

64	Sangeen Khan	Sr. Project Manager	11	Software House	4	Australia
65	Syed Zakir	Manager R&D	7	Telecom	7	Pak
66	Taimur Shafique	Manager	9	Software House	5	Pak
67	Saira Abbasi	Project Manager	8	Software House	2	Pak
68	Atifa Alvi	Scrum Master	13	Software House	8	U.K
69	Junaid Nasir	People Manager	18	Software & Services	11	Pak

APPENDIX-III Project Data

Objectives/Alternatives Priorities

	Alternatives Priorities
Goal [L:100.00 %] [G:100.00 %]	
Ensure equal human knowledge [L:54.10 %] [G:54.10 %]	
acknowledge culture differences	100.00 %
Ensure upper management support	34.01 %
Apply appropriate to employee	32.41 %
Provide training	44.27 %
Cross skilling	41.94 %
minimize and manage staff turnover [L:29.57 %] [G:29.57 %]	
acknowledge culture differences	37.43 %
Ensure upper management support	34.87 %
Apply appropriate to employee	50.33 %
Provide training	75.60 %
Cross skilling	100.00 %
inadequate skill set [L:16.33 %] [G:16.33 %]	
acknowledge culture differences	100.00 %
Ensure upper management support	63.14 %
Apply appropriate to employee	7.49 %
Provide training	11.33 %
Cross skilling	20.42 %

Overview of inputs

abid ali

Ensure equal domain knowledge	2.02	minimize and manage staff turnover
Ensure equal domain knowledge	3.00	inadequate skill set
minimize and manage staff turnover	2.00	inadequate skill set

[illegible] equal domain knowledge

abid ali

acknowledge culture differences	0.00	Ensure upper management support
acknowledge culture differences	3.00	Apply appropriate to employee
acknowledge culture differences	3.00	Provide training
acknowledge culture differences	5.00	Cross skilling
Ensure upper management support	0.00	Apply appropriate to employee
Ensure upper management support	3.00	Provide training
Ensure upper management support	3.00	Cross skilling
Apply appropriate to employee	0.00	Provide training
Apply appropriate to employee	1.00	Cross skilling
Provide training	0.00	Cross skilling

[illegible] and manage staff turnover

abid ali

acknowledge culture differences	3.00	Ensure upper management support
acknowledge culture differences	0.00	Apply appropriate to employee
acknowledge culture differences	5.00	Provide training
acknowledge culture differences	7.00	Cross skilling
Ensure upper management support	0.00	Apply appropriate to employee
Ensure upper management support	0.00	Provide training
Ensure upper management support	3.00	Cross skilling
Apply appropriate to employee	0.00	Provide training
Apply appropriate to employee	0.00	Cross skilling
Provide training	0.00	Cross skilling

[illegible] skill set

abid ali

acknowledge culture differences	3.00	Ensure upper management support
acknowledge culture differences	7.00	Apply appropriate to employee
acknowledge culture differences	7.00	Provide training
acknowledge culture differences	7.00	Cross skilling
Ensure upper management support	5.00	Apply appropriate to employee

1

Ensure upper management support	7.00	Provide training
Ensure upper management support	7.00	Cross skilling
Apply appropriate to employee	3.00	Provide training
Apply appropriate to employee	5.00	Cross skilling
Provide training	3.00	Cross skilling