PROBLEMS, CONSEQUENCES AND THEIR SOLUTIONS FOR EMOTION BASED REQUIREMENT ENGINEERING IN GLOBAL SOFTWARE DEVELOPMENT – A GUIDELINE

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I declare that this thesis entitled "*Problems, Consequences and their Solutions For Emotion Based Requirement Engineering in Global Software Development – A Guideline*" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

Software Requirement Engineering (SRE) is a valued domain of software engineering. The success of a software project is mainly dependent on good requirement engineering practices. Emotion based requirement engineering is said to increase the credibility of requirement engineering. When requirement engineering is taken to a bigger scenario of global software development (GSD), it becomes more tricky and difficult to handle. There is a lack of studies focusing on emotion based requirement engineering in GSD. Due to lack of such studies academicians, researchers and practitioners are unaware of the problems and their consequences on successful software development.

The proposed study identifies the problems due to lack of emotion based requirement visualization, consequences of these problems, overcoming strategies / solutions for these problems. The systematic literature review (SLR), expert evaluation and survey are used as methodology instrument. Twenty three (23) problems were identified through SLR. Besides, the consequences and solutions of the identified problems are also found out by SLR and are evaluated through experts. In SLR conduction, ak9t first 60 papers were collected which reduced to 30 after assessing their quality. For extraction of potential problems from the literature, their consequences and solutions, grounded theory was applied. Furthermore, a survey is conducted to evaluate the practicality of the identified problems, consequences and overcoming solution strategies in real working environment. The study provides a comprehensive guideline for the practitioners, academicians and researchers for performing better visualization of emotion based requirement engineering in GSD environment which increases ratio of success. The visualization support of requirements may best be achieved in this way.

DEDICATION

This thesis work is dedicated

To my Creator *Allah Almighty* first of all who is always there for me for everything,

Then to His *Holiest prophet* (peace be upon him) whose guidelines are always a source of my inspiration,

To my parents *Muhammad Mazhar ul Islam Qazi* and *Shamim Mazhar* who loved me unconditionally and gave me the very first lesson of education especially my mother who put great effort for my education,

To my ever praying students

Last but not least, to my family especially to my loving husband *Amir Saeed* and lovely kids *Taha, Izzah And Hadi*, who suffered a lot in my absence and compromised with my busy schedule, they always proved to be my motivation whenever I felt weak.

Thank you all for your prayers.

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LIST OF ABBREVIATIONS

EBRE	-	Emotion based Requirement Engineering
GSD	-	Global Software Development
RE	-	Requirement Engineering
Res	-	Requirement Engineers
SLR	-	Systematic Literature Review
SRE	-	Software Requirement Engineering
RQ	-	Research Question
GT	-	Grounded Theory

LIST OF SYMBOLS

&	**-**	AND SYMBOL
~	-	NOT
||	-	OR
*	-	For All combinational words
(	-	Opening bracket
)	-	Closing bracket

CHAPTER 1

INTRODUCTION

1.1 Overview

The chapter contains information about objectives, how they are achieved and what is supposed to be improved. It provides an overview of the research background, main terminologies and the problem statement; it also highlights research objective, motivation and a brief overview of the research methodology.

1.2 Introduction

Emotion based Requirement Engineering (EBRE) in Global Software Development (GSD) is basically involving emotions into software requirement engineering process in distributed environment where multiple nationalities are working together [1]. While working on Emotion based Requirement Engineering in GSD, the problems which occur due to lack of emotion based work in GSD environment, the consequences of those problems and their solutions are found out by consulting literature. The problems, consequences and solutions are validated and evaluated by the renowned reviewers. Furthermore, these three things are reviewed, evaluated, authenticated and added on by the industry personnel by survey. The study provides a guideline which is a thorough guideline for the practitioners, academicians and researchers for performing better visualization of requirement engineering in GSD environment.

Emotions play an important role in our daily life through which somebody's inner feelings can be predicted that either he is happy, sad, disappointed or fearful etc. [2].

"Even if a design is elegant and functional, it will not have a place in our lives unless it can appeal at a deeper level, to our emotions." Hartmut Esslinger [1]

As the eminent quote from Hartmut Esslinger [1] expresses, it is principally factual while addressing the social goals like users' emotional needs. The contemplation of emotion has turn out to be more prevailing recently in design [2], as well as human–computer interaction (HCI) design, but such kind of considerations have not yet been shifted effectively to the field of software engineering, regardless of the fact that a user's credit of software product is normally based on emotion [2]. The Software Engineering (SE) put a lot of focus on the human side and it has more significant than the technical side in some cases [3]. Its significance is because of the reason that software engineering is mainly based on rational and social activities [4].

Though the role played by emotions is predominant in the area of human computer interaction [5-6] and its importance is pointed by many eminent researchers of the domain, it is hardly discovered in the literature of software engineering [7-8]. Mostly the existing literature explores emotions with respect to requirements engineering. Some scenarios focus more on accepting that emotions can significantly affect the process of requirements engineering [7-9]. They categorize the values of self-esteem and people's motivations as soft issue that may have different special effects on requirements. Differentiation is been done between critical and normal effects and emotions for the accomplishment of the project. Likewise, Proynova et al. [10] make use of the subjective values to categorize factors that can then be mapped to requirements which would have remained unexplored otherwise. The authors in both of the studies are making use of specific values to line up or determine requirements

Requirement Engineering (RE) is deliberated to have a very data oriented, challenging knowledge oriented, human capital demanding and media involving set of activities [11-12]. As stated by F.P. Brooks in his seminal book states that projects who placed RE back generally fail [13]. Evidence advocates that insufficient attention

to requirements is a key reason of failure of software project [14]. With respect to technology acceptance, a technology is discarded or used in restricted way by users when their wishes and experiences with that technology are not talked about and met appropriately [15-16].

Yu. E., in [17] make use of soft goals for modelling quality concerning requirements or non-functional requirements. In addition typical non-functional requirements like “reliability” or “security”, and some other less traditional factors having association with emotions are also included, like “trustworthy”, “flexible”, “minimal intrusion” or “normal lifestyle”.

The work of Colomo Palacios et al. in [18-19], unambiguously ask stakeholders about their feelings regarding particular requirements. Their response is documented in a grid which represents in the X axis the arousal caused by the requirement and in the Y axis the pleasure. Equating the responses with the advancement of the requirements throughout the requirement engineering process iterations, they determine that high levels of pleasure and low levels of arousal seem to indicate accepted requirements. Although in [18-19] Colomo Palacios et al., provide an interesting insight on the correlation between pleasure and arousal and requirements stability, this approach measures stakeholders’ emotional perceptions of requirements around emotional-related qualities such as pleasure and arousal, whereas Ramos et al. in [20] recommends the usage of emotions to discover and draft requirements with stakeholders and checks whether they are according to Maiden’s argument or not [7].

The work of Ramos et al. [20-21] cites some exemplary projects where emotions affect requirements, beliefs or values, and claim that the effect of these factors is as necessary as functionality or qualities in spite of the fact that they are conservatively ignored. The quick categorization of these issues is encouraged according to them and further managerial and technical treatment is recommended. They also propose many psychological methods to classify emotional concerns while communicating to the stakeholders. When they are pointed out once, the requirements engineering (RE) process carries on in a usual way. Their research is built to add on detail to the existing meaning of emotions appropriately for the process of development

and to outline a notation to represent emotions graphically in the structure of the requirements engineering process.

In [20, 22] it is claimed that emotions should be considered important as other factors of cost, performance, and user interface and function in RE process. Stakeholders 'emotions are assimilated in RE process in [10] likewise some other factors e.g. stability. Emotions are treated as soft issues or problems as reported in [23] and a method for refining these is recommended.

Emotional requirements capture the game designer's vision for the player's emotional experience and are used to assist communication between pre-production and production teams [24]. However, production-phase insufficiencies in emotional requirements have been recognized. In this work, the definition of emotional requirements is extended to include emotion prototypes and emotion markers and present improved techniques for eliciting, capturing and visualizing emotional requirements. A thorough exploration of one gameplay scenario is presented, with a focus on appraising visualization techniques for emotional requirements. The solutions established in this work met the needs of all development team members and appear to be general solutions for the domain.

The outcomes of case study as in [25] show that current emergency systems fail to address the emotional needs of users, leading to low adoption and low usage. In agent-oriented modelling, the emotional goals are modeled using a direct notation n this work. They planned to concentrate on mapping the concept of emotional goals from requirements to many different phases of systems development life cycle i.e. software design, testing, implementation and system validation. It permits to find out the requirements which are emotion-led throughout the software development lifecycle [25].

Additionally, the profound understanding of more methodical approaches for taking care of emotions in design is the goal.

In Global software Development (GSD), teams develop the software which are located at diverse geographical locations [26-28]. As per Agerfalk et al. in [29], 20% of client organizations in the USA, and 20% of the 1000 leading software

development organizations, are globalizing their work. Outsourcing development to vendor organizations in low-cost countries has become increasingly important, because of the significant reduction in development costs [30-31]. GSD has been found to be a rapid and economical mode to develop software [32]. Babar and Niazi [33] advocated that the benefits of GSD have widened from decreasing development costs towards the enhancement of other facets of software development.

When it comes to global software development (GSD), due to strenuous communication, coordination and interaction, requirement engineering becomes much more critical and tricky [34-35]. Hence emotion based requirement engineering may even be more critical in GSD which is anticipated to be studied.

1.3 Gap analysis and Motivation

In all the papers consulted i.e. [22, 23, 24, 25], it is observed that although papers have highlighted the need that there should be some mechanism to better visualize the software and its requirements but emotion based RE in GSD is not addressed in true sense. Moreover, the problems due to lack of emotion based requirement engineering in GSD, consequences or impact of these problems and overcoming strategies /solutions for these problems are not identified yet.

1.4 Problem Definition(s)

Based upon the existing literature [22, 32, 24, 25], it is observed that there is a lack of studies focusing on emotion-based requirement engineering in GSD for the problems, consequences and their solutions. Due to lack of such studies academicians, researchers and practitioners are unaware of the problems and their consequences on successful software development.

The study proposes a comprehensive guideline for problems that can occur due to lack of emotion-based requirement engineering in GSD, their consequences and the solution strategies to overcome these problems. The guideline helps to better visualize the requirement engineering in GSD environment for practitioners, academicians and researchers.

1.5 Research Question(s)

RQ1: What are the problems due to lack of emotion-based requirement engineering in GSD?

The RQ1 highlights the problems due to lack of emotion-based requirement engineering in literature.

RQ2: What are the consequences of these problems?

The RQ2 pinpoints the consequences and impact of these problems on requirement visualization.

RQ3: What are the overcoming strategies solutions for these problems?

The RQ3 finds out the overcoming solution strategies for these problems.

1.6 Objective

Objective1: To identify the state of knowledge problems due to lack of emotion based requirement engineering

Objective2: To highlight the consequences or impact of problems due to lack of emotion based RE faced by practitioners, academicians and researchers.

Objective3: To find out the overcoming solution strategies to mitigate the problems

1.7 Scope of the Study

This study proposed a comprehensive and thorough guideline to better visualize the requirement engineering in GSD environment. To achieve the objectives, systematic literature review (SLR), expert evaluation and survey is used. The problems, consequences and solutions are found out by systematic literature review. They were reviewed by three expert reviewers and finally the list of problems, consequences and solutions are reviewed, evaluated and add on by the industry personnel through survey. At last, the review and comments were integrated with evaluated and reviewed list of problems, consequences and solutions to generate a comprehensive guideline for researchers, academicians and practitioners.

1.8 Contribution and Importance of the Study

The first contribution of this study is a list of problems that can occur due to lack of emotion based requirement engineering in GSD environment. This further enhances the existing software engineering and more specifically requirement engineering body of knowledge.

The second contribution is the list of consequences and impacts of the aforementioned problems are valuable finding as well.

The third contribution is the list of solution strategies that overcome the problems.

The study provides a comprehensive guideline for problems due to lack of emotion-based requirement engineering in GSD, the consequences, the strategies to overcome problems and to better visualize the requirement engineering in GSD environment.

Through this research the academicians, practitioners and researchers may better visualize the requirements of the GSD projects which increase ratio of success. The visualization support of requirements may best be achieved in this way.

1.9 Thesis Outline / Organization

First chapter contains information about the topic under study i.e. Emotion based requirement engineering in GSD, the objectives of the study, how they are achieved and what is supposed to be improved.

Second chapter gives detailed information about all the critical and technical terms in aforementioned topic under study. After that all the existing studies which compelled and triggered to do the research are listed in a proper tables.

Third chapter presents the research methodology, the research plan and design that how the planned steps would be followed practically to solve the identified problem. Operational framework of the research is presented in which each and every module of research is discussed.

Fourth chapter provides the results of the systematic literature review. It contains detail of developed solution, how it was collected and compiled. In this

systematic literature review, the research queries entered, their results, the streamlined and selected papers, the application of quality assessment guidelines, checklists and its application, the application of grounded theory and its resultant final draft of problems, consequences and solutions are all discussed. The results of these activities are attached in appendices accordingly. Fourth chapter contains the survey and its results as well covering all the information that how problems, consequences and their respective solutions are identified, which can occur due to lack of emotion based requirement engineering in GSD, identified and characterized software houses, designed the sampling plan having software houses of Islamabad, designed survey form, pilot tested by some people, distributed the survey form and analyzed the results to write report. This chapter also includes the full and final list of integrated problems, consequences and solutions from literature and survey to be considered as a guideline to be followed by the researchers, academicians and practitioners.

Last chapter of conclusion includes the primary focus of the research, what is achieved and what remained as a limitation. The future prospects are also narrated in this chapter.

1.10 Summary

In the first chapter of introduction the background of emotions, requirement engineering and Global software development is discussed. Gap analysis and scope of the study are defined with problem statements, research questions and objectives and at last but not the least contribution and significance of the study is presented.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

In this chapter, the related studies which pointed out and enhanced the effect of topic under study were found out. Those studies proved to be the main studies which provided a guideline towards the research.

There are various kinds of literature review: traditional review and systematic literature review. Traditional literature reviews provide the complete crux of all the study performed on some specific field in one go without following any schematic and systematic steps, but systematic literature reviews provide the recommended systematic steps reported in [37] as a rule to be adopted. The systematic literature review is a scientific approach to detect, compute and interpret the present research relevant to specific research questions as reported in [37]. Users utilizes clearly defined method through which the trustworthy and reliable results are obtained.

The systematic literature review is used to explore and collect research content or information. By using this kind of methodology the fair, positive and reliable results can be obtained.

2.2 Introduction to the Terms in Emotion based RE in GSD

Emotion based Requirement Engineering (EBRE) in GSD is basically involving emotions into software requirement engineering process in distributed

environment where multiple nationalities are working together [1] as mentioned in chapter 1. While working on Emotion based Requirement Engineering in GSD, it is mandatory to understand the topic under study thoroughly to reap the benefits out of that if required. The problems which occur due to lack of emotion based work in GSD environment, the consequences of those problems and their solutions are found out by consulting literature, validated and evaluated by the renowned reviewers and at last are validated and enhanced by the industry through survey.

The study provides a thorough guideline for the practitioners, academicians and researchers to better visualize requirement engineering in GSD environment through emotions. Hence, it is necessary to understand the research topic. For this purpose the topic is broken down and main concepts are explained in detail here.

2.2.1 Emotions

An important role is played by emotions in daily life through which somebody's inner feelings can be predicted that either he is happy, sad, disappointed or fearful etc. [2]. Figure 2.1 shows different kinds of emotions which convey important information.

Figure 2.1: Different Emotions Conveying Information [38]

Figure 2.2 shows emotions of different emoticons which are very much in use now a days [39].

Figure 2.2: Different Emoticons Conveying Information [39]

An important part is played by emotions during the whole course of life in this world as they enhance nearly all of the live moments having either a happy or an unhappy value. Cacioppo et al, in [40] quote that "emotions guide, enrich an ennoble life; they provide meaning to everyday existence; they render the valuation placed on life and property". They illustrate that all the physical world is having emotional relationships. So it is not surprising to claim that consumer researchers have come to know that emotions induced by products increase the pleasure of transaction and using them as reported by Hirschman & Holbrook in [41].

For distinctive improvement in the marketplace it has often been claimed that the empirical or emotional quality of products is very significant because now products are usually alike with respect to technical qualities and price. The thing which may make a difference is emotionality perspective which in many purchasing decisions, is a decisive point. In contrast to rational domain, affective domain is associated in seeking pleasure to use product in which the emotional perspective is taken care of. [42]. Figure 2.3 shows different emotions with respect to different situations so as to increase information about emotions [43].

Figure 2.3: Different Emotions in Different Situations [43]

"Even if a design is elegant and functional, it will not have a place in our lives unless it can appeal at a deeper level, to our emotions." Hartmut Esslinger [1]

As the eminent quote from Hartmut Esslinger [1] expresses, it is principally factual while addressing the social goals like users' emotional needs. The contemplation of emotion has turn out to be more prevailing recently in design [2], as well as human–computer interaction (HCI) design, but such kind of considerations have not yet been shifted effectively to the field of software engineering, regardless of the fact that a user's credit of software product is normally based on emotion [2]. The Software Engineering (SE) put a lot of focus on the human side and it has more significant than the technical side in some cases [3]. Its significance is because of the reason that software engineering is mainly based on rational and social activities [4].

The know-how of emotional perspective can augment the understanding of enjoyable interaction with a computer or open a new dimension for clarity of concept. However, user's emotional reaction to products and what facets of design or interaction activate emotional reactions is less known. As per reported in [42], emotional responses can be measured by some instruments that can further support emotional study. It is told in their work that the instrument should be able to measure delicate (i.e. low intensity) emotions, and mixed emotions (i.e. more than one emotion practiced simultaneously). Moreover it is said that a cross cultural and language independent instrument is essential. [42].

For quite a long time the pursuit for tools to measure emotions is observed. Conventionally, efforts for measurement of emotions have been done in psychology and sociology. From the last twenty years, the important part has been played by emotions in research and consumer marketing etc. Researchers have established tools to measure the emotional responses in advertisements and customer experiences. For the last ten years due to the fast invasion of computers and computer science, emotions' measurement is not a big deal. The developed instruments are not applicable for the measurement of emotional responses because all of the aforementioned requirements are not fulfilled [42].

The emotion assessment is indispensable in various fields such as affective computing, different areas of psychology or user experience (UX) [44].

In human computer interaction, the major part is played by emotions [5-6] but in the software engineering literature, it is hardly pondered. Although many prominent researchers highlighted their importance [7-8]. Emotions exploration is mostly done with respect to requirements engineering. According to some cases, emotions can significantly affect the requirements engineering process [7-9]. They classify many motivations and morals as soft issues having different special effects on requirements.

They distinguish between critical and less influential emotions. Likewise, Proynova et al. [10] make use of personal ethics to classify features that are then mapped to requirements that may have otherwise remained unrevealed.

2.2.2 Requirement Engineering (RE)

Requirement Engineering (RE) is deliberated to have a data oriented, challenging knowledge oriented, human capital demanding and media involving set of activities [11-12]. Requirements analysis, also called requirements engineering, is the "process of defining user expectations for a new or modified product." These features, called requirements, must be measureable, related and thorough [45].

The measurable, related and thorough requirements are often called functional requirements in the field of software and requirement engineering. As stated by F.P. Brooks in his seminal book states that projects who placed RE back generally fail [13]. Evidence advocates that insufficient attention to requirements is a key reason of failure of software project [14]. With respect to technology acceptance, a technology is discarded or used in restricted way by users when their wishes and experiences with that technology are not talked about and met appropriately [15-16]. Figure 2.4 shows the importance of understanding and engineering the requirements [46].

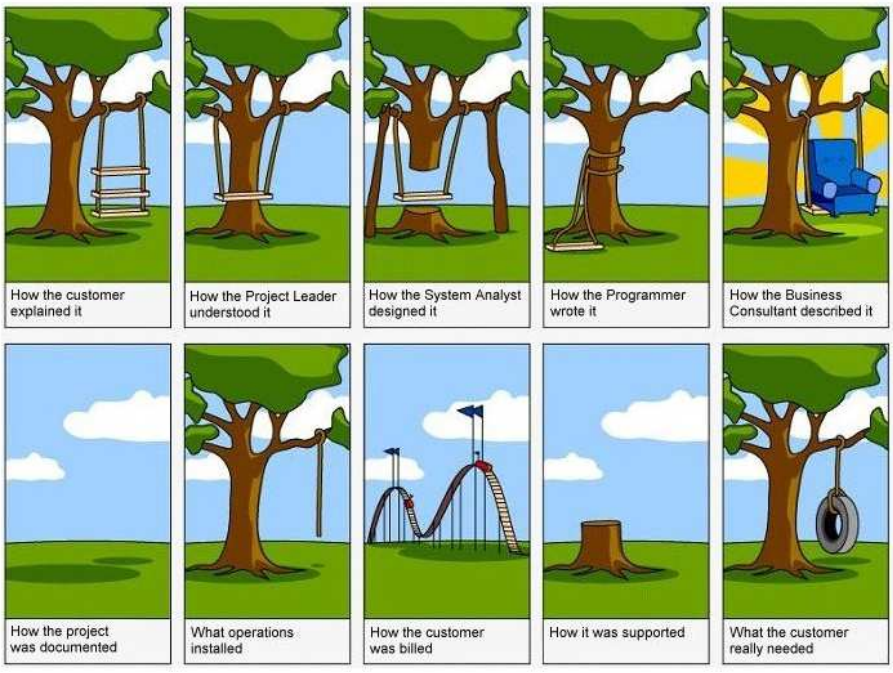

Figure 2.4: Importance of Requirement Engineering using Analogy of Swing [46]

Yu. E., in [17] make use of soft goals for modelling quality concerning requirements or non-functional requirements. In addition typical non-functional requirements like “reliability” or “security”, and some other less traditional factors having association with emotions are also included, like “trustworthy”, “flexible”, “minimal intrusion” or “normal lifestyle”.

Software Requirement Engineering (SRE) consists of several distinct activities which together make up its process [13]. Figure shows the requirement development process framework [47].

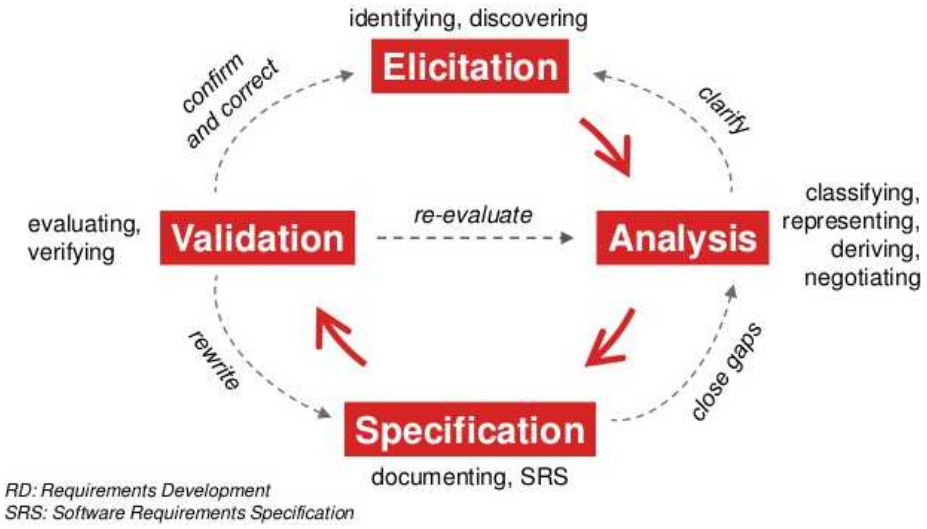

Figure 2.5: Requirement Development Process Framework [47]

2.2.3 Emotion based Requirement Engineering

Superficially, emotions may appear to be not related to requirements engineering but emotions may be caught up in applications where goals are personal [48], and ethical values are noteworthy. If emotions are taken care of while clearing the requirements picture for personal goals then designers can predict about human emotional responses and lessen their downsides (if present) [49].

Often the user experience is ignored and the software systems are designed in a pathetic way. Cooper in [50] cites this as “the inmates running the asylum”. Mostly requirement engineers (REs) collect the requirements from the customers but design it

according to their own wishes and ideology resulting in an unsatisfactory product by users. Moreover it is considered that interaction design problems can be treated after development by merely adjusting the user interface.

The elicitation of emotional perspective of stakeholders should be the first and foremost step from software engineering point of view. It is found that existing software engineering methods are having deficiency in them by not addressing social objectives [51, 52, 53]. It is the thinking narrated well by Baxter and Sommerville [51] in their detailed review of socio-technical designing methods:

"Modelling and abstraction is fundamental to software engineering, with models of different types being used by engineers to communicate. The practical use of socio-technical approaches has to acknowledge this by providing a means of modelling, and by integrating with existing approaches. The abstractions currently used in technical system modelling (e.g., use-cases, objects, etc.) do not seem to us to be sufficient to represent socio-technical considerations."

Identification of the utilitarian side of software is the ultimate moto of the requirements elicitation techniques. People usually address userfriendliness, functionality, reliability and maintenance which is not enough as urge for something new is always there. The fun or enjoyment perspective is very rarely focussed in elicitation of requirements. The requirements for many affective factors are not collected in a professional way [54].

Juran [55] is given credit of using the phrase "fitness for purpose" for the very first time. Acoording to him, the fullfillment of user's intended use is the rubric for quality.

The work of Colomo Palacios et al. in [18-19], clearly enquires stakeholders about their emotions pertaining to certain requirements. Stakeholders' responses are written in a grid which shows the arousal caused by the requirement on x-axis and the pleasure on y-axis. They plotted the reactions with requirements in a way that high pleasure level with low arousal showed requirements that are accepted. Though they give something new by correlating arousal, pleasure and requirements steadiness, it evaluates the emotional insights of stakeholders for requirements about emotions

oriented characteristics like arousal and pleasure, however Ramos et al. in [20] recommends the usage of emotions to discover and draft requirements with stakeholders and checks as if they are as per Maiden's argument.[7].

The work of Ramos et al. [20-21] cites some exemplary projects where emotions affect requirements, beliefs or values, and claim that the effect of these factors is as necessary as functionality or qualities in spite of the fact that they are conservatively ignored. The quick categorization of these issues is encouraged according to them and further managerial and technical treatment is recommended. They also suggest many psychological methods to classify emotional concerns while communicating to the stakeholders. If they are pointed out they advise to continue the requirements engineering (RE) process in a usual way. Their research is built to add on detail to the existing meaning of emotions appropriately for the process of development and to outline a notation to represent emotions graphically in the structure of the requirements engineering process.

In [20, 22] it is claimed that emotions should be considered important as other factors of cost, performance, and user interface and function in RE process. Stakeholders 'emotions are assimilated in RE process in [10] likewise some other factors e.g. stability. Emotions are treated as soft issues or problems as reported in [23] and a method for refining these is recommended.

As reported in [24] the emotional perspective in a software is elaborated with respect to games and it is claimed that idea of game designers is captured by emotional requirements for finding the player's emotional experience. This emotional information helps to support communication with teams before and after production [24]. Though, in development phase inadequacies in emotional requirements have been acknowledged. Emotional requirements' definition is enhanced to take in emotion markers and prototypes. The better methods for eliciting, apprehending and visualizing emotion based requirements are presented. For emotional requirements, a detailed and complete investigation of one game oriented scenario is discussed with an emphasis on assessing visualization methods. The provided solutions are

according to the desires of all development team members and seem to be generalized ones.

The case study as reported in [25] discusses the lacking of emotional aspect of the emergency systems which leads to less usage and adoption of the software practically. In agent-oriented modelling, they present a candid notation of modelling the emotional goals. They planned to concentrate on mapping the concept of emotional goals from requirements to many different phases of systems development life cycle i.e. software design, testing, implementation and system validation. It permits to find out the requirements which are emotion-led throughout the software development lifecycle [25].

Additionally, the profound understanding of more methodical approaches for taking care of emotions in design is the goal.

2.2.4 Global Software Development

To apply in different global organizations, GSD (global software development) has turn out to be a widespread approach and the reputation of this strategy is increasing [56, 57]. The presence of capable software engineers situated in less budget markets has enabled global and subcontracted software development [58]. Communication revolution is also given credit for facilitating GSD through the Internet. Due to this, the facilities of email, Skype, WWW (World Wide Web), IM (Instant Messenger), and bespoke communication and operating tools and video conferencing can be utilized.

So international communication is having a very less cost as a result [59]. For good achievement and maintenance of economic advantage, the reasoning for the adoption of a Global Software Development (GSD) strategy has been credited to daring software organizations [60, 61]. To gain the supposed competitive advantage, it is admitted that labor arbitrage among geographical locations can be capitalized [62]. Joining this with temporal difference leverage among distributed locations can bring prospects of smooth competitive pricing and reduced time to market. Moreover

companies are striving to influence these prospects to empower the market share in the unpredictable international markets [63, 64].

Due to this software development has become a global service [65] that has helped the transfer of software development along with its maintenance to physically distributed sites. For serving this purpose organizations have made its affiliated firms in cost-cutting markets and some content of software development projects to offshored locations. As software is complex by nature, offshoring and outsourcing the development is proved to be a tough work [66]. The understanding of the requirements, collaboration of projects and testing are some of the challenging factors [58]. The aforementioned challenges, problems and difficulties are aggravated by difference of culture and linguistic, geographical and temporal distance and communication factors. Difference in levels of process maturity, software construction and its testing tools, technicality and experience of staff and followed standards are also the contributing factors. Hence, there is no doubt in saying that GSD projects encompass difficult and intricate tasks [67-69].

Different geographically dispersed teams develop the software in GSD projects [26-28]. As per Agerfalk et al. in [29] many client organizations i.e. 20% have globalized their work in USA. Moreover, 20% of the 1000 leading software companies have distributed their work globally. Subcontracting the software development effort to seller organizations in cost cutting markets has become more and more vital due to development cost reduction [30-31]. GSD has become a fast and cost-effective means for software development [32]. According to Babar and Niazi in [33], GSD has increased benefits compared to decreased development costs in the augmentation of other sides of software development.

When it comes to global software development (GSD), due to strenuous communication, coordination and interaction, requirement engineering becomes much more critical and tricky. It is difficult because of some critical factors i.e. the geographical distance, time zone difference, cultural and language differences etc. [34-35]. As quoted in [11-12], Requirement Engineering (RE) has a data oriented, challenging knowledge oriented, human capital demanding and media involving set of

activities. Considering this, RE becomes much more complex in GSD [34-35]. In fact this is because of the laborious nature of RE [11-12]. Mostly requirement engineers (REs) collect the requirements from the customers but design it according to their own wishes and ideology ignoring emotions and wishes of their customers resulting in an unsatisfactory product by users [51,52,53]. This ailment of ignorance of customers' wishes in RE is further sabotaged by the GSD environment as GSD projects encompass difficult and intricate tasks [67-69].

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Figure 2.6: Representation of Global Software Development [70]

Hence emotion based requirement engineering may even be more critical in GSD which is anticipated to be studied.

2.3 Existing studies

The existing literature relative to emotion based requirement engineering is reviewed to evaluate it in GSD perspective. Table 2.1 consists of eight columns named 'paper reference', 'author and year', 'title', 'contributions', 'GSD', 'Problem identified', 'consequences', and 'solution strategies'. The paper reference is shown in first column, author and year represent the corresponding authors and the year of publication, contributions represents additions of the paper to the literature, column

'GSD' shows that the paper is addressing the global software development environment or not, 'problem identified' column shows the problems highlighted by the paper (may be one or many), column 'consequences' show the ultimate impact of the problems identified, column 'solution strategies' show whether any solution is proposed to lessen or eliminate the problem or its consequence.

Table 2.1: Related studies

Paper	Author & Year	Title	Contributions	GSD	Problem identified	Consequence	Solution strategies
[22]	Abad, et al. 2016	"Requirements Engineering Visualization: A Systematic Literature Review."	-Derived a clear need for visualization support work -listed many barriers weaknesses	Not dealt	-Weak knowledge visualization support in RE -no visualization support for RE lifecycle -Less visualization support in RE communication & evolution -more investigation demand regarding Nonfunctional requirements & requirement uncertainties -need for more visualization support in distributed RE	Requirement engineering work is not having benefit of visualization comprehensively	Not given
[30]	Khan, Arif Ali, et al. 2017	"Systematic Literature Review and Empirical Investigation of Barriers to Process Improvement in Global Software Development: Client–Vendor Perspective."	-Critical are identified that can undermine the SPI programs -identified barriers are classified based on their significance to client and vendor organizations	dealt	Barriers faced in implementing SPI programs in client and vendor organizations were not clear	Software process improvement (SPI) implementation was not done properly	By the SLR and survey the problem is resolved

			- a moderate correlation between the rankings of the barriers in the SLR and the empirical study were also found				
[34]	Callele, et al. 2009	Visualizing emotional requirements."	-Presented a detailed investigation of one gameplay scenario -focus on evaluating visualization techniques for emotional requirements	Not dealt	production-phase deficiencies in emotional requirements have been identified	Requirement engineering work is not having benefit of visualization comprehensively	General solutions recommended
[35]	Miller, Tim, et al. 2015	"Emotion-led modelling for people-oriented requirements engineering: The case study of emergency systems."	-introduced a straight-forward notation of modelling emotional goals in agent-oriented modelling -:personal emotional goals, and context-specific emotional goals are distinguished -models are evaluated -designed, implemented, and evaluated a new prototype for an	Not dealt	Emotional needs of people are not fully investigated (what do user want to feel, how do they feel about a system) -Emotion desires are not treated as first class citizens in software engineering methodology	Requirement engineering is not taking full benefit of emotion based requirement engineering	Solution is provided up to some extent by introducing emotional goals modeling notation, classification and evaluation design and implementation of models

			emergency system -attracted people to apply emotion led models				

Abad et al. [22] reported on the outcomes of an SLR related to RE visualization. According to them, visualization techniques are used to comprehend and manage RE decisions and actions. With the help of SLR on visualization techniques, the answers to the key research questions are gathered, classified, and analyzed.

As reported in [24] the emotional perspective in a software is elaborated with respect to games and it is claimed that idea of game designers is captured by emotional requirements for finding the player's emotional experience. This emotional information helps to support communication with teams before and after production [24]. Though, in development phase inadequacies in emotional requirements have been acknowledged. Emotional requirements' definition is enhanced to take in emotion markers and prototypes. The better methods for eliciting, apprehending and visualizing emotion based requirements are presented. For emotional requirements, a detailed and complete investigation of one game oriented scenario is discussed with an emphasis on assessing visualization methods. The provided solutions are according to the desires of all development team members and seem to be generalized ones.

The case study as reported in [25] discusses the lacking of emotional aspect of the emergency systems which leads to less usage and adoption of the software practically. In agent-oriented modelling, they present a candid notation of modelling the emotional goals. They planned to concentrate on mapping the concept of emotional goals from requirements to many different phases of systems development life cycle i.e. software design, testing, implementation and system validation. It permits to find out the requirements which are emotion-led throughout the software development lifecycle [25].

The identified barriers as in [30] are described to successful software process improvement (SPI). SPI can prove to be a help for GSD companies (client and vendor) during start of a program. A clear SPI program is presented by using client and vendor classification of organization along with their particular barriers. The information of the marked top most barriers can prove to be a guideline for GSD companies to seek insight before the commencement of an SPI program. Implementation problems of SPI can be dealt in a useful way by the help of the results of this study. Additional investigation and research are required for the support of information visualization in RE. Up till now there is no visualization support for the all RE lifecycle. Requirements communication and evolution have less visualization support. The maps, collaborative visualization and storytelling demand more hard work to be explored. Furthermore, paper claims that there is an obvious requirement for visualization support for distributed RE. The results indicate that more and more assessment of the existing approaches is necessary for finding the mature and quality oriented visualization strategies.

As shown in the Table 2.1, it is observed that although papers have highlighted the need for visualization support while conducting RE in GSD or distributed environment however they did not address the emotion based RE which may increase the requirement visualization in GSD. They did not identified the problems due to lack of emotion based requirement engineering in GSD, consequences or impact of these problems and overcoming strategies /solutions for these problems are still to be answered.

2.4 Summary

In this chapter, the basic concept of emotion based requirement engineering in GSD is given and the preliminary studies which proved to be the basis of such kind of study are discussed in detail. These are not those papers which were referenced during systematic literature review.

CHAPTER 3

METHODOLOGY

3.1 Overview

This chapter presents the research methodology which is used to reach up to the desired results. In the chapter the plan as a whole is described that how research proves to be a solution for the software engineering and computer science community and solves the identified potential problems. The operational framework of the research is presented here that contains different phases and research methodology plan for intended work.

3.2 Research Methodology

Research methodology is a technique to logically solve the research problem. The name "science of learning" can be given to it and how research is completed scientifically is considered in it. Various steps are studied that are usually implemented by a researchers while studying his/her "research problem" meaningfully, logically and accordingly [36].

3.3 Research Design and Procedure

The Research Design and Procedure tells about the whole plan and steps followed in order to perform the research. The followed research design and procedure is shown in Figure 3.1.

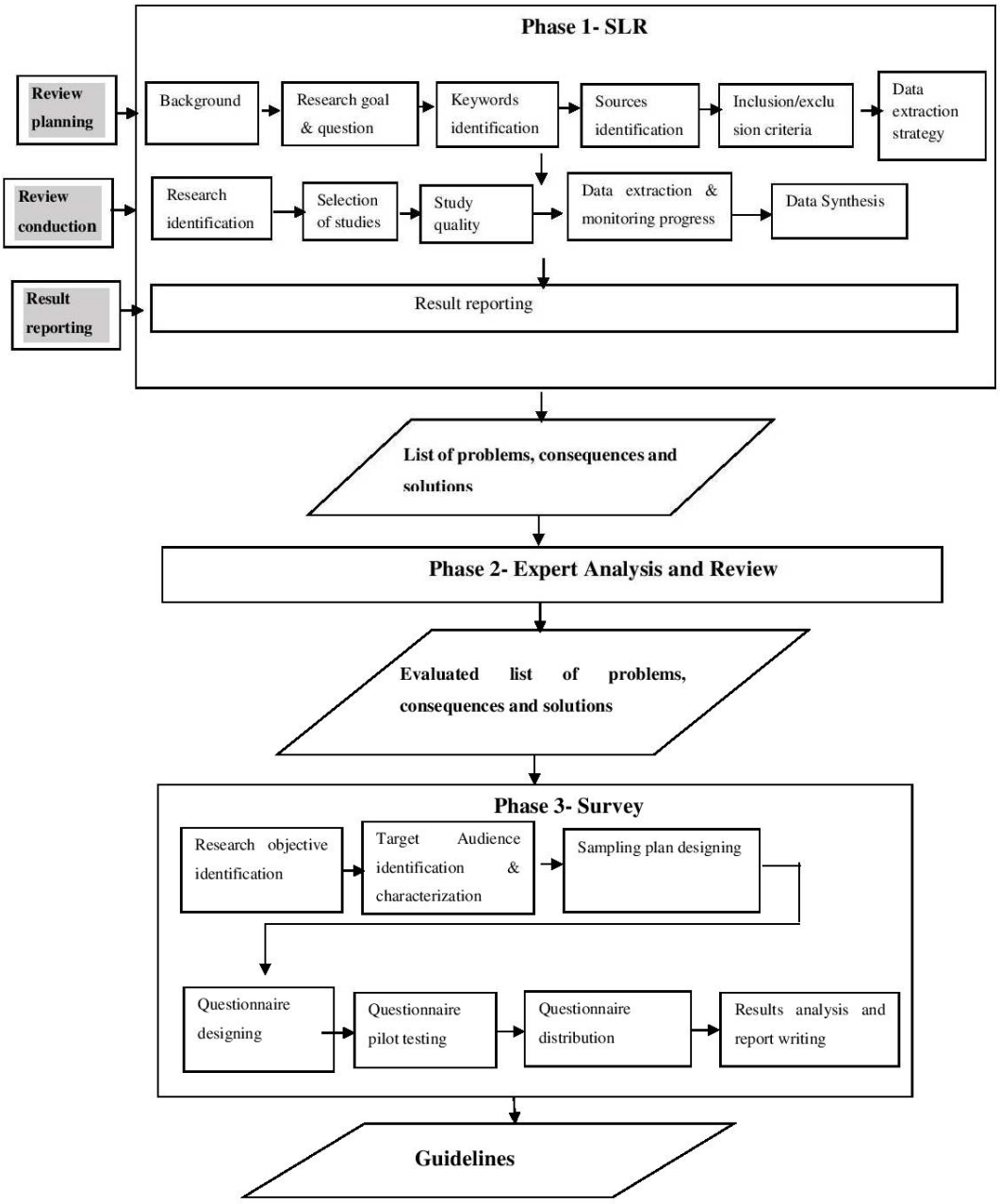

Figure 3.1: Detailed Phases of Research Methodology

As shown in Figure 3.1, research topic comprises of three main phases. Phase 1 is related to identification of problems due to lack of emotion based requirement engineering, their consequences and solution strategies through systematic literature

review (SLR). Here the two main activities done were the performed SLR and the performed data coding technique from Grounded Theory.

In this SLR, first step is review planning in which research background, research goal and question, keyword identification, sources identification, inclusion exclusion criteria and data extraction strategy is done. Once the data is extracted, then second step of SLR i.e. review conduction, is done in which the work starts with research identification. Then selection of studies are done followed by study of quality assessment, data extraction and monitoring progress and data synthesis. Data is synthesized by the application of the grounded theory. The data synthesis is the end of second activity of SLR i.e. performed data coding techniques from Grounded Theory. Once it is done, the results are reported in the last step of SLR.

The output of this whole SLR phase is List of problems which can occur due to lack of emotion based requirement engineering, their consequences and solution strategies.

In phase 2, the expert review is performed not only to review the list of results (i.e. problems, their consequences and solutions) but to add any valuable ailment left or ignored. The output of this phase is evaluated and reviewed list of problems, consequences and solutions.

Phase 3 of proposed research is done to investigate the practicality of problems due to lack of emotion based requirement engineering, their consequences and overcoming solution strategies of identified authentic problems with the industry and to identify the most influential problems and their solutions in GSD environment. The output of this phase are the valuable guidelines which can better help the researchers, practitioners and academicians while doing emotion based requirement engineering in GSD.

Through this research the academicians, practitioners and researchers can clearly visualize the requirements and criticalities of the GSD projects. The visualization support of requirements may best be achieved in this way.

3.4 Systematic Literature Review (SLR)

At first the SLR is performed which is the systematic review of the literature in order to identify the problems and their consequences due to lack of emotion based requirement engineering. In an attempt to review, the work of Kitchenham et al. [37] is followed. The SLR comprises of three parts: Review planning, Review conduction and Results reporting. Figure 3.2 explains the overview of the SLR steps.

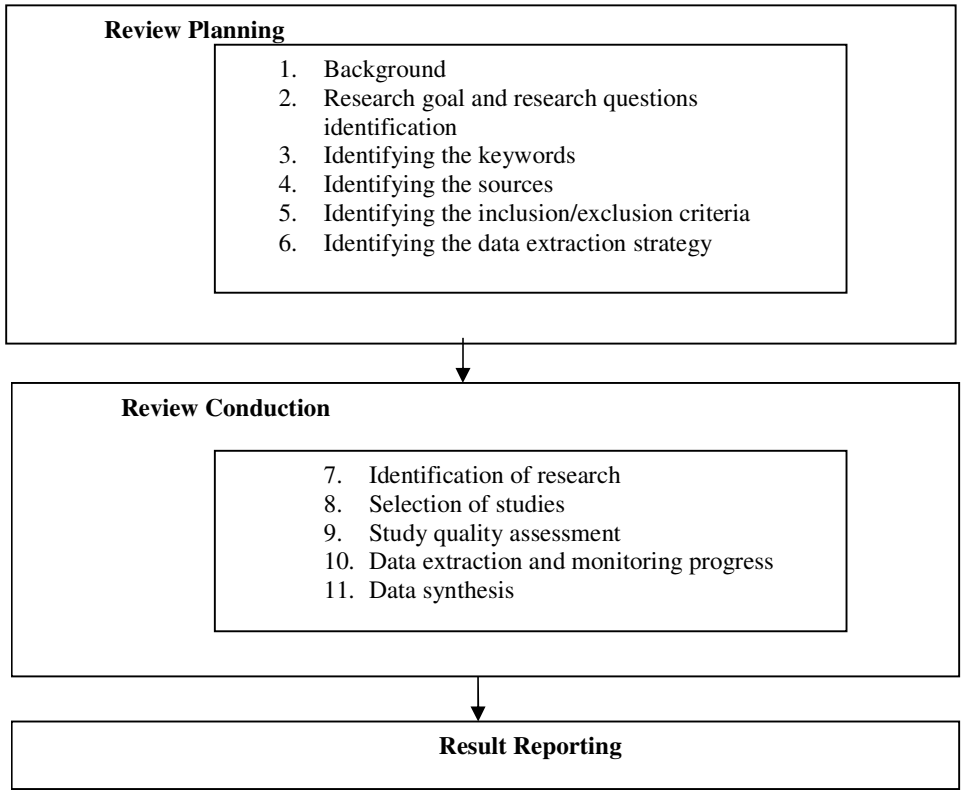

Figure 3.2: Overview of SLR Steps Adopted from Kitchenham et al. [37]

In SLR, the first part is *Review Planning* which helps to elaborate the need of an SLR besides with the development of a reviewing protocol. Figure 3.3 shows the elements of review planning.

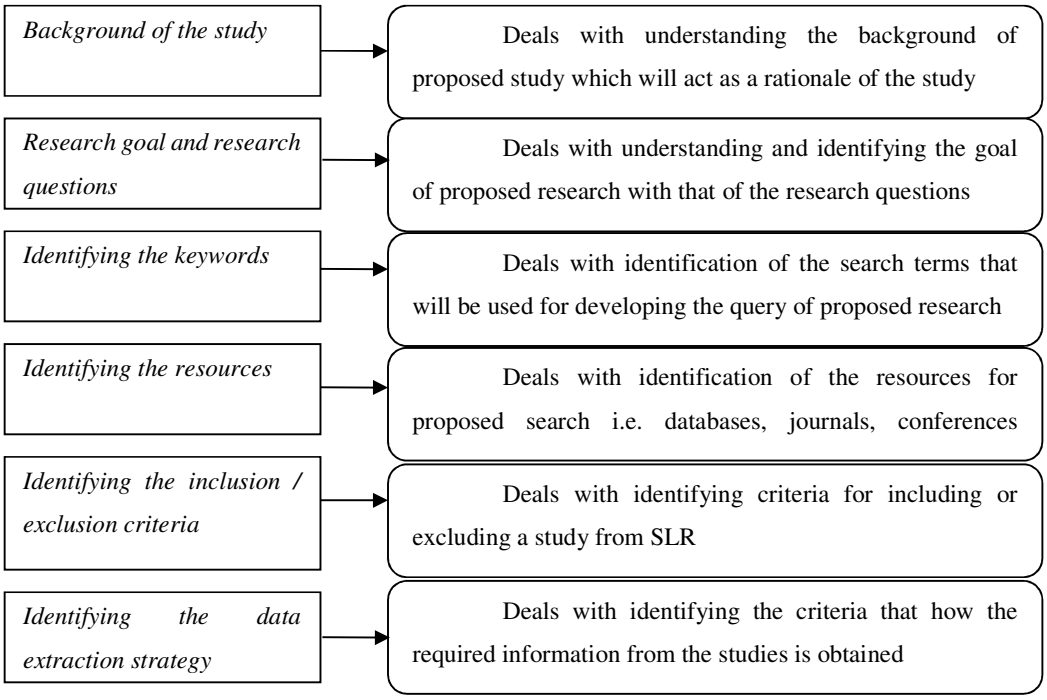

Figure 3.3: Review Planning Elements

As shown in Figure 3.3, background of the study is the first step of "review planning". At this step the review of existing literature is planned which is related to emotion based RE in GSD. The related studies are guiding us to make proposed idea in area of emotion based RE for GSD environment.

The second step of Review Planning is *Research Goal and Research Question identification.* The research goal and research questions are clearly explained by this step. The research goal of SLR is to come up with a unique list of problems that can occur due to lack of emotion based requirement engineering in GSD. Besides, SLR is conducted to find the consequences of identified problems in RE. The research question are: What problems are faced due to lack of emotion based requirement engineering in GSD environment?

The third step of Review Planning is the *identification of the Keywords*. The relevant keywords of proposed research i.e. alternate spellings and synonyms for major terms are identified. For example the keywords can be Emotion based requirement engineering, Global software development and Requirement visualization.

Fourth step of Review Planning is *Identification of the Resources*. In this step the data sources are identified from where the related papers can be collected. Selected data sources for this research are IEEE, ACM Digital Library, Science Direct, Emerald, Wiley online and Springer-Link. The search is divided into two layers. The first layer is the automated search comprising on queries in selected data sources and second manual layer of search searches the references of the papers manually to certify that it is complete.

The fifth step of Review Planning is *Identification of the Inclusion/Exclusion Criteria*. The criteria for simply dropping or keeping the paper is described at this step. The inclusion/exclusion criteria of proposed study is based on three levels. The Information related to proceedings of conferences and workshops and table of contents are excluded at first. Then papers are checked on keyword basis. In the second level, papers which are not having any of the keywords Emotion based requirement engineering, Global Software Development and requirement visualization are dropped in second level. In third level, all the repeated papers are excluded. Once the inclusion exclusion criteria is applied, then the selected papers is further forwarded to researchers for the assessment of quality.

The assessment of the quality of the selected studies is done by adopting a specifications list from the work of Kitchenham [37]. Table 3.1 shows the checklist that was used for serving this purpose.

The questions are scored as follows:

_ QA1: Y (yes), the aim of the study is clearly defined; P (Partly), the aims are implicit; N (no), the aims are not defined.

_ QA2: Y, the findings of the study is convincing and reliable as it is based on comprehensive set of peer reviewed published work; P, the findings of the study is based on few papers which are even not published in peer reviewed

journals and conferences; N, the findings are not credible and important as it is based on assumptions only.

Table 3.1: Quality Assessment Checklist

Number	Question	Answer
1	Are the aims clearly stated?	Yes/ No/Partially
2	Are the findings credible and important?	Yes/ No/Partially
3	Are the prediction techniques used clearly described & selecting them is justified?	Yes/ No/Partially
4	Is the knowledge or understanding been extended by the research?	Yes/ No/Partially
5	Is the diversity of perspective and context been explored?	Yes/ No/Partially
6	Are the links between data, interpretation and conclusions are clear?	Yes/ No/Partially
7	Does the detail/ depth/ complexity of the data is conveyed?	Yes/ No/Partially

_ QA3: Y, the identification techniques and methodologies are clearly described and justified by the study; P, the identification techniques are mentioned but not defined clearly and comprehensively; N, the identification techniques are neither defined nor justified.

_ QA4: Y, the knowledge of the previous cited studies is broaden by the study by giving progressive contribution to the area of research; P, the knowledge of the cited studies are discussed but no important contribution is performed; N, the study is not extending the knowledge and understanding of the previous studies.

_ QA5: Y, the area of research is explored by the researchers diversely by looking into various perspectives; in short multiplicity of the idea is explored; P, the study is exploring the idea but some parts are diversely explored and some are ignored; N, the study is not discussing the context of research diversely.

_ QA6: Y, the study is organizing the study data in an understandable and traceable manner where every interpretation and conclusions are clear and easily be linked; P, the study is using the data extracted from the other studies but it is not easy

to trace that data due to its inappropriate organization; N, the study lacks the links between the data, its interpretation and conclusions.

_ QA7: Y, the study is discussing the concept in detail and its complexity is conveyed to the reader; P, the study is discussing the concept and its complexity in general; N, the study is not discussing the data in detail.

The quality evaluation procedure is a coordinated process, where the studies are randomly allocated to researchers who can be the post graduate students. The scoring procedure are Y = 1, P = 0.5, N = 0. The feedback against each question of the checklist is recorded and given the values accordingly. The scores for each paper are accumulated. After applying the quality assessment, the selected/filtered papers are investigated for data extraction.

The sixth step of Review Planning is *Identification of the Data Extraction Strategy*. The forms are designed for recording the data gathered from the studies. Table 3.1 and 3.2 shows the design of the form which was used for showing the information of the study. Table 3.2 shows the form for recording the data focusing the research question.

Table 3.2: Study Information Form

Data Item	Data Item Information	Notes
Id		
Title		
Author		
Year of Publication		
Publication Type	Journal/conference/un-published	
Selection status	Exclude/Included	Reason of exclusion
What are the problems which occur due to lack of emotion based RE in GSD?		
What are the consequences of those problems in GSD environment?		

Once the Reviewing Protocol is completed then the proper review is started. Review conduction and reporting are performed by following the SLR protocol defined in review planning. The findings of the review conduction are narrated in Chapter 4.

3.5 Qualitative Analysis

Grounded Theory [71, 72] is applied by thoroughly studying the selected papers and by the use of it the coding of the variables is done. The theory emerges from a process of data collection through primary data (i.e. interviews and/or focus groups) and secondary data (collected from literature review and data from organizations such as Statistics).

The application of the Grounded theory (GT) [73] is done as a casual theoretical description as it may take place in usual discussion or a happening. Grounded theory concepts have intellectual supremacy for people to make the variables. It is applied on to the text and by observing the text different variables are defined logically and accordingly. Informally, grounded theory application has grown with the spread of classic grounded theory. It also relates with fit and relevance to similar areas of concern. The GT methodology is based on coding which is done naturally. During the application of a grounded theory approach, [71] data analysis and interpretation and theory building occur at the same time as data collection. It is a pro-active approach. What makes it original is the regional nature of the approach. There are seven analytical steps according to Chesler [74].

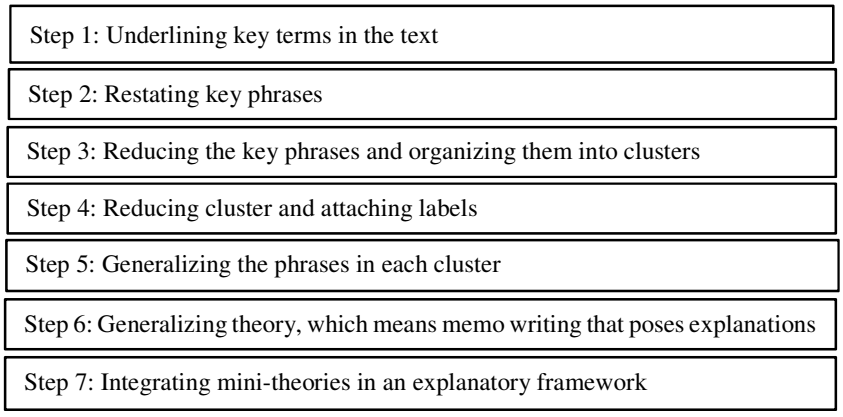

Figure 3.4: Analytical steps in Grounded Theory by Chesler [74]

By following the steps of Chesler [74], grounded theory is applied and variables are defined. These are those variables which are either the problems, the

consequences of those problems or the solutions in literature of the selected papers. The tables which are formed after application of grounded theory are attached in the Appendix D.

3.6 Expert Evaluation

The list of gathered problems, their consequences and solutions are then forwarded to the experts. The experts are contacted to not only review the grouping and naming conventions of the problems and their consequences but also to be invited to recommend some new problems and their consequences. In order to conduct an expert review, the expert opinion elicitation guideline by Ayyub [75] and Boring, et al., [76] is followed because of its maturity, peer reviewed mechanism and thorough guideline to bring about experts opinions. Figure 3.5 shows the steps to conduct the expert review.

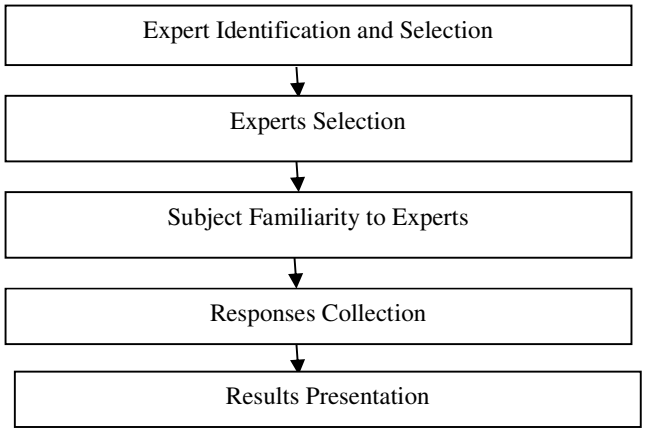

Figure 3.5: Steps to Conduct Expert Review

The criteria for the selection of expert is that he / she should be Software Engineering professional with more than 10 years of experience either from academia or from industry having expertise in Requirement Engineering (RE) and detailed knowledge of Global Software Development Environment (GSD) environment. Details of reviewers are attached in appendix E.

In Expert Identification and Selection, the expert evaluators are selected. After expert selection, the experts are given familiarization of the topic under research. All the followed procedures are clearly demonstrated and then for further authentication they are given the charge. Then collection of responses is done in which experts give many of the recommended modifications for further implementation. Then the results are presented.

3.7 Survey

This work is followed which is considered to be the most frequently and extensively used manual for effective survey conduction in field of software engineering. Figure 3.6 shows the steps which are followed for conducting the survey.

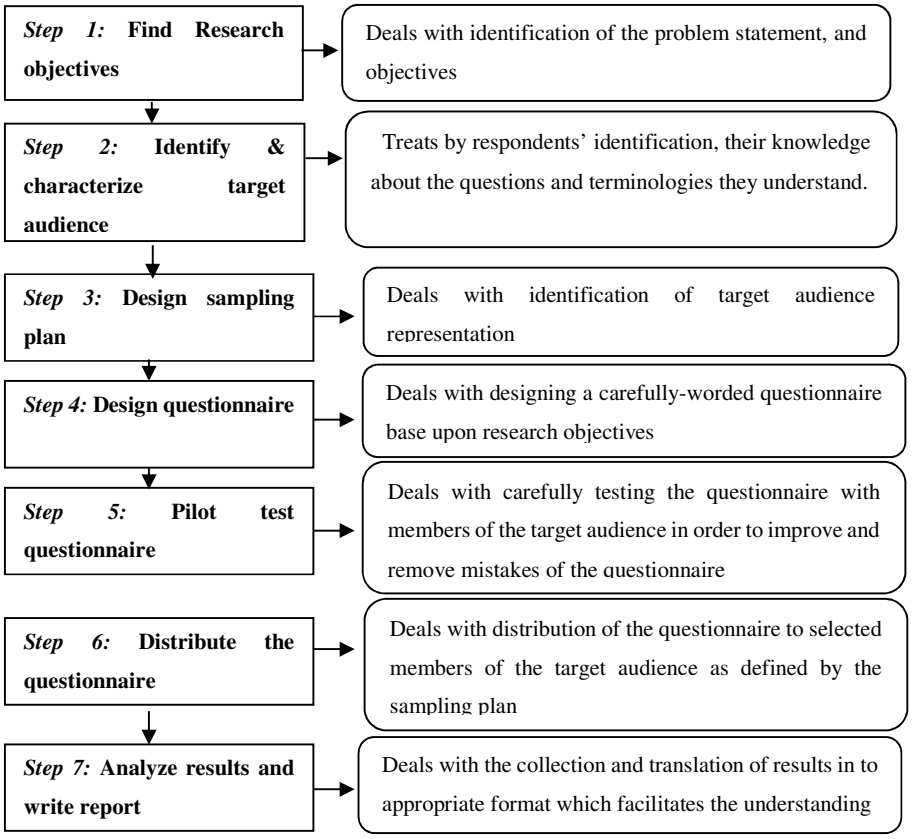

Figure 3.6: Steps for Survey Conduction, Adopted from Kasunic [77]

The first step of the survey conduction is the identification of research objective. The research objective of this phase is to find out the practicality of the problems due to lack of emotion based requirement engineering in GSD, their consequences and overcoming solution strategies to mitigate the problems.

In proposed study software organizations are being focused while working in GSD environment. The target population of this research is the Res (requirement engineers) from software oriented companies working in distributed environment. To identify the appropriate target population on definite questions, the work of Kasunic [77] was focused. Table 3.3 shows the set of questions, which are given importance while doing identification and characterization of the target population.

Table 3.3: Questions to Identify and Characterize Target Audience that are adapted from Work of Kasunic [77]

1. How many people are in the population were studied?
2. What are their jobs and responsibilities?
3. What is the most common education level?
4. What relevant experience do they possess?
5. What technical abilities do they possess?
6. What is the age range of the respondent population?
7. Is it anticipated that they would have difficulty with using a questionnaire that is:
   - mailed to them?
   - completed using a computer via the internet?
   - handed to them?
8. What can be assumed about their knowledge of the domain that is studied in the survey?
9. How much of their time can be assumed that they will spend completing the questionnaire?

Afterwards, sampling is done. A subset of total target population is called a sample, having qualities of the population. In this study, a questionnaire is sent to the distributed software companies. The directory is acquired by Pakistan software export board (PSEB) or ministry of information technology (MOIT). The directory provides an authentic source of registered software development companies. The detail of the organization is attached in appendix H.

After completion of the phases of target audience selection and sampling, questionnaire is developed. A questionnaire or survey form is designed for the identification of overcoming solution strategies that may be followed in response to identified problems. The work of Kasunic [77] was adopted to make the questionnaire. Table 3.4 shows the questions which are well-thought-out while designing and developing the questionnaire.

Table 3.4: Questions for Designing Questionnaire, Adapted from Kasunic [77]

Questions for Designing a Questionnaire
1. How will the survey be mediated (e.g., via paper, email soft copy, Web)?
2. How long should the questionnaire be?
3. How should the questionnaire be structured and organized?
4. What page design and formatting will be most effective?

The questionnaire is named as survey form because it is not like the traditional questionnaire. The development process of the survey form involves a pilot study, which is used for amendments and exclusions related to the information and questions that are stated in the questionnaire until the final questionnaire is designed. The pilot study is done for validation and improvement of the questionnaire, in terms of the statements, wordings, sequencing along with the potential interests of the participants. The survey form is forwarded to target audience. Their comments are about the survey form understandability, clarity etc. On the basis of comments and suggestions the survey form is modified and improved. The problems, consequences and solution

strategies are adjusted and enhanced with respect to quality for their due understandings. The final version of the survey form is produced accordingly then. The updated survey form is attached in appendix I.

Then survey form circulation and data gathering is done. After completing the pilot study the survey package is referred to the target population. The manual industry survey are used to take data from many different respondents without considering their geographical presence.

3.8 Summary

In this chapter the protocol or the action plan for the practical layout of the proposed work is described. The course of action or protocol is listed for systematic literature review (SLR), qualitative analysis (data coding protocol), expert evaluation, survey. In the protocol the corresponding research methodologies, designs and phases are described thoroughly with the help of tables and figures. The results are reported in chapter 4.

CHAPTER 4

PROBLEMS AND CONSEQUENCES DUE TO LACK OF EMOTION BASED REQUIREMENT ENGINEERING IN GSD AND THEIR SOLUTIONS-FINDINGS

4.1 Overview

In this chapter the step by step results of systematic literature review (SLR) and survey are presented. The proper details of developed solution including its steps, tables and charts are discussed in this chapter. As the study used the technique known as systematic literature review. This chapter explains the execution phase of SLR protocol as specified in chapter 3. Main search terms are detected from the RQs in this phase and their synonyms and substitute spellings are utilized to make the search strings.

4.2 Major Search Terms

There are various steps that are used to extract search terms are as follows:

i. From search questions, deduce main search strings.
ii. Detect substitute synonyms and spellings for main terms.
iii. Utilize the Boolean OR to include substitute spellings and synonyms, and use the Boolean function AND to connect the main terms, only when database permits.

iv. Main search terms detected from the RQs in this study's context are: Requirement Engineering, Emotion, and Global Software Development.

v. Substitute synonyms and spellings for main terms and use of Boolean function "AND" and "OR": (Emotion OR feeling OR passion OR sentiment OR sensation) AND (requirement OR "requirement engineering" OR "RE" OR "Software requirement engineering" OR "requirement elicitation" or "requirement negotiation") AND (Global OR "Global software Development" OR "GSD" OR "GSE" OR distributed OR virtual)

To give response to stated search questions, search study is required to elaborate before conducting and managing the review. Research articles depend upon empirical proof, with professional software developers or students as members, were the fundamental focus of this literature review. Studies focusing emotion based requirement engineering in global software development were considered. The final search strings were chosen by depending on experience from pilot search and containing following terms:

i. Emotion, feeling, sentiment, sensation and passion.

ii. Requirement engineering , RE, Requirement Negotiation

iii. Global software development, GSD, distributed, off shore, virtual, Distributed software development, GSE, Global Software Engineering

4.3 Data Sources

Various databases were used for the retrieval of the studies includes IEEE, ACM, Science Direct (Elsevier), Emerald insight, Wiley Blackwell journals, Springer link, JSTOR and CiteSeer.

4.4 Study Selection Criteria

There were different phases for study selection criteria. Included and excluded studies of each phase were saved individually. Study Selection Criteria is described below in detail.

i. Search Strings were run on the above mentioned databases and obtained references were collected.
ii. Duplicates were detected and erased.
iii. The headings of studied were evaluated with the help of inclusion criteria.
iv. In next step, the abstracts were evaluated on the basis of inclusion criteria.
v. Complete text of studies were evaluated by depending upon both inclusion/exclusion criteria.
vi. As, there were different phases of including and excluding criteria so, the results of every screening step were managed and kept in separate files.
vii. Not related (unrelated) were included or excluded in conference with supervisor.

4.5 Study Inclusion/Exclusion criteria

The criteria for an inclusion or exclusion was also multiphase. The main aim of this phased study selection process was to diagnose the articles related to goals of this methodical literature review. A wide range of search strings were present and hence it was assumed that all studies detected would not be added in the complete final phase. Table 4.1 represents selection criteria of the study. This criteria was applied in first phase on heading/title and abstract and next, it was utilized to screen the studies upon full text. The motive of this step by step screening was to make sure that only related studied are added in the final SLR inclusion.

Table 4.1: Study Selection Criteria

Study Selection Criteria	
Analysis of Relevance	**Inclusion Criteria**
Selection of studies based on the search	English oriented
	Date of publication:1994---Present
	Published words only
	Containing the search strings
Screening upon headings/titles	No discussions, prefaces editorials, panels, comments, duplicates and summaries of tutorials
Abstracts screening	Check focus of the study is RE
Screening upon full text	Presence of 'emotions and GSD' in the paper
	One time occurrence recorded for the studies which is published multiple times by multiple publishers
	Sufficient focus on requirement engineering

4.6 Search String Application

By executing multiple search strings on chosen database to discover the related studies. The search strings were applied using all possible combinations of the available keywords. The yielded results were noted in separate word files. Many search strings were used for the SLR of "Emotion Based Requirement Engineering in Global Software Development" to search the relevant studies. The syntax of strings were dissimilar for each database.

4.7 Search Queries, Keywords and results

The information under this heading includes all possible keywords which were utilized to have proper results. It includes the queries which brought zero results in a separate table according to different data sources respectively. It also includes the comprehensive result oriented table of queries. Result in tables are shown in appendix A. Table 4.2 and 4.3 give information about the keyword and their synonyms respectively.

Table 4.2: Keywords/Main Terms

Keywords	Emotion
	Requirement engineering
	Global software development

Table 4.3: Synonyms

Keywords	**Synonyms**
Emotion	sentiments, sensation, passion, feeling
Requirement engineering	"RE", requirement gathering, requirement elicitation requirement process, software requirement, software requirement engineering
Global software development	Distributed, offshore, virtual, across borders, GSD, GSE, global software engineering

The information about all possible queries along with their data sources is available in Appendix A.

4.8 Studies Inclusion/Exclusion Process

There were 164,877 total studies gained from search. They were the raw studies in which there were many duplicate studies, table of contents and proceedings of the conferences. The studies were suffering from irrelevancy as well at that time. The screening of the studies upon title, full text and abstract and duplication etc., was performed but in reality screening was not simple to resolve and regulate relevancy and irrelevancy with respect to title of the study. There were no descriptive titles so study screening was accomplished in four different phases. Firstly studies were screened by considering that they should not be the conference proceedings /table of contents. Secondly they were screened by title and keyword. Then thirdly screening on the basis of abstract was performed and then at last full text was screened and result was recorded.

Below is the brief explanation of screening process which can be represented by the Figure 4.1.

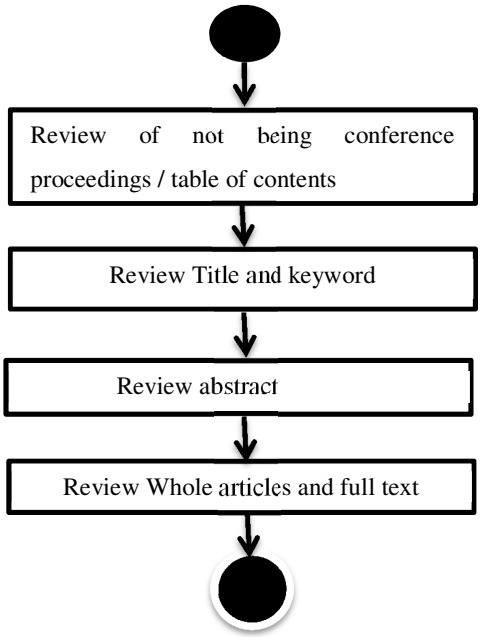

Figure 4.1: The phases of screening process of studies

A total of 444 studies were chosen for full text screening. Relevant studies were stored in files containing included studies. Figure 4.2 shows the full screening process.

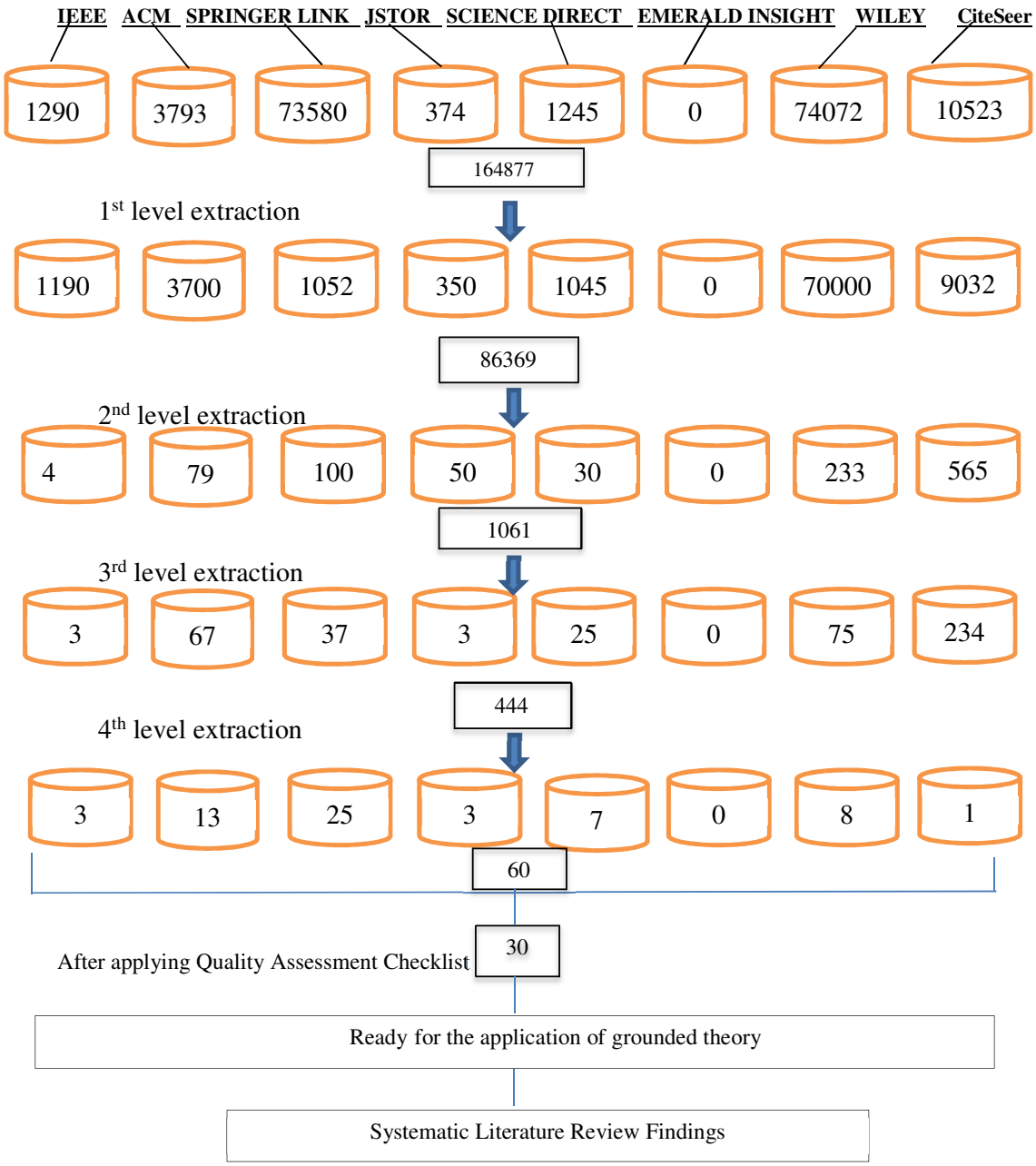

Figure 4.2: Screening / Extraction Process of Studies

First of all, a total of 164877 studies were collected from all of the mentioned data sources. After application of first level extraction, the number of studies reduced to 86369. The second level extraction yielded 1061 studies. The third level extraction produced 444 results. Finally, 60 studies were shortlisted after fourth level extraction of papers.

After the enumeration of results from different data sources, the quality assessment checklist was applied on to 60 papers. While applying the quality assessment checklist, software engineering researchers were supposed to rate the papers who were mostly MS/PhD students. The detail of the quality assessment is shown in appendix C.

4.9 Study Quality Assessment

After screening process, the phase of applying the quality Assessment checklist of Kitchenham [37] was executed and performed which is explained in a detailed in chapter 3 while explaining protocol. The application of quality assessment checklist was to authenticate and validate that the screening was impartial and fair. These studies were reviewed by MS / PhD personnel and they scored the papers impartially and without biasness. The papers having three or above marks out of five were selected. Afterwards grounded theory was applied on selected papers.

The implementation of Quality Assessment checklist is available in Appendix C. The application of Quality assessment checklist further streamlined and shortlisted the papers. Their count down was as shown in the Figure 4.3.

These were altogether 30 papers in which 1 was from IEEE, 8 were from ACM, 5 were from Science Direct, 7 were from Springer Link, 5 from Wiley Black well journals, 3 from JSTOR and 1 from Cite Seer. There was no paper from Emerald insight.

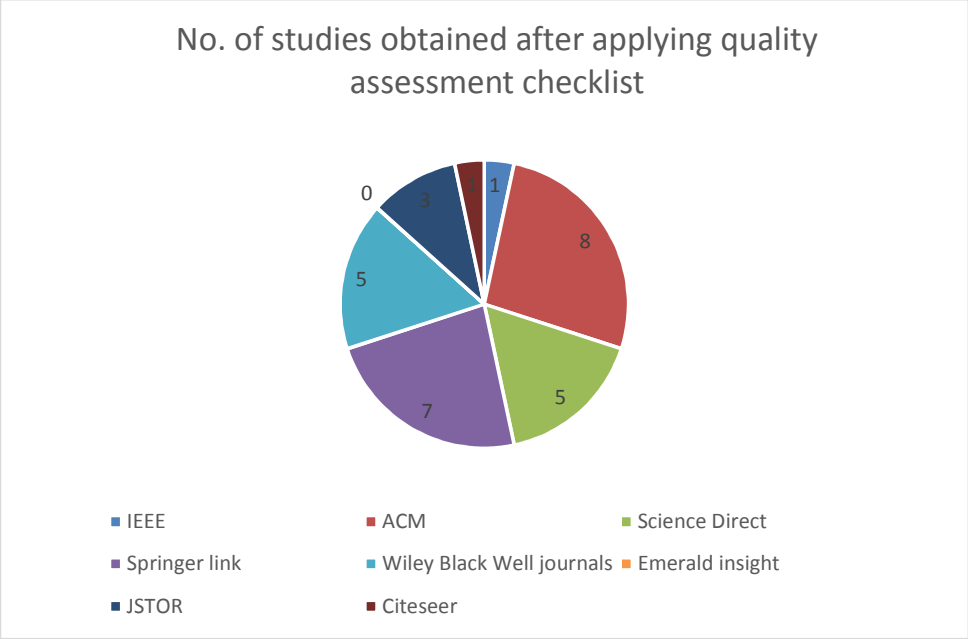

Figure 4.3: No. of studies obtained after applying quality assessment checklist

The papers after applying quality assessment checklist are tabulated in Table 4.4.

Table 4.4: Total No. of Studies Obtained After Applying Quality Assessment Checklist and Scoring [37]

No. of Studies gained	
Resource	**No. of studies**
IEEE	1
ACM	8
Science Direct	5
Springer link	7
Wiley Black Well journals	5
Emerald insight	0
JSTOR	3
CiteSeer	1
Total	30

4.10 Country wise Distribution of Studies

The obtained studies were further analyzed to foresee the patterns which they contain. So, the analysis of country wise distribution of studies was done. The main countries of final number of studies from which the final list of problems, their consequences and solutions is extracted is shown here in the bar graph.

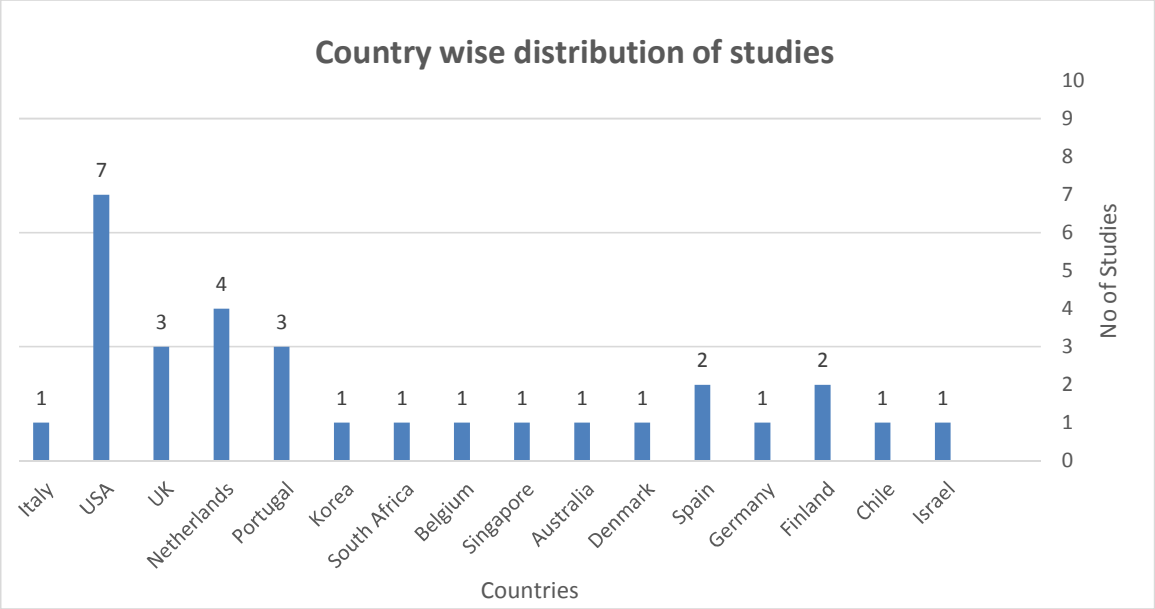

Figure 4.4: Country wise Distribution of Studies

In Figure 4.4, the country wise distribution of studies is shown. The maximum number of relevant studies were 7 from USA, followed by Netherlands, United Kingdom and Portugal. Equal number of papers i.e. 2 each were from Spain and Finland. Rest of countries contributed 1 paper each.

4.11 Year wise Distribution of Studies

Likewise another pattern may be interpreted from the results which is the distribution and dispersal of studies with respect to years. It ultimately shows that how related studies were published periodically.

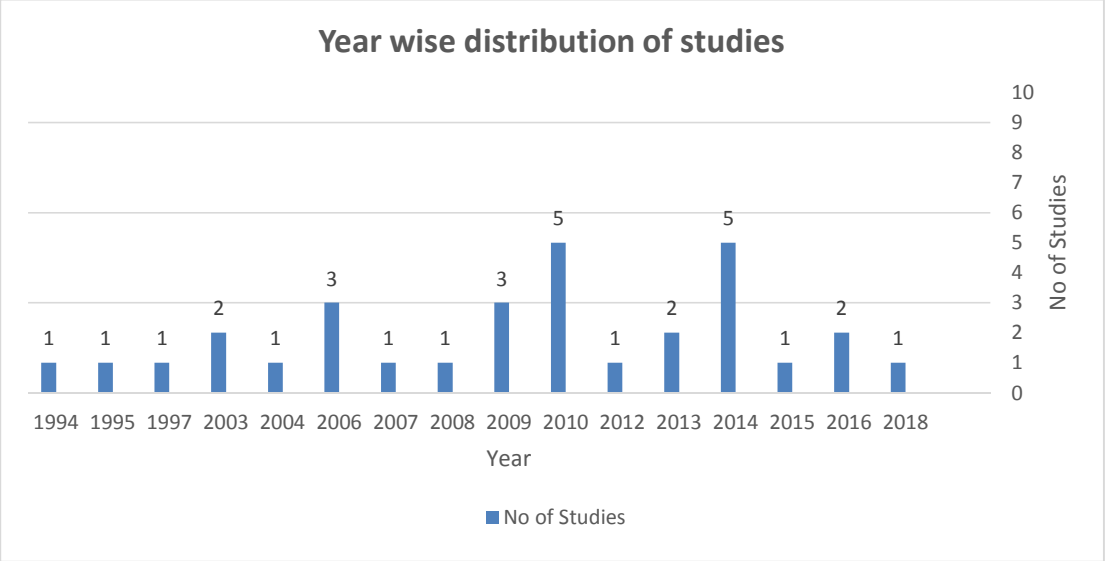

Figure 4.5: Year wise Distribution of Studies

In Figure 4.5, year wise distribution of studies is shown. The maximum number of relevant studies were undertaken in 2010 and 2015 that is 5 each. Then in 2006 and 2009, 3 studies each were collected. 2 related studies were highlighted in year 2003, 2013 and 2016 followed by much other work in different years.

4.12 The Grounded Theory Application

The streamlined studies after application of quality assessment checklist were subjected to grounded theory [71, 72] to find out the problems, their consequences and solution strategies which can occur due to lack of emotion based requirement engineering. The results after applying the grounded theory are available in Appendix D.

4.13 Reviewers' Evaluation after Grounded Theory Application

The results which were found out by grounded theory needed expert review, evaluation and validation. So they were evaluated by three renowned experts and reviewers who recommended modifications to be made. Their highlighted recommendations and comments were recorded. Some problems were cancelled by

them as they were not the ultimate problems due to lack of emotion based requirement engineering. Meanwhile, some problems were merged and grouped under one category likewise their consequences and solutions. These all worthy recommendations were highly taken care of and not only recorded but the course of action was duly taken accordingly. For review, it is attached in appendix F and G.

In this way the final findings were obtained which are discussed in the following Table 4.5. The ID for the papers are mentioned in appendix D.

Table 4.5: Evaluated Findings after Systematic Literature Review

Paper ID	**Problems**	**Consequences**	**Solutions**
P1, P3, P26	Reduction in trust	- "aggravate the feeling of being separate teams with conflicting goals" [P1] - "decrease the willingness to share information and cooperate to solve problems" [P1] - "affect goodwill toward others in case of objections and disagreements" [P1] - "Creates damaging effects on collaborations and communications" [P26] - "promoting the business case difficult" [P3]	"Information collection should be from social media and linkages should be to work artifacts" [P1] -"Develop trust via meetings" [P26] -"project estimates should be considered including time to build detailed specifications" [P3] - "strong communication should be done to understand the level of specification by documenting requirements" [P3] -"Questions should be asked and not to make assumptions" [P3] -"Mutual success criteria should be defined" [P3]
P1	Reduction in integrity		
"P1	Lack of project performance measurement	Project advancement cannot be checked and it cut short the increase in approximating the overall performance of a project	Generate "approximation of the overall performance of a project with history of successful collaborations occurring between project developers"
P1	Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	collaborative development platforms should be used
P2	Risk of others' uncooperative behaviors	Trust building is at a stake	Develop "non-work related communication behavior with remote collaborators"

P4	Human politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	"Understanding user beliefs and values is vital for the success of software development"
P4	Inadequate understanding of people's motivations	Software failure	Take care of people's feelings
P4	Inadequate understanding of values of self-esteem and autonomy		
P4	The emotional reaction to lack of involvement in RE process		
P5, P6, P16, P30	Difficulty in emotion assessment	It becomes difficult to sense the emotions and how to sense it [P5] -serious investments to projects are wasted [P6] - Emotion measurement cannot be done with required efficacy [P30] - Important cues (Information) for social emotion detection cannot be provided.[P16]	Use of combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions [P5] - Use of "emotion assessment framework should be done for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms" [P6] - The use of "evaluated Face-Reader for capturing instant emotions" [P30] - "emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms" [P16]
P9	Lack of subjective feeling evaluators using visual effects	Failure of IT projects occurs	Use of emocards which are used to capture the experience regarding the mobile application development process

P12	Moment to Moment ratings suffer	Immediate and continuous measurement of emotion cannot be performed.	A computerized tool "feelings monitor" that can be used to find "Moment to-moment ratings that are inexpensive, user friendly and provide immediate and continuous measurement of emotion"
P22	"Low understanding of the context of use that how users might behave in specific situations"	Unpredictable behavior of user	"Scenarios with Personas should be used to get knowledge that how users might behave in specific situations"
P23	Less supportive collaborative requirement elicitation	lack of effective requirement elicitation process	use of ithink game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability
P23	Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment
P23	No informal contact	Poor working relationships and reestablish trust between	use of Instant Messaging tool should be used to facilitate informal contact
P23	Information sharing is not facilitated	Trust at a stake	Development of intranet sites having personalized information pages should be used
P23	No clarity in informal and formal review of activities	Decreases trust	Team's personalized pages should be used for informal and formal review of activities
P23	Invalid information sharing	Time wastage in unnecessary sharing	Encouragement of valid knowledge sharing should be done by giving bonuses
P23	Inappropriate role assignment	Lack of facilitation in reestablishment of trust	Effective role assignment should be done to Project manager
P23	Incorrect performance evaluations	No Reinforcement of a unified team	Performance evaluations of individual team as a single unit on global level

P26	Software failure fear	have severe negative effects on collaboration	Develop trust via meetings
P30	Poorly introduced global distribution of the work	distrust	Organized distribution of work should be done on global level

In Table 4.5, the problems which can occur due to lack of emotion based requirement engineering in GSD, their consequences and solutions are found out after detailed evaluation and review. At first the problems are presented in the first column that are either extracted from different papers or from one paper, then in the next column all the consequences which are available in the literature are presented and at last the overcoming solution strategies discussed in papers are extracted in the third column.

4.14 Results Validation

The expert reviewers evaluated and validated the findings and gave recommendations and modifications as per their perspective. The problems due to lack of emotion based requirement engineering, their consequences and solutions were streamlined by following their recommendations. The work which was given to the evaluators, their recommended modifications and actions taken accordingly are all attached in appendix G. The final findings were presented to the industry personnel for seeing the practicality of problems, consequences and solutions in real time environment.

4.15 Diagrammatic representation of Final Findings

The Figure 4.6 describes diagrammatically the problems which can occur due to lack of emotion based requirement engineering in GSD, their consequences, and solutions. In diagram, at first problems are shown and then their consequences and solutions can be seen by moving down the chart.

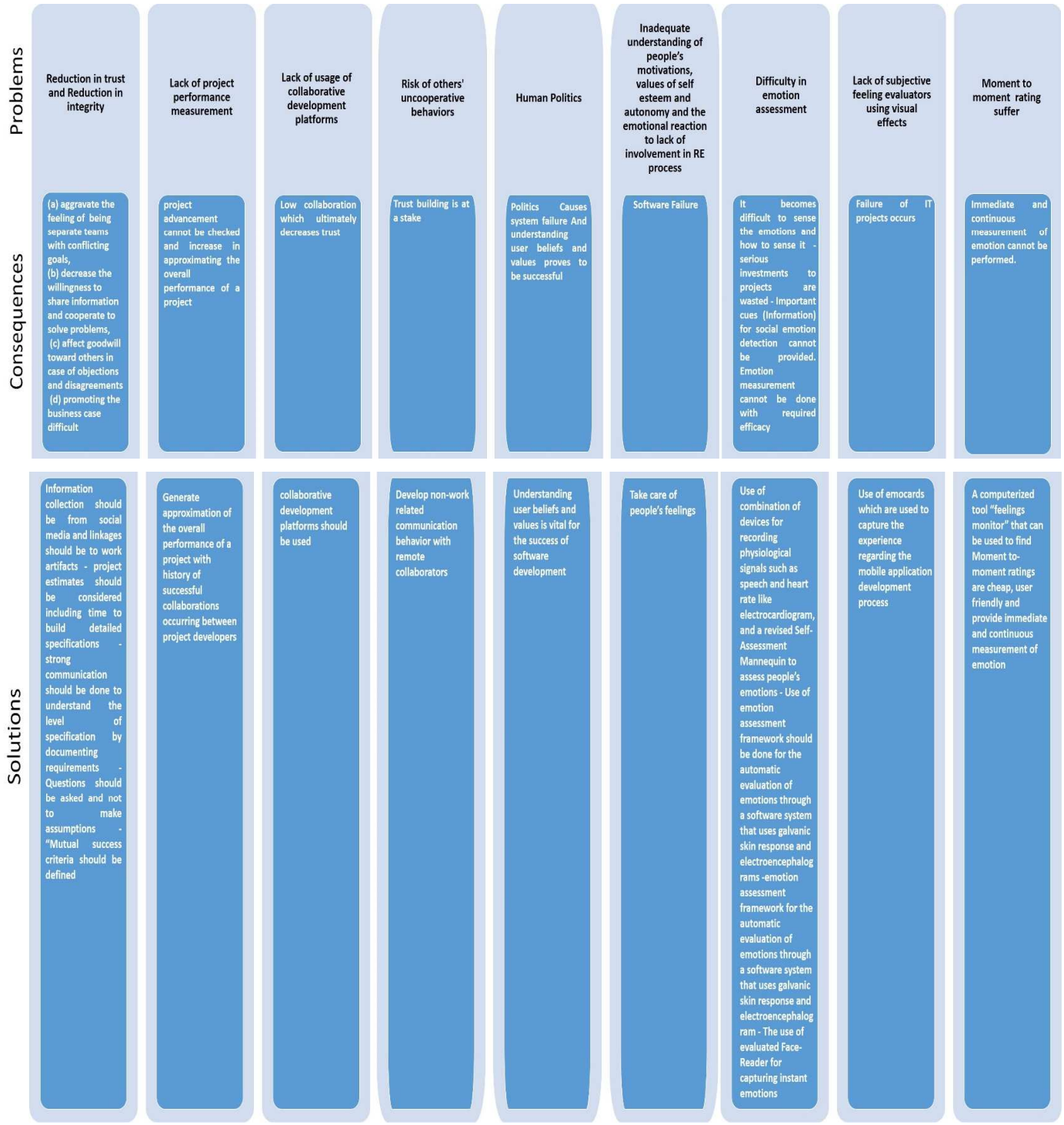
Problems
Consequences
Solutions
Reduction in trust and Reduction in integrity
Lack of project performance measurement
Lack of usage of collaborative development platforms
Risk of others' uncooperative behaviors
Human Politics
Inadequate understanding of people's motivations, values of self esteem and autonomy and the emotional reaction to lack of involvement in RE process
Difficulty in emotion assessment
Lack of subjective feeling evaluators using visual effects
Moment to moment rating suffer
(a) aggravate the feeling of being separate teams with conflicting goals, (b) decrease the willingness to share information and cooperate to solve problems, (c) affect goodwill toward others in case of objections and disagreements (d) promoting the business case difficult
project advancement cannot be checked and increase in approximating the overall performance of a project
Low collaboration which ultimately decreases trust
Trust building is at a stake
Politics Causes system failure And understanding user beliefs and values proves to be successful
Software Failure
It becomes difficult to sense the emotions and how to sense it - serious investments to projects are wasted - Important cues (Information) for social emotion detection cannot be provided. Emotion measurement cannot be done with required efficacy
Failure of IT projects occurs
Immediate and continuous measurement of emotion cannot be performed.
Information collection should be from social media and linkages should be to work artifacts - project estimates should be considered including time to build detailed specifications - strong communication should be done to understand the level of specification by documenting requirements - Questions should be asked and not to make assumptions - "Mutual success criteria should be defined
Generate approximation of the overall performance of a project with history of successful collaborations occurring between project developers
collaborative development platforms should be used
Develop non-work related communication behavior with remote collaborators
Understanding user beliefs and values is vital for the success of software development
Take care of people's feelings
Use of combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions - Use of emotion assessment framework should be done for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms -emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalogram - The use of evaluated Face-Reader for capturing instant emotions
Use of emocards which are used to capture the experience regarding the mobile application development process
A computerized tool "feelings monitor" that can be used to find Moment to-moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion

Figure 4.6: Diagrammatic Representation of Final Findings

In Figure 4.6, final findings of systematic literature review are listed. The problems due to lack of emotion based requirement engineering in global software development, their consequences and their solutions are shown following the recommendations of reviewers. At first, all the problems are represented in the first

row, then in the second row the consequences of these problems quoted in the literature are represented. Finally in the third row, all the solutions are shown.

In the proposed study the problems, consequences of those problems and overcoming solution strategies are found out at first by systematic literature review, then they are evaluated by expert reviewers and evaluators and at last the reviewed list is further authenticated and enhanced by industry personnel through a qualitative survey, where the data was obtained through a survey form. The detail of the survey protocol is specified in chapter 3 whereas the survey form designed can be reviewed in appendix I.

The survey was done to counter check the practicality of the problems due to lack of emotion based requirement engineering in GSD, their consequences and overcoming solution strategies from industry. The survey form was used, distributed among the software personnel of distributed application development in software houses, collected and recorded responses is all discussed about. The industry personnel either agreed with problems and solutions or added into the available knowledge which was from the research literature. Furthermore the practicality of the final finding is represented by quantification of the qualitative data [78].

The respondents of the survey were from different software houses in Islamabad. The details of respondents are attached in appendix H. The Figure 4.7 depicts the names and experience of different individuals.

The analysis of Figure 4.7 reveals that the maximum years of experience of respondents is 10 years then 7 years and mostly the respondents were having an average of 5 years of experience. The respondents' information and the years of experience working in a distributed environment is shown in the diagram. Each individual is symbolized with a different color on pie chart and years of experience is represented on colored patch in pie chart.

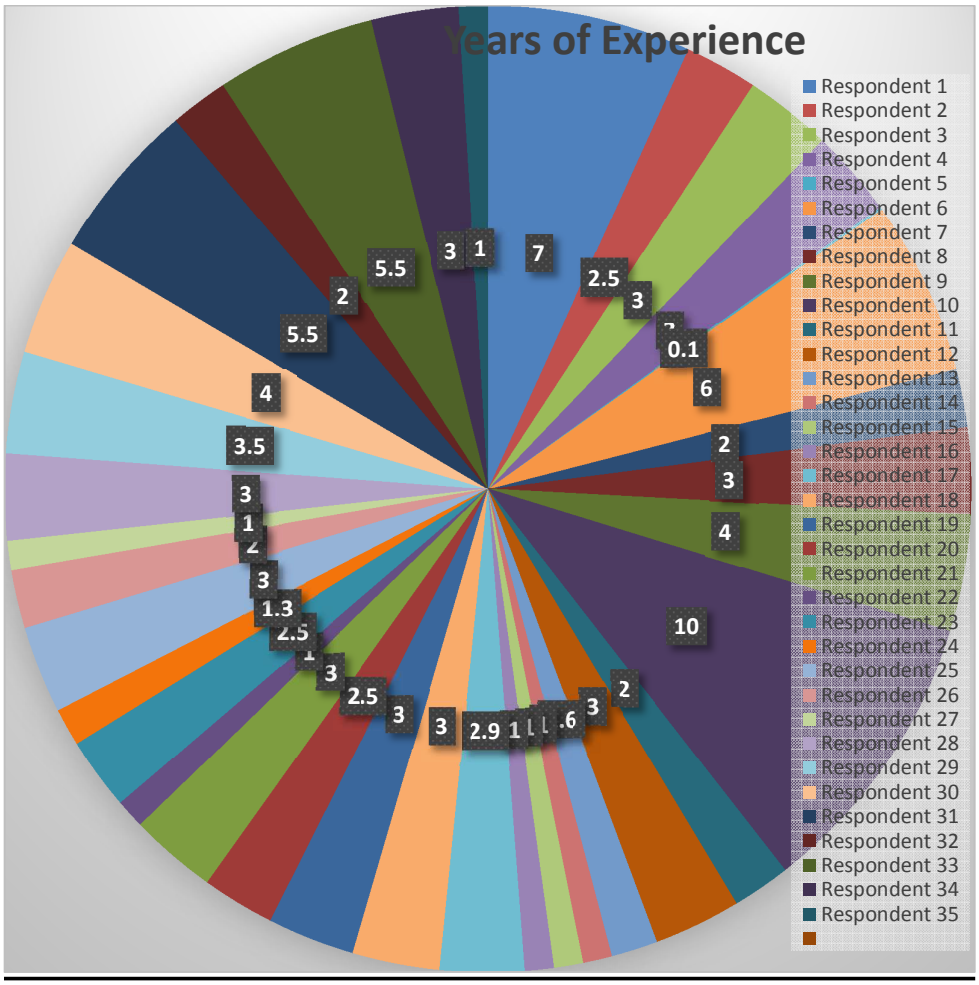

Figure 4.7: The Respondents' Experience

In Figure 4.8, the software houses to which the respondents belong and the organization size is depicted. The organization size was part of survey form which was inquired from the respondents. The Analysis shows that the most organizations surveyed were the medium sized organizations working on GSD projects. The three categories were given to the respondents to mention about their organization size i.e. small, medium and large. Mostly respondents belong to medium sized organization.

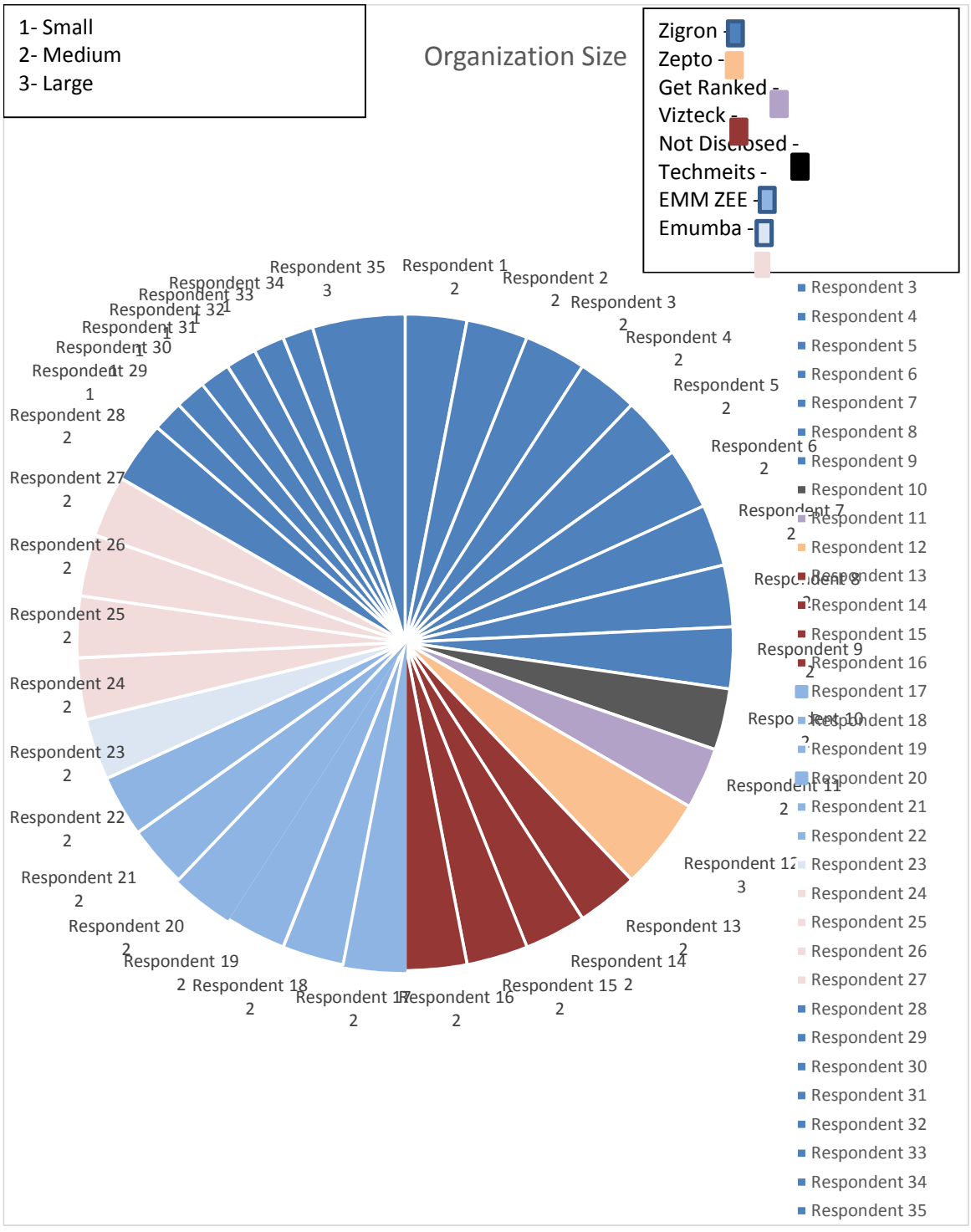

Figure 4.8: Respondents' Organization Size

The respondents filled the survey forms by either agreeing upon the identified potential problems or added on the detail. They wrote "no" in case if their software house is not making use of some recommended solution. The responses of 35 respondents were recorded who mostly responded in favor of literature findings. The opinions which were other than the literature findings were all recorded and attached in appendix J for review.

At last the survey results were collected (The filled survey forms are attached in appendix K) after one week duration as many personnel did not fill and return it in time. The survey results were collected and the comments which were adding to available knowledge were recorded and then integrated with the results of systematic literature review. The different comments which were recorded are attached in appendix J.

Then the practicality of the findings was found by changing the qualitative data to quantitative data through quantification [78]. All the results are available in Table 4.6.

4.16 Practicality of Findings through quantification of qualitative data

The following table 4.6 demonstrates the practicality Analysis of final findings through quantification of qualitative data. The results can further be used for validation.

Table 4.6: Practicality Analysis through quantification of Qualitative Data

Factors	**Number of Agreement**	**%age of agreement**	**Number of Dis-agreement**	**%age of dis-agreement**	**Number of Added Details**	**%age of added details**
Reduction in trust	21	60 %	0	0	14	40%
Reduction in integrity	28	80%	0	0	7	20%
Lack of project performance measurement	22	63%	0	0	13	37%
Lack of usage of collaborative	28	80%	4	11%	5	14%

development platforms						
Risk of others' uncooperative behaviors	26	74%	0	0	9	26%
Human politics	28	80%	0	0	14	40%
Inadequate understanding of people's motivations	17	49%	2	6%	14	40%
Inadequate understanding of values of self-esteem and autonomy						
The emotional reaction to lack of involvement in RE process						
Difficulty in emotion assessment	24	68.5%	6	17%	5	14%
Lack of subjective feeling evaluators using visual effects	29	83%	3	3%	4	11%
Moment to Moment ratings suffer	30	86%	4	11%	1	3%
Low understanding of the context of use that how users might behave in specific situations	31	88.5%	1/ 3%	3%	6	17%
Less supportive collaborative requirement elicitation	32	91%	1/ 3%	3%	2	6%
Lack of effective communication in virtual team environment	30	86%	0	0	5	14%
No informal contact	31	88.5%	2/ 6%	6%	2	6%
Information sharing is not facilitated	28	80%	0	0	7	20%

No clarity in informal and formal review of activities	27	77%	1/ 3%	3%	6	17%
Invalid information sharing	30	86%	1/ 3%	3%	4	11%
Inappropriate role assignment	25	71%	1 / 3%	3%	9	26%
Incorrect performance evaluations	29	83%	0	0	8	23%
Software failure fear	23	66%	0	0	11	31%
Poorly introduced global distribution of the work	28	80%	0	0	7	20%

Table 4.6 discusses the practicality percentage of all the problems which can occur due to lack of emotion based requirement engineering in GSD, their consequences and solution strategies in real time environment i.e. industry analytically. Mostly, the results show that the industry agrees upon the literature findings but there are some respondents who claim of not using the technology as a practical mean. The add-on percentage shows that industry's additional opinions and recommendations as an additional knowledge base while doing emotion based requirement engineering in GSD. The Table 4.6 demonstrates the agreement, disagreement and the number of add on details along with its respective percentages. A sample of 35 respondents was taken. Out of 35, the agreeing, disagreeing and adding on percentage is calculated. The respondents mentioned the organization size deliberately in survey form as it was part of survey form.

From the findings, it can be concluded that the factor which is given the most agreement percentage i.e. 91% by the respondents is "Less Supportive and collaborative requirement elicitation". This factor should be given importance especially while doing emotion based requirement engineering in GSD. The second highest agreement percentage (88.5%) is for two factors; "Low understanding of context that how users might behave in specific situations" and "No informal contact" concluding that they are also noteworthy. Furthermore three factors were having 86%

of the respondents' agreement namely "Moment to moment ratings suffer", "Lack of effective communication in virtual team environment" and "Invalid information sharing". 83% of the respondents recommended "Lack of subjective feeling evaluators using visual effects" and "Incorrect performance evaluation" to be consulted. 80% showed agreement with "Poorly introduced global distribution of work", "information sharing not done", "Human Politics", "Lack of usage of collaborative development platforms" and "reduction in integrity". 77% of the respondents showed agreement with "No clarity in informal and formal review of activities". 74% of the respondents were agreed upon "Risk of others' uncooperative behavior". 71% of the respondents were with "Inappropriate role assignment". 68.5% agreed with "Difficulty in emotion assessment". 66% agreed upon "Software failure fear". 60% of the respondents showed their agreement with "reduction in trust" and "Lack of project performance measurement". The minimum response agreement (49%) was found for three factors namely agreed with "Inadequate understanding of the peoples' motivations", "The emotional reaction to lack of involvement in RE processes", and "Inadequate understanding of values of self-esteem and autonomy".

The integrated list of problems, their consequences and solutions after survey is shown in Table 4.7.

4.17 Revised and Integrated List of Solutions after Systematic Literature Review and Survey

The following are the problems, consequences and the integrated list of solution after literature and survey which are being reviewed, evaluated, authenticated and added on by the industry personnel through survey.

Table 4.7: Revised and Integrated List of Solutions after Systematic Literature Review and Survey

Problem	**Consequence**	**Solution strategy**
Lack of mutual trust	- aggravate the feeling of being separate teams with conflicting goals,	-Information collection should be from social media and linkages should be to work artifacts - project estimates should be considered including time to build detailed specifications

Reduction in integrity	- decrease the willingness to share information and cooperate to solve problems, - affect goodwill toward others in case of objections and disagreements - promoting the business case difficult -Creates damaging effects on collaborations and communications	- strong communication should be done to understand the level of specification by documenting requirements -Questions should be asked and not to make assumptions -Mutual success criteria should be defined -Develop trust via meetings and recurrent communication with not only the client/customer but also users of the product. There should be a group/team leader to decide and intervene in case of any arbitration. -Information collected from social media cannot be reliable every time -Requirement should be cleared and documented properly Keep Switching group members and team leaders so that everyone gets a chance to know others and work together. ”Delegation of authority” Data should be attributable and legible, any type of weak integrity should be tried to sought out - quality assurance must be made -Criteria should be defined -The documentation with highlighted description the main points. -sometimes a surprise meeting (to talk about the informal activities) helps to make environment friendly. A social platform where remote teams can chat and hangout help them how to ask personal or problematic questions without any risks and hesitations.

Lack of project performance measurement	project advancement cannot be checked and increase in approximating the overall performance of a project	Generate approximation of the overall performance of a project with history of successful Collaborations occurring between project developers. Analysis of project completion should be done before starting the new project. Every team member should be present in that meeting and everyone's point should be considered. Project performance is considered to be good if client is happy. -Teams should properly conduct status Meetings and properly follow IIRA (tools for status and product measurement)." -Project performance is considered to be good if client is happy." - Training for project performance measurement may help otherwise personnel will have to learn from experience which requires time.
Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	Emotionally more intuitive Collaborative development platforms should be used. Latest more intuitive platforms may help with this.
Risk of others' uncooperative behaviors	Trust building is at a stake	Develop non-work related communication behavior with remote collaborators Define everyone's role and give them responsibility. →Team work →decisions forums →Penalties for crossing deadlines. →Appreciation rewards." Some team building activities will completely eliminate the problem as because of this people will understand each other temperament" -Remote communications doesn't make prominent impact, but individual efforts can break that distance barrier." A social platform where remote teams can chat, hangout and fully express their feelings help them how to ask personal or problematic questions without any risks and hesitations.
Human politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	Understanding user beliefs and values is vital for the success of software Development. Ban on political and religious discussions. Zero tolerance for aggressive behavior. Politics should be avoided and the leaders should not be biased with anyone working in a team.

		Keep switching developers so that they don't get chance to create some crew. Proper work assignment for building an urge of sense of achievement. Emotional Counseling for all stakeholders by project manager to concentrate on one's own work to get benefit/ appraisal/punishment etc.
Inadequate understanding of people's motivations Inadequate understanding of values of self-esteem and autonomy The emotional reaction to lack of involvement in RE process	Software failure	Take care of people's feelings. Emotional counseling Technical training Institute's focus on collective good Regulation of uniform code of conduct. Trainings should be there to judge the mental / physical health of the people. It may depend the way you communicate and transfer your reaction to positive / negative feedback. Responsibilities of every member should be clear. Client's administration should be guided to respect such phenomena.
Difficulty in emotion assessment	-It becomes difficult to sense the emotions and how to sense it -serious investments to projects are wasted - Important cues (Information) for social emotion detection cannot be provided - Emotion measurement cannot be done with required efficacy	-Use of combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions -Use of emotion assessment framework should be done for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms - emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms - The use of evaluated Face-Reader for capturing instant emotions Have sessions / seminars with team, give them time to express themselves and understand nonverbal communication by providing open environment. Assure trainings for professional environment. Push the team to attend in which they could get more information about this. Try more and more to go into live conversations rather than at a distance understanding is an art.
Lack of subjective feeling evaluators using visual effects	Failure of IT projects occurs	Use of emocards which are used to capture the experience regarding the mobile application development process.

Moment to Moment ratings suffer	Immediate and continuous measurement of emotion cannot be performed.	A computerized tool "feelings monitor" that can be used to find Moment to-moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion As it is difficult to measure Human Emotions Management from any device or tools precisely. That's why Humans and Emotion/psychologist is preferable" The User friendly systems should be developed.
Low understanding of the context of use that how users might behave in specific situations	Unpredictable behavior of user	Scenarios with Personas should be used to get knowledge that how users might behave in specific situations. There is lack of difference between user demand and IT Company demand so, they should sit together first and made proper understanding to reduce failure.
Less supportive collaborative requirement elicitation	lack of effective requirement elicitation process	Use of think game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability. Follow Agile Approaches/Scrum oriented techniques.
Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment. Use modern means of monitored communication and management of resources.
No informal contact	Poor working relationships and reestablish trust between	Use of Instant Messaging tool should be used to facilitate informal contact. Merge areas →discussion forums Also involve the team in some sports/games activity. Instant messaging tools are always monitored by the organization. So employees refrain from it. Some relaxed monitoring environment may be fruitful.
Information sharing is not facilitated	Trust at a stake	Development of intranet sites having personalized information pages should be used More advanced techniques of information sharing should be developed.
No clarity in informal and formal review of activities	Decreases trust	Team's personalized pages should be used for informal and formal review of activities
Invalid information sharing	Time wastage in unnecessary sharing	Encouragement of valid knowledge sharing should be done by giving bonuses/high ratings Properly conduct the requirement elicitation techniques.

		Trainings/meetings should be done to define proper criteria to share valid Information.
Inappropriate role assignment	Lack of facilitation in reestablishment of trust	Effective role assignment should be done to Project manager/ team lead with Clear and defined job description for everyone
Incorrect performance evaluations	No Reinforcement of a unified team	Performance evaluations of individual team as a single unit on global level There should be clarity in evaluation.
Software failure fear	have severe negative effects on collaboration	Develop trust via meetings Team leader or Manager should build his team's confidence and minimize their failure. Keep a backup plan. Incremental development approach works wonders in this case. Prototyping is a good approach.
Poorly introduced global distribution of the work	distrust	Organized distribution of work should be done on global level. Work should be distributed depending upon level of skill set, not low cost or politics.

The integrated results are the combined results of industry and literature which can therefore best be followed by academicians, researches and practitioners as guidelines. They are actually the integrated guidelines (for the problems, consequences and solution strategies) to be followed when emotion based requirement engineering is to be done practically.

4.18 Summary

In this chapter, the whole execution process of protocol of systematic literature review along with expert reviewers' evaluation and survey are elaborated in a detailed way. Each and every step is tried to be explained thoroughly and concisely. While starting from search strings, the results accumulation and refinements are all shown with final results which are listed in appendices. The selection criteria was followed to

select the respondents and their software houses accordingly and as per plan. How the survey form is used in place of a questionnaire, distributed among the software personnel of distributed application development in software houses, collected and recorded is all discussed. The survey artifacts which were produced are available for review.

In the proposed study the problems, consequences of those problems and overcoming solution strategies are found out at first by systematic literature review, then they are evaluated by expert reviewers and evaluators and at last the reviewed list is further authenticated and enhanced by industry personnel through a qualitative survey, where the data was obtained through a survey form. In this manner, all the results of literature and industry were collected at one place for all viewers.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Overview

A systematic literature review and survey is conducted to find out the list of problems, consequences and solution strategies which exist in the literature and industry. The state of art is found out by SLR. They were the potential problems that can occur due to lack of emotion based requirement in GSD, their consequences and solutions. It was further reaffirmed by the industry survey. The time period for conducting the SLR was from 1994 to 2018.

The main attention of the SLR was to collect the problems which can occur because of ignoring emotions while engineering requirements of globally distributed projects. The online data sources IEEE, ACM, Wiley Online, Emerald insight, Elsevier (Science Direct) and springer link were consulted for finding the appropriate and relevant papers and studies. For the screening of the studies a predefined inclusion/ exclusion criterion was used. After screening process, relevant data was extracted from the chosen primary studies accordingly the set data extraction scheme.

The data which was extracted was then stored into appropriate tables for data analysis. Data analysis was done by generating different types of charts and graphs. The quality assessment checklist was applied on to the selected data and on the basis of scoring they were included. After all, the data synthesis was done to answer the research questions. The grounded theory was applied to find out the basic problems

consequences and solutions available in selected literature. The important facts found by conducting the systematic literature review were sent for expert analysis. The expert reviewers reviewed and evaluated the problems, consequences and solutions and recommended modifications which were rectified accordingly.

At last the reviewed list is further authenticated and enhanced by industry personnel through a qualitative survey, where the data was obtained through a survey form.

5.2 Potential Impact of Research

The first contribution of this study is list of problems that can occur due to lack of emotion based requirement engineering in GSD environment. This further enhances the existing software engineering and more specifically requirement engineering body of knowledge.

The second contribution is the list of consequences and impacts of the afore-mentioned problems are valuable finding as well.

The third contribution is the list of solution strategies that overcome the problems.

The research provides a comprehensive guideline for problems due to lack of emotion based requirement engineering in GSD, the consequences, the strategies to overcome problems and to better visualize the requirement engineering in GSD environment.

Through this research the academicians, practitioners and researchers may better visualize the requirements of the GSD projects which increase ratio of success. The visualization support of requirements may best be achieved in this way.

5.3 Future Directions

The results show that the industry agrees with literature but some points are being added as per practical usage of the industry. Many of the solution strategies are not yet followed in academia and research but if used they have potential to serve the community. This research focused a limited span and in future if it is conducted on a

bigger scale the results would surely be more promising, reliable and generalized. So there is a need for future researchers to conduct more research to contribute to RE community. It is good to conduct similar studies so as to strengthen the empirical research on emotional perspective in RE with proper documentation (including protocols, list of primary studies etc.). Some research methodologies like action research and observational studies can also be used to contribute to emotional software engineering to further clarify the results. The addition of experimental validation is planned for the future enhancement. The study is aimed to be generalized since it included the software houses of Islamabad, Pakistan only. In this way the results will encompass more generalization and authenticity.

5.4 Limitations

Although the problems due to lack of emotion based requirement engineering, their consequences and solutions are found from well-known international data sources, results cannot be generalized with respect to survey limitation as it is involving only software houses of Islamabad, Pakistan. The results would have been more promising if the international survey conduction would have been done. So the research suffers from generalization perspective.

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APPENDIX A

In appendices the supplementary materials to the text is included. These may include tables, charts, computer program listings, and others. Appendix A includes all the startup queries which are either workable and result oriented or non-result oriented ones

All Possible Queries

Queries:

Data Sources	All possible queries
IEEE	(((emotion*)AND requirement engineering) AND global software development)
	(((emotion*) AND requirement engineering) AND GSD)
	(((emotion*) AND requirement engineering) AND GSE)
	(((emotion oriented) AND "requirement engineering") AND "global software development")
	(((emotional) AND "requirement engineering") AND "global software development")
	((("emotion based") AND "requirement engineering") AND "global software development")
	((("emotion*") AND "requirement engineering") AND "global software development")
	((("emotion oriented") AND "requirement engineering") AND "global software development")
	((("emotional") AND "requirement engineering") AND "global software development")
	(((emotion* requirement engineering) AND global software development) AND requirement visualization)
	(((sentiment*) AND requirement engineering) AND global software engineering)
	(((sentiment*) AND requirement engineering) AND global software development)
	((("sentiment*") AND "requirement engineering") AND " global software development")
	(((sensation*) AND requirement engineering) AND global software development)
	(((sensation oriented) AND requirement engineering) AND global software development)
	(((sensation based) AND requirement engineering) AND global software development)
	(((sensational) AND requirement engineering) AND global software development)
	((("sensation*") AND "requirement engineering") AND "global software development")
	((("sensation based") AND "requirement engineering") AND "global software development")
	((("sensation oriented") AND "requirement engineering") AND "global software development")
	((("sensational") AND "requirement engineering") AND "global software development")
	(((passion*) AND requirement engineering) AND global software development)
	(((passion oriented) AND requirement engineering) AND global software development)
	(((passion*) AND requirement engineering) AND global software engineering)
	(((passion based) AND requirement engineering) AND global software development)
	((("passion*") AND "requirement engineering") AND "global software development")

	(((“passion oriented”) AND requirement engineering) AND global software development)
	(((“passion based”) AND requirement engineering) AND global software development)
	((("sentimental") AND "requirement engineering") AND "global software development")
	((("sentiment oriented") AND "requirement engineering") AND "global software development")
	((("sentiment based ") AND "requirement engineering") AND "global software development")
	((("sentiment*") AND "requirement engineering") AND "global software development")
	((("feeling based ") AND "requirement engineering") AND "global software development")
	((("feelingful") AND "requirement engineering") AND "global software development")
	((("feeling*") AND "requirement engineering") AND "global software development")
	((("feeling oriented") AND "requirement engineering") AND "global software development")
	(((distributed) AND "software requirement) AND emotion)
	(((emotion*) AND “software requirement”) AND global)
	(((offshore) AND "software requirement") AND emotion)
	((("across the border") AND "software requirement") AND emotion)
	((("GSD") AND "software requirement") AND emotion)
	((("global software development") AND "software requirement") AND emotion)
	((("GSE") AND "software requirement") AND emotion)
	((("global software engineering") AND "software requirement") AND emotion)
	((("global software development") AND "requirement process") AND emotion)
	((("global software development") AND "requirement elicitation") AND emotion)
	((("global software development") AND "requirement gathering") AND emotion)
	((("global software development") AND "RE") AND emotion
	((("global software development") AND "software requirement engineering") AND emotion)
	((("global software development") AND "software requirement process") AND emotion)
	((((global software development) OR distributed software development) AND requirement*) AND sentiments)
	(("Abstract":"emotion*" OR "emotion based" OR "emotion oriented" OR "emotional") AND (p_Abstract:"software requirement engineering" OR "RE" OR "requirement engineering") AND (p_Abstract:"global software development" OR "GSD" OR "GSE" OR "offshore development" OR "global software engineering"))
	(("Abstract":"sensation*" OR "sensation based" OR " sensation oriented" OR "sensational") AND (p_Abstract:"software requirement engineering" OR "RE" OR "requirement engineering") AND (p_Abstract:"global software development" OR "GSD" OR "GSE" OR "offshore development" OR "global software engineering"))
	(("Abstract":"sentiment*" OR " sentiment based" OR " sentiment oriented" OR " sentimental") AND (p_Abstract:"software requirement engineering" OR "RE" OR "requirement engineering") AND (p_Abstract:"global software development" OR "GSD" OR "GSE" OR "offshore development" OR "global

	(("Abstract":"feeling*" OR "feeling based" OR " feeling oriented" OR " feelingful" OR " feelingly")) AND (p_Abstract:"software requirement engineering" OR "RE" OR "requirement engineering") AND (p_Abstract:"global software development" OR "GSD" OR "GSE" OR "offshore development" OR "global software engineering"))
	(("Abstract":"passion*" OR "passion based" OR "passion oriented" OR "passionful") AND (p_Abstract:"software requirement engineering" OR "RE" OR "requirement engineering") AND (p_Abstract:"global software development" OR "GSD" OR "GSE" OR "offshore development" OR "global software engineering"))
	(((((global software development) OR distributed software development) AND requirement*) AND emotion*))
	(((emotional) AND "requirement engineering") AND "global")
	((((sentiments) AND "requirement ") AND "software") AND global)
	((((crowdsourcing) AND "requirement ") AND "software") AND "emotion")
Springer Link	Emotion* “requirement engineering” in “global software development”
	“Emotion*” “requirement engineering” in “global software development”
	Emotion oriented “requirement engineering” in “global software development”
	“Emotion oriented” “requirement engineering” in “global software development”
	“Emotional” “requirement engineering” in “global software development”
	Emotional “requirement engineering” in “global software development”
	“Emotion based” “requirement engineering” in “global software development”
	Emotion based “requirement engineering” in “global software development”
	Feeling oriented “requirement engineering” in “global software development”
	“Feeling oriented” “requirement engineering” in “global software development”
	“Feeling based” “requirement engineering” in “global software development”
	Feeling based “requirement engineering” in “global software development”
	Feelingful “requirement engineering” in “global software development”
	“Feelingful” “requirement engineering” in “global software development”
	Feeling* “requirement engineering” in “global software development”
	“Feeling*” “requirement engineering” in “global software development”
	“Passion*” “requirement engineering” in “global software development”
	Passion* “requirement engineering” in “global software development”
	Passion oriented “requirement engineering” in “global software development”
	“Passion oriented” “requirement engineering” in “global software development”
	“Passion based” “requirement engineering” in “global software development”
	Passion based “requirement engineering” in “global software development”
	Sensation oriented “requirement engineering” in “global software development”
	“Sensation oriented” “requirement engineering” in “global software development”

	Sensational “requirement engineering” in “global software development”
	“Sensational” “requirement engineering” in “global software development”
	Sensation based “requirement engineering” in “global software development”
	“Sensation based” “requirement engineering” in “global software development”
	Sensation* “requirement engineering” in “global software development”
	“Sensation*” “requirement engineering” in “global software development”
	Sentiments oriented “requirement engineering” in “global software development”
	“Sentiments oriented” “requirement engineering” in “global software development”
	Sentimental “requirement engineering” in “global software development”
	“Sentimental” “requirement engineering” in “global software development”
	Sentiment based “requirement engineering” in “global software development”
	“Sentiment based” “requirement engineering” in “global software development”
	“Sentiment*” “requirement engineering” in “global software development”
	Sentiment* “requirement engineering” in “global software development”
	Sentiment oriented “requirement engineering” in “global software development”
	Requirement engineering globally
	emotions AND "business" AND (global)
	emotion "Requirement Engineering" Distributed
	emotion "Requirement Engineering" offshore
	emotion "Requirement Engineering “global
	emotion "Requirement Engineering" “ across border”
	emotion "Requirement Engineering" GSD
	passion “Requirement Engineering” distributed
	passion “Requirement Engineering” offshore
	“Sentiment oriented” “requirement engineering” in “global software development”
	passion “Requirement Engineering” “across border”
	passion “Requirement Engineering” GSD
	Requirement engineering globally
	'(emotion*/emotional/emotion based/emotion oriented/feeling*/feeling based/feeling oriented/feelingly/passion*/passion based/passion oriented/sentimental/sentiment*/sentiment based/sentiments oriented/sensation*/sensational/sensation oriented/sensation based) AND (requirement/"requirement engineering"/"RE"/"negotiation support"/negotiation) AND (global/"global software development"/distributed/"GSD"/"virtual teams"/"offshore development")'
ACM	*("emotion*" +"requirement engineering" +"global software development")*

	(+"emotion based" + "requirement engineering" + "global software development")
	(+"emotion oriented" + "requirement engineering" + "global software development")
	(+emotional + requirement engineering + global software development)
	(+sentimental + requirement engineering + global software development)
	(+sentiments based + requirement engineering + global software development)
	(+sentiment oriented + requirement engineering + global software development)
	(+sentiment* + requirement engineering + global software development)
	(+"emotion oriented"/"emotional") + ("requirement engineering"/"RE"/"software requirement engineering") + ("global software development"/"GSD"/"GSE"/"global software engineering")
	+((software +(global distributed))+ "software requirement" +emotion)
Science direct (Elsevier)	emotion based AND "requirement engineering" AND "global software development"
	Emotional AND "requirement engineering" AND "global software development"
	"Emotional" AND "requirement engineering" AND "global software development"
	Emotion* "requirement engineering" in "global software development"
	Emotion oriented "requirement engineering" in "global software development"
	Feeling oriented "requirement engineering" in "global software development"
	Feeling based "requirement engineering" in "global software development"
	Feelingful "requirement engineering" in "global software development"
	Passion oriented "requirement engineering" in "global software development"
	Sensation oriented "requirement engineering" in "global software development"
	Sensational "requirement engineering" in "global software development"
	Sensation based "requirement engineering" in "global software development"
	Sentiments oriented "requirement engineering" in "global software development"
	Sentiment based "requirement engineering" in "global software development"
	Sentimental "requirement engineering" in "global software development"
Jstor	(((emotion*)AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((emotional)AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((emotion based)AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((emotion oriented)AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sentiment*)AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)

	(((sentiment oriented) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sentiment based) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((passion*) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((passion based) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((passion oriented) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sensation based) AND(requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sensational) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sensation*) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((sensation oriented) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((feeling oriented) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((feeling based) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((feelingful) AND (requirement engineering)) AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
	(((feeling*) AND (requirement engineering))AND (global software development)) AND la: (eng or en) AND disc: (engineering discipline)
Wiley online	Emotion based AND “requirement engineering” AND “global software development”
	Emotional “requirement engineering” AND “global software development”
	Emotion oriented AND “requirement engineering” AND “global software development”
	Emotion* AND “requirement engineering” AND “global software development”
	sensational AND “requirement engineering” AND “global software development”
	Sensation oriented AND “requirement engineering” AND “global software development”
	Sensation based AND “requirement engineering” AND “global software development”
	Sentiments oriented AND “requirement engineering” AND “global software development”
	Sentimental AND “requirement engineering” AND “global software development”
	Feelingful AND “requirement engineering” AND “global software development”
	Feeling oriented AND “requirement engineering” AND “global software development”
	Feeling based AND “requirement engineering” AND “global software development”

	Passion oriented AND “requirement engineering” AND “global software development”
	Feelingful AND “requirement engineering” AND “global software development”
	passion in All Fields AND "requirement engineering" in All Fields AND "across border" 0 results
	emotion "Requirement Engineering" offshore
	emotion "Requirement Engineering" global
	emotion in All Fields AND "requirement engineering" in All Fields AND "across border" in All Fields
	emotion in All Fields AND "requirement engineering" in All Fields AND GSD in All Fields
	: passion in All Fields AND "requirement engineering" in All Fields AND distributed in All Fields
	sensation in All Fields AND "requirement engineering" in All Fields AND offshore in All Fields. 0 result
	sensation in All Fields AND "requirement engineering" in All Fields AND "across border" in All Fields. 0 result
	sensation in All Fields AND "requirement engineering" in All Fields AND GSD in All Fields
	passion in All Fields AND "requirement elicitation" in All Fields AND offshore in All Fields. 0 result
	sentiment in All Fields AND "requirement elicitation" in All Fields AND offshore in All Fields. 0 results
	sentiment in All Fields AND "requirement elicitation" in All Fields AND "across border" in All Fields. 0 result
	sensation in All Fields AND "requirement elicitation" in All Fields AND "across border" in All Fields. 0 result
	: sensation in All Fields AND "requirement elicitation" in All Fields AND GSD in All Fields. 0 result
	“Passion" based in All Fields AND "requirement engineering" in All Fields AND "GSD" in All Fields. 0 result
	sensation “Requirement Engineering” “across border”
	sensation “Requirement Engineering” offshore
	Sensation “Requirement Engineering” global
	sensation “Requirement Engineering” GSD
	passion “Requirement Elicitation” distributed
	passion “Requirement Elicitation” offshore
	passion “Requirement Elicitation” “across border”
	passion “Requirement Elicitation” global
	passion “Requirement Elicitation” GSD

	sentiment “Requirement Elicitation” distributed
	sentiment “Requirement Elicitation” offshore
	sentiment “Requirement Elicitation” global
	sentiment “Requirement Elicitation” “across border”
	sentiment “Requirement Elicitation” GSD
	sensation “Requirement Elicitation” distributed
	sensation “Requirement Elicitation” offshore
	sensation “Requirement Elicitation” global
	sensation “Requirement Elicitation” “across border”
	sensation “Requirement Engineering” GSD
	emotion "RE“ global
Emerald insight	emotion oriented “requirement engineering” AND “global software development”
	emotion based “requirement engineering” AND “global software development”
	Emotion* “requirement engineering” AND “global software development”
	emotional “requirement engineering” AND “global software development”
	Sensation oriented “requirement engineering” AND “global software development”
	Sensational “requirement engineering” AND “global software development”
	Sensation based “requirement engineering” AND “global software development”
	sentimental “requirement engineering” AND “global software development”
	Sentiments oriented “requirement engineering” AND “global software development”
	Feeling oriented “requirement engineering” AND “global software development”
	Feelingful “requirement engineering” AND “global software development”
	Feeling based “requirement engineering” AND “global software development”
	“ Emotion based requirement engineering” AND “global software development” AND “requirement visualization”
	emotion based requirement engineering in global software development
	(((emotion) AND ("requirement engineering")) AND ("global software development")) AND la:(eng OR en)
	sensation based requirement engineering in GSD
	emotion oriented requirement elicitation in offshore development
	sentiment oriented requirement gathering across borders
	passion based requirement engineering

	sensation based requirement engineering in GSD
	passion* RE
	emotion* software requirement engineering in GSE
	Software requirement engineering across borders
	Emotion* AND “requirement elicitation” AND “in GSD”
	Feeling oriented RE in virtual development
	Sentiment* requirement elicitation
	Feeling based requirement engineering in global software development
	Feeling based requirement engineering
	“emotion” AND “based” AND “requirement” AND “engineering” AND “in” AND “global” AND “software” AND “development”
	"emotion" AND "based" AND "requirement" AND engineering in global software development
CiteSeer	Emotion* AND “requirement engineering” AND “global software development”

APPENDIX B

Queries Having Results

Data Sources	Queries	Obtained Results	1st level extraction conference proceedings /table of contents	2nd level extraction Title/keyword	3rd level extraction Abstract	4th level extraction whole content
IEEE	(((emotion*) AND requirement engineering) AND global software development)	1	1	1	1	0
	(((emotion*) AND "software requirement") AND global)	1	1	1	1	0
	((((global software development) OR distributed software development) AND requirement*) AND sentiments) Model-Driven Engineering and Elicitation Techniques: A Systematic Literature Review	1285	1285	1	1	1
	(((((global software development) OR distributed software development) AND requirement*) AND emotion*)) Challenges in Requirements Engineering for Mobile Games	3	3	1	1	1

	Development: The Meantime Case Study					
	Total	1290	1190	4	3	3
Springer Link	'"Emotion*/feeling*/sentiment*/sensation*/passion*" AND "requirement engineering"AND "global software development"'	38	20	15	6	6
	Requirement engineering globally	505	5	4	1	1
	emotions AND "business" AND (global)	12831	23	5	3	3
	emotion "Requirement Engineering" Distributed	35	5	3	3	3
	emotion "Requirement Engineering" offshore	6	6	2	2	2
	emotion "Requirement Engineering "global	33	3	1	1	1
	emotion "Requirement Engineering" " across border"	2	2	1	1	1
	emotion "Requirement Engineering" GSD	4	4	1	0	0
	passion "Requirement Engineering" distributed	5	5	0	0	0
	passion "Requirement Engineering" offshore	1	1	0	0	0
	passion "Requirement Engineering" global	8	8	0	0	0
	sentiment "Requirement Engineering" distributed	6	6	0	0	0
	sentiment "Requirement Engineering" offshore	2	2	0	0	0

	sentiment “Requirement Engineering” global	9	9	0	0	0
	sentiment “Requirement Engineering” “across border”	1	1	0	0	0
	sentiment “Requirement Engineering” GSD	1	1	0	0	0
	sensation “Requirement Engineering” distributed	10	10	0	0	0
	sensation “Requirement Engineering” “across border”	0	0	0	0	0
	sensation “Requirement Engineering” offshore	0	0	0	0	0
	Sensation “Requirement Engineering” global	4	4	2	0	0
	sensation “Requirement Engineering” distributed	10	10	0	0	0
	sensation “Requirement Engineering” GSD	10	10	0	0	0
	emotion "Requirement Elicitation" Distributed	12	12	2	0	0
	emotion "Requirement Elicitation" offshore	3	3	3	0	0
	emotion "Requirement Elicitation “global	11	11	0	0	0
	emotion "Requirement Elicitation" “ across border”	10	10	2	0	0
	emotion "Requirement Elicitation” GSD	2	2	1	1	1
	passion “Requirement Elicitation” distributed	3	3	1	0	0
	passion “Requirement Elicitation” global	4	4	0	0	0
	sentiment “Requirement Elicitation” distributed	4	4	0	0	0
	sentiment “Requirement Elicitation” global	1	1	0	0	0

	sensation "Requirement Elicitation" distributed	1	1	0	0	0
	sensation "Requirement Elicitation" global	1	1	0	0	0
	emotion "RE" Distributed	22186	221	10	1	0
	emotion "RE" offshore	760	110	13	7	3
	emotion "RE" global	35563	356	13	1	1
	emotion "RE" " across border"	1378	159	13	10	2
	emotion "RE" GSD	56	5	3	1	1
	Emotion Requirement engineering in distributed	35	3	2	0	0
	Emotion Requirement Engineering in GSD	4	4	2	0	0
	Emotion Requirement Engineering in Virtual	25	7	1	0	0
Total		73580	1052	99	37	25
ACM	+((software +(global distributed))+ "software requirement" +emotion)	3793	3700	79	67	13
Wiley online	*emotion "Requirement Engineering" offshore*	2	2	1	1	0
	emotion "Requirement Engineering" global	13	7	7	7	3
	emotion "Requirement Engineering" Distributed	7	3	3	2	2
	emotion "Requirement Engineering" offshore	4	4	1	0	0
	emotion "Requirement Engineering "global	7	5	2	1	0
	emotion "Requirement Engineering" " across border"	2	2	0	0	0
	emotion "Requirement Engineering" GSD	3	3	2	2	0
	sentiment "Requirement Engineering" offshore	1	1	0	0	0
	sentiment "Requirement Engineering" global	1	1	0	0	0

	sentiment “Requirement Engineering” “across border”	1	1	0	0	0
	sentiment “Requirement Engineering” GSD	1	1	0	0	0
	sensation “Requirement Engineering” distributed	1	1	1	0	0
	emotion "Requirement Elicitation" Distributed	4	1	1	0	0
	emotion "Requirement Elicitation" offshore	2	2	0	0	0
	emotion "Requirement Elicitation “global	3	3	1	1	0
	emotion "Requirement Elicitation" “ across border”	1	1	0	0	0
	emotion "Requirement Elicitation” GSD	2	1	0	0	0
	emotion "RE" Distributed	1	1	0	0	0
	emotion "RE" offshore	2	1	0	0	0
	emotion "RE" “ across border”	1	1	0	0	0
	emotion "RE" GSD	4	4	1	0	0
	Emotion Requirement engineering in distributed	9	7	3	3	0
	Emotion Requirement Engineering in GSD	2	2	1	0	0
	Emotion Requirement Engineering in Virtual	6	4	2	1	0
	emotions AND "business" AND (global)	9	6	3	3	0
	Requirement engineering globally	12	12	6	3	0
	Emotion Requirement Engineering in GSD	2	2	2	1	0
	Emotion Requirement Engineering in Distributed	28	11	7	3	0
	Emotion Requirement Engineering in Virtual	19	10	6	4	0

	Feeling Requirement Engineering in Virtual	11	11	10	5	0
	Feeling Requirement Engineering in Offshore	29	20	1	1	0
	Feeling Requirement Engineering in GSD	10	10	3	1	0
	Feeling Requirement Engineering in GSE	3	3	3	0	0
	Feeling Requirement Engineering in Across Border	2	2	1	0	0
	Passion Requirement Engineering in GSD	1	1	0	0	0
	Sentiment Requirement Engineering in GSD	1	1	0	0	0
	Sentiment Requirement Engineering Distributed	2	2	1	0	0
	Sensation Requirement Engineering Distributed	1	1	0	0	0
	Emotion Oriented Requirement engineering in Distributed	10	10	6	0	0
	Passion Requirement Engineering Virtual	0	0	0	0	0
	Emotion Requirement Elicitation in Global software Development	5	5	4	0	0
	emotion "Requirement Engineering" offshore	6	6	2	0	0
	emotion "Requirement Engineering" global	34	34	13	7	0
	emotion "Requirement Engineering" Distributed	35	35	7	0	0
	emotion "Requirement Engineering" offshore	6	6	4	0	0
	emotion "Requirement Engineering "global	33	33	7	0	0

	emotion "Requirement Engineering" " across border"	2	2	2	0	0
	emotion "Requirement Engineering" GSD	4	4	3	0	0
	passion "Requirement Engineering" distributed	5	5	0	0	0
	passion "Requirement Engineering" offshore	1	1	0	0	0
	passion "Requirement Engineering" "across border"	0	0	0	0	0
	passion "Requirement Engineering" GSD	0	0	0	0	0
	passion "Requirement Engineering" global	8	8	0	0	0
	sentiment "Requirement Engineering" distributed	6	6	0	0	0
	sentiment "Requirement Engineering" offshore	2	2	1	0	0
	sentiment "Requirement Engineering" global	9	9	1	0	0
	sentiment "Requirement Engineering" "across border"	1	1	1	0	0
	sentiment "Requirement Engineering" GSD	1	1	1	0	0
	sensation "Requirement Engineering" distributed	10	10	1	0	0
	sensation "Requirement Engineering" "across border"	0	0	0	0	0
	sensation "Requirement Engineering" offshore	0	0	0	0	0
	Sensation "Requirement Engineering" global	4	4	0	0	0
	sensation "Requirement Engineering" GSD	0	0	0	0	0

	emotion "Requirement Elicitation" Distributed	12	12	4	0	0
	emotion "Requirement Elicitation" offshore	3	3	2	0	0
	emotion "Requirement Elicitation "global	11	11	3	0	0
	emotion "Requirement Elicitation" " across border"	1	1	1	0	0
	emotion "Requirement Elicitation" GSD	2	2	2	0	0
	passion "Requirement Elicitation" distributed	3	3	0	0	0
	passion "Requirement Elicitation" offshore	0	0	0	0	0
	passion "Requirement Elicitation" "across border"	0	0	0	0	0
	passion "Requirement Elicitation" global	4	4	0	0	0
	passion "Requirement Elicitation" GSD	0	0	0	0	0
	sentiment "Requirement Elicitation" distributed	4	4	0	0	0
	sentiment "Requirement Elicitation" offshore	0	0	0	0	0
	sentiment "Requirement Elicitation" global	1	1	0	0	0
	sentiment "Requirement Elicitation" "across border"	0	0	0	0	0
	sentiment "Requirement Elicitation" GSD	0	0	0	0	0
	sensation "Requirement Elicitation" distributed	1	1	0	0	0
	sensation "Requirement Elicitation" offshore	0	0	0	0	0
	sensation "Requirement Elicitation" global	1	1	0	0	0

	sensation “Requirement Elicitation” “across border”	0	0	0	0	0
	sensation “Requirement Engineering” GSD	0	0	0	0	0
	emotion "RE" Distributed	22186	22186	1	0	0
	emotion "RE" offshore	760	760	2	0	0
	emotion "RE“ global	35563	35563	0	0	0
	emotion "RE" “ across border”	1378	1378	1	0	0
	emotion "RE" GSD	56	56	4	0	0
	Emotion Requirement engineering in distributed	35	35	9	0	0
	Emotion Requirement Engineering in GSD	4	4	2	0	0
	Emotion Requirement Engineering in Virtual	25	25	6		0
	emotions AND "business" AND (global)	12831	12831	9		0
	Requirement engineering globally	505	505	12		0
	Emotion Requirement Engineering in GSD	4	4	2	2	0
	Emotion Requirement Engineering in Distributed	35	35	7	2	0
	Emotion Requirement Engineering in Virtual	25	25	6	1	0
	Feeling Requirement Engineering in Virtual	122	122	10	5	0
	Feeling Requirement Engineering in Offshore	30	30	1	0	0
	Feeling Requirement Engineering in GSD	12	12	3	1	0
	Feeling Requirement Engineering in GSE	6	6	3	1	0

	Feeling Requirement Engineering in Across Border	5	5	2	1	0
	Passion Requirement Engineering in GSD	0	0	0	0	0
	Sentiment Requirement Engineering in GSD	1	1	0	1	0
	Sentiment Requirement Engineering Distributed	6	6	2	4	0
	Sensation Requirement Engineering Distributed	10	10	1	0	0
	Emotion Oriented Requirement engineering in Distributed	26	26	10	6	0
	Passion Requirement Engineering Virtual	3	3	0	1	0
	Emotion Requirement Elicitation in Global software Development	9	8	5	4	0
	Total	74072	70012	233	75	8
JSTOR		374	350	50	3	3
Emerald insight	No Relevant					
Science direct (Elsevier)	Global OR distributed AND software AND requirements AND emotion [All Sources(Computer Science)].	1245	1045	30	25	7
CiteSeer	Emotion* AND “requirement engineering” AND “global software development”	10523	9032	565	234	1

APPENDIX C

Quality Assessment Checklist Application

Scores of relevant studies after applying Quality Assessment checklist

Sr. #	Assigned ID	Paper Name	Score
1	01	Following the Sun: Case Studies in Global Software Development	6.5
2	02	Affective trust as a predictor of successful collaboration in distributed software projects	6.5
3	03	Analyzing "people" problems in requirement engineering	3.5
4	04	Evaluating Creative Mobile Applications Development Using Emotional Design	4
5	05	Getting a Grip on Emotions in Negotiations: the Possibilities of ICT	5
6	06	Latent Discriminative Models for Social Emotion Detection with Emotional Dependency	6.5
7	07	One Size Doesn't Fit All: Diversifying "The User" Using Personas and Emotional Scenarios	4.5
8	08	Stories with Emotions and Conflicts Drive Development of Better Interactions in Industrial Software Projects	4
9	09	Personas: Practice and theory	5
10	10	Improvement of the Elderly Quality of Life and Care through Smart Emotion Regulation	3
11	11	Measuring instant emotions based on facial expressions During computer-based assessment	3
12	12	Ubiquitous Emotion Aware Computing	3
13	13	Portable Device for Bi emotional State Identification Using Heart Rate Variability	3
14	14	BioStories: Dynamic Multimedia Environments based on Real time Audience Emotion Assessment 3	3
15	15	Measuring emotions	3
16	16	Measuring instant emotions based on facial expressions During computer-based assessment	4

17	17	Good Effects of Bad Feelings: Negative Affectivity and Group Decision-making	3
18	18	Sensemaking In Virtual Teams: The Impact Of Emotions And Support Tools On Team Mental Models And Team Performance	7
19	19	How software development competences change in global Settings an explorative study	3
20	20	Fear and distrust in global software engineering projects	7
21	21	Developing Trust in Virtual Software Development Teams	7
22	22	Bodily sensation maps: Exploring a new direction for detecting emotions from user self-reported data	5
23	23	Cyber-Specifications: Capturing User Requirements for Cyber-Security Investigations	3.5
24	24	iThink: A game-based approach towards improving collaboration and participation in requirement elicitation	3
25	25	Measuring Emotion: The Self-Assessment Manikin and the Semantic Differential	3
26	26	A Domain Independent Framework for Modeling emotion	7
27	27	SAM: the Self Assessment Manikin. An Efficient Cross Cultural Measurement of Emotional Response	3.5
28	28	Patterns of Affective Reactions to Advertisements: the Integration of Moment to Moment Responses into Overall Judgements	3.5
29	29	How to Capture the Heart? Reviewing 20 years of Emotion Measurement in Advertising	3.5
30	30	Automatic Emotion Induction and Assessment Framework: Enhancing User Interfaces by Interpreting Users Multimodal Bio Signals	3.5

APPENDIX D

The Grounded theory is applied on to the following research papers to find the core concepts which lie inside the content.

Grounded Theory Implementation Table

Papers	**Names**	**Codes**
Paper 1	Affective Trust as a Predictor of Successful Collaboration in Distributed Software Projects	P1
Paper2	Cheap talk, cooperation, and trust in global software engineering: An evolutionary game theory model with empirical support	P2
Paper3	Following the sun: Case studies in global software development	P3
Paper4	Analyzing “People” Problems in Requirements Engineering	P4
Paper5	Ubiquitous emotion-aware computing springer	P5
Paper6	Automatic emotion induction and assessment Framework Enhancing User Interfaces by Interpreting Users Multimodal Bio signals	P6

Paper7	Portable Device for Bi-emotional State Identification Using Heart Rate Variability	P7
Paper8	BioStories: Dynamic Multimedia Environments Based on Real-Time Audience Emotion Assessment	P8
Paper9	Evaluating Creative Mobile Applications Development Using Emotional Design	P9
Paper10	Getting a Grip on Emotions in Negotiations: the Possibilities of ICT	P10
Paper11	SAM: the Self-Assessment Manikin. An efficient cross cultural measurement of emotional response	P11
Paper12	Patterns of Affective Reactions to Advertisements: The Integration of Moment-to-Moment Responses into Overall Judgments	P12
Paper13	How to Capture the Heart? Reviewing 20 Years of Emotion Measurement in Advertising	P13
Paper14	Measuring Emotion: The Self-Assessment Manikin And The Semantic Differential	P14

Paper15	Measuring Emotion	P15
Paper16	Latent Discriminative Models for Social Emotion Detection with Emotional Dependency	P16
Paper17	One Size Doesn't Fit All: Diversifying "The User" Using Personas and Emotional Scenarios	P17
Paper18	Stories with Emotions and Conflicts Drive Development of Better Interactions in Industrial Software Projects	P18
Paper19	Personas: Practice and Theory	P19
Paper20	A Domain-independent Framework for Modeling Emotion - ELSEVIER (SCIENCE DIRECT)	P20
Paper21	Bodily sensation maps: Exploring a new direction for detecting emotions from user self-reported data - ELSEVIER (SCIENCE DIRECT)	P21
Paper22	Cyber-Specifications: Capturing User Requirements for Cyber-Security Investigations - elsevier	P22
Paper23	iThink : A game-based approach towards improving collaboration and participation in requirement elicitation	P23

Paper24	How Do Software Development Competences Change in Global Settings—An Explorative Study	P24
Paper25	Developing Trust In Virtual Software Development Teams	P25
Paper26	Fear and distrust in global software engineering projects	P26
Paper27	Good Effects of Bad Feelings: Negative Affectivity and Group Decision-making	P27
Paper28	Sensemaking in virtual teams: The impact of emotions and Support tools on team mental Models and team performance	P28
Paper29	Improvement of the Elderly Quality of Life and Care through Smart Emotion Regulation	P29
Paper30	Measuring instant emotions based on facial expressions during computer-based assessment	P30

Abbreviation Codes:

Heading – H
Abstract – A
Conclusion - C
Subheading – SH
Sub Subheading – SSH
Paragraph – Pa
Line – L
P – Problem
C –Consequence
S - Solution

Unique List of problems, consequences and overcoming solution strategies as per Literature consultation

Paper id	Variable code	Problem	Consequence	Solution strategy
P1	P1H1Pa2L2PA P1H1Pa2L2CA P1H1Pa3L4SA	Reduced trust (benevolence (e.g., courtesy, availability) and integrity (e.g., faithfulness, adherence to moral norms)	(a) aggravate the feeling of being separate teams with conflicting goals, (b) decrease the willingness to share information and cooperate to solve problems, and (c) affect goodwill toward others in case of objections and disagreements	information collection from social media and linkage to work artifacts
	P1H2Pa3L6PA P1H2Pa3L18CA P1H2Pa3L12SA	no previous study provided direct evidence that connects affective trust to project performance	project advancement cannot be checked and increase in approximating the overall performance of a project	Approximation of the overall performance of a project with history of successful collaborations occurring between project developers
	P1H3SH1Pa2L24PA P1H3SH1Pa2L23CA	Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	collaborative development platforms

	P1H3SH1Pa2L22 SA			
P2	P2H1Pa2L11PA P2H1Pa2L7CA P2H1Pa2L6SA	risk of others' uncooperative behaviors	Usage of non-work related communication with remote collaborators has trust building effect	non-work related communication behavior with remote collaborators
P3	P3H5Pa2L5PA P3H5Pa2L5CA P3H13Pa2L2SA P3H13Pa3L1SA P3H13Pa4L3SA P3H13Pa5L2SA P3H13Pa6L1SA	lack of mutual trust between distant sites is more important than resolving technical issues	promoting the business case difficult	project estimates including time to build detailed specifications synchronized source control system strong communication to understand the level of specification by documenting requirements ask questions and not to make assumptions defined Mutual success criteria
P4	P3H1Pa1L9PA P3H1Pa1L10CA P3H1Pa1L11SA	Politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	Understanding user beliefs and values is vital for the success of software development.
	P3H1Pa1L16Pa P3H1Pa1L19Ca P3H3Pa2L6Sa	Inadequate understanding of people's motivations, values of self-	Technology failure	Take care of people's feelings

		esteem and autonomy and the emotional reaction to lack of involvement in RE process		
P5	P5HAPa1L1PA P5HAPa1L2CA P5HAPa1L4SA	Emotions are a crucial element	Challenge to sense the emotion and how to sense it	combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions
P6	P6H2Pa2L3PA P6HAPa1L3CA P6H1Pa5L2SA	Emotion assessment difficult	User interfaces evaluation were not friendly	emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms
P7	P7HAPa1L7PA P7HAPa1L7CA P7H1Pa1L35SA	Lack of Portable and Continuously measuring devices offering optimal feedback	Portability and continuous measurement of emotions difficult	The use of emotion interactive ubiquitous service having one bio-signal (PPG-HRV)
P8	P8HAPa1L3PA P8HAPa1L6CA P8H1Pa4L3SA	possibility of performing real-time automatic emotion assessment through online	end users would unconsciously be determining the story graph	a framework for evaluating a user's emotional state in real time by means of electroencephalo

		biometric channels monitoring		graphy (EEG), electromyography (EMG) respiration rate and volume, skin temperature and heart rate and Galvanic Skin Response (GSR)
P9	P9H4SH2SSH1Pa3L6PA P9H5SH1Pa1L6CA P9H6Pa1L2SA	Lack of subjective feeling evaluators using visual effects such as emocards	IT project failures	Use of emocards
P10	P10H6Pa1L2PA P10H1Pa7L5CA P10H1Pa7L4SA	Low consideration of negotiation support system that can be used during real-time negotiations	Less support of humans in all aspects and phases of negotiation	negotiation support system called the Pocket Negotiator
	P10H5SHASSH1Pa4L6PA P10H5SHASSH1Pa4L6CA P10H5SHASSH1Pa5L2SA	A negotiation support-application (with self-report tool in it) on a PDA is socially undesirable due to Subjective and social desirability bias	Hesitation in using such system	Subjective bias and social desirability bias can be overcome by measuring reactions such as facial expressions and physiological reactions that are beyond respondents' control
	P10H5SHASSH2Pa1L8PA	practically and socially unacceptability of autonomic	"wiring" for negotiation	Use of Observation based measures

	P10H5SHASSH2 Pa1L9CA P10H5SHASSH3 Pa1L1SA	measurement techniques		
	P10H5SHASSH2 Pa1L11PA P10H5SHASSH2 Pa1L11CA P10H5SHASSH3 Pa1L1SA	Autonomic techniques aimed at emotion recognition produces difficult-to-interpret data in uncontrolled settings	Make the use of autonomic techniques difficult	Use of Observation based measures
	P10H5SHASSH3 Pa1L6PA P10H6Pa1L9CA P10H5SHASSH3 Pa1L6SA	under developed Observation-based measurement techniques (body posture and gestures, facial expressions, and voice characteristics)	Measurement Techniques are difficult to integrate in real time negotiations	Highly developed observation based techniques
	P10H5SHASSH3 Pa1L8PA P10H5SHASSH2 Pa1L11CA P10H6Pa1L12SA	social acceptability of under developed observation-based measurement techniques	Make the use of autonomic techniques difficult	emotion measurement might have to rely on self-report techniques
P11	P11H1Pa1L5PA P11H1Pa3L1CA P11HAPa1L4SA	Verbal self reports were cumbersome sometimes	Difficult in guessing emotions	Visual self-report is quick and

				User-friendly. suitable for cross-cultural research and applicable for different age groups
P12	P12H1Pa4L5PA P12H1Pa4L6CA P12H1Pa4L4SA	Moment to- moment ratings were not used	immediate and continuous measurement of emotion cannot be done	A computerized tool “feelings monitor” can be used to find Moment to- moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion
P13	P13HAPa1L9PA P13HPa1L7CA P13H2Pa2L4SA	self-reports suffer from subjective bias and emotions (social desirability bias)	Emotions cannot be captured in true sense	visual self-report measures and autonomic measures are more direct effects compared to verbal self-report
P14	P14HAPa1L4PA P14HAPa1L2CA P14HAPa1L9SA	Semantic Differential scale was having problems	Measurement of pleasure, arousal, and dominance associated with a person’s affective reaction to a wide variety of stimuli was not good	Use of quick and user-friendly visual self-report techniques SAM may better track the personal response

P15	P15H5Pa1L2PA P15H5Pa1L2CA P15H5Pa1L1SA	cross cultural usage of SAM not known	Distributed environment cannot reap benefits	Use of quick and user-friendly visual self-report techniques i.e. PrEmo
	P15H5Pa1L3PA P15H5Pa1L3CA P15H5Pa1L1SA	SAM does not measure mixed emotions	For measurement of mixed emotions some other technique may be used	
P16	P16H1Pa5L10PA P16H1Pa5L10CA P16H1Pa5L19SA	Social emotional detection was not using emotional dependency	emotional dependency can provide important cues for social emotion detection	a Latent Discriminative Model (LDM) for social emotion detection
	P16H1Pa5L5PA P16H1Pa5L7CA P16H1Pa5L6SA	No Modeling for the dependency between social emotions	provide additional guidance to LDM in the training process	Emotional Dependency-based LDM (eLDM)
P17	P17HAPa1L15PA P17HAPa1L11CA P17H1Pa3L14SA	the diversity of people's background, emotions and motivations, and how they would react emotionally to design decisions not known	Impact on product acceptance. Meeting of emotional desires and that a product appeals to the intended audience is not known	personas to emotional scenarios / personas within emotional scenarios
P18	P18H8Pa3L7PA & P18H8Pa2L1PA P18H8Pa3L8CA P18H8Pa4L5SA	human centered stories method was considered impossible & a normal report of a user study	Human details hide for writing an engaging and credible story	Use of detailed Human centered stories with informal conversations

		leaves out details that are necessary		
P19	P19HAPa1L1PA P19HAPa1L10CA P19H6Pa1L1SA	No usage of interaction design technique	Effective team members engagement and focus attention on aspects of design suffers	Personas
P20	P20HAPa1L6PA P20HAPa1L6CA P20HAPa1L4SA	Appraisal model was not used	emotional state and behaviors' information was not been derived	Use of detailed domain-independent model of appraisal and emotional state
P21	P21HAPa1L5PA P21H1Pa4L4CA P21H1Pa4L9SA	BSM (Bodily sensation maps) creation difficult for user	Not easy for user to use BSMs	Use mobile app called EmoPaint that includes the BSM creation interface and the classifier that tries to match the created BSM with the 14 recommended BSMs
P22	P22H5Pa5L18PA P22H5Pa5L18CA P22H5Pa5L17SA	Low understanding of the context of use that how users might behave in specific situations	Unpredictable behavior of user	Scenarios with Personas
P23	P23H4Pa1L1PA P23H4Pa1L2CA P23H4Pa1L1SA	Less supportive collaborative requirement elicitation	Requirement elicitation cannot be done in a good way	ithink game platform based on gamification concepts and

				the Six Thinking Hats method
P24	P24H4SH1Pa15L2PA P24H4SH1Pa16L3CA P24H4SH1Pa15L4SA	Difference in language	Deficiency in Trust building	Raise Competences of the individual team members
	P24H4SH1Pa21L8PA P24H4SH1Pa21L9CA P24H4SH1Pa21L10SA	The lack of soft competencies i.e. "Adaptability" and "Cultural Awareness	Lack of trust	Training to raise the soft competencies
	P24H4SH1Pa23L4PA P24H4SH1Pa23L8CA P24H4SH1Pa24L1SA	different cultural and educational backgrounds	uncertainty regarding the competences of team members	create good level of competency
P25	P25H7Pa2L1PA P25H7Pa2L2CA P25H7Pa2L1SA	geographical distance and the limited opportunities for face to face contact	development and maintenance of trust suffers	use of online communication tools
	P25H7Pa2L4PA P25H7Pa2L4CA P25H7Pa2L4SA	Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment
	P25H7Pa2L7PA P25H7Pa2L8CA P25H7Pa2L6SA	No proper team formation	Fear of collaboration and no facilitation in communication	Effective formulation and management of Cohesive and collaborative teams

	P25H7Pa2L8PB P25H7Pa2L7CB P25H7Pa2L6SB	No informal contact	Poor working relationships and reestablish trust between team members	Instant Messaging tool to facilitate informal contact
	P25H7Pa3L1PA P25H7Pa3L1CA P25H7Pa3L1SA	information sharing was not facilitated	Trust at a stake	Development of intranet sites having personalized information pages
	P25H7Pa3L1B P25H7Pa3L1B P25H7Pa3L1B	informal and formal review of activities not obvious	Decreases trust	Team's personalized pages for informal and formal review of activities
	P25H7Pa3L3PA P25H7Pa3L2CA P25H7Pa3L3SA	No or less Relevant information sharing	No time wastage in unnecessary sharing	Encouragement of Knowledge sharing by giving bonuses
	P25H7Pa3L6PA P25H7Pa3L6CA P25H7Pa3L6SA	Telephonic calls inadequate for informal conversation and discussion	Informal discussion and conversation difficult	Video conferences for face to face conversation feeling
	P25H7Pa4L1PA P25H7Pa4L1CA P25H7Pa4L1SA	Less use of bespoke online tools	Facilitation cannot be availed	A number of bespoke online tools for configuration management, document exchange and approval
	P25H7Pa5L2PA P25H7Pa5L5CA P25H7Pa5L1SA	No Role assignment	No facilitation in reestablishment of trust	Effective role assignment to Project manager
	P25H7Pa6L1PA P25H7Pa6L2CA	Performance evaluation based on	No Reinforcement of a unified team	Performance evaluations of

	P25H7Pa6L1SA	geographical location		individual team as a single unit
P26	P26H1Pa6L3PA P26H1Pa6L3CA P26H1Pa7L1SA	fear and distrust	have severe negative effects on collaboration	Develop trust
	P26H5SH3Pa1L3PA P26H5SH3Pa1L1CA P26H5SH3Pa1L4SA	poorly introduced global distribution of the work	distrust	Organized distribution of work on global level
	P26H5SH3Pa2L8PA P26H5SH3Pa2L9CA P26H5SH4Pa1L1SA	'opportunism' of management	fear	a three-phase model in preventing the development of fears
P27	P27H1Pa13L12PA P27H1Pa13L12CA P27H1Pa13L12SA	insufficient information elaboration inspired by a focus on common ground and emerging group consensus	positive affect, is not always preferable to negative affect when it comes to the quality of group performance	Negative affectivity inspires greater attention and openness to new decision-relevant information and motivates more evidence-driven and less preference-driven information processing
P28	P28H1Pa2L8PA P28H1Pa2L9CA P28H1Pa2L10SA	sensemaking and the emotions of the team were not shaped up	Help to shape the sense making and the emotions of the team	support tools

	P28H7Pa4L6PA P28H7Pa4L5CA P28H7Pa4L4SA	perspectives of other people in a virtual team were not considered	individual sensemaking not facilitated	Effective support tools
P29	P29H4Pa1L4PA P29H4Pa1L5CA P29H4Pa1L7SA	No emotion regulation techniques. for improving the quality of life and care of the elderly	No quality of life and care of the elderly who can or wants to continue living at home	The use of Heterogeneous vision and body sensors and Emotion detection through color, music and light
P30	P30HAPa1L13PA P30H5Pa2L2CA P30H1Pa10L1SA	measuring emotions with a good efficacy percentage for the purpose of emotion recognition was not there	Emotion measurement cannot be done with required efficacy	The use of evaluated FaceReader for capturing instant emotions

APPENDIX E

Details of Expert Reviewers

Reviewer 1 is Doctor in Software Engineering, from Computer Science Department of National University of Modern Languages, Islamabad having 12+ years of experience.

Reviewer 2 is Doctor in Software Engineering, working currently from last two years in Software Engineering Department of National University of Modern Languages, Islamabad but having several years of experience in other institutions.

Reviewer 3 is Doctor in Software Engineering, from Computer Science department of International Islamic University, Islamabad having 10 years of experience.

APPENDIX F

List of Problems, Consequences and Solutions submitted to Expert Reviewers for Review (Expert Evaluation)

Paper	Problem	Consequence	Solution strategy	Comment
P1	Reduced trust (benevolence e.g. courtesy, availability) and integrity (e.g. faithfulness, adherence to moral norms)	(a) aggravate the feeling of being separate teams with conflicting goals, (b) decrease the willingness to share information and cooperate to solve problems, and (c) affect goodwill toward others in case of objections and disagreements	Information collection from social media and linkages to work artifacts	
P1	No previous study provided direct evidence that connects affective trust to project performance	project advancement cannot be checked and increase in approximating the overall performance of a project	approximation of the overall performance of a project with history of successful collaborations occurring between project developers	
P1	Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	collaborative development platforms	
P2	risk of others' uncooperative behaviors	Usage of non-work related	non-work related communication behavior with remote collaborators	

		communication with remote collaborators has trust building effect		
P3	lack of mutual trust between distant sites is more important than resolving technical issues	promoting the business case difficult	-project estimates including time to build detailed specifications synchronized source control system -strong communication to understand the level of specification by documenting requirements -ask questions and not to make assumptions -defined Mutual success criteria	
P4	Politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	Understanding user beliefs and values is vital for the success of software Development.	
P4	Inadequate understanding of people's motivations, values of self-esteem and autonomy and the emotional reaction to lack of involvement in RE process	Technology failure	Take care of people's feelings	
P5	Emotions are a crucial element	Challenge to sense the emotion and how to sense it	combination of devices for recording physiological signals	

			such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions	
P6	Emotion assessment difficult	User interfaces evaluation were not friendly	emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms	
P7	Lack of Portable and Continuously measuring devices offering optimal feedback	Portability and continuous measurement of emotions difficult	The use of emotion interactive ubiquitous service having one bio-signal (PPG-HRV)	
P8	possibility of performing real-time automatic emotion assessment through online biometric channels monitoring	end users would unconsciously be determining the story graph	a framework for evaluating a user's emotional state in real time by means of electroencephalography (EEG), electromyography (EMG) respiration rate and volume, skin temperature and heart rate and Galvanic Skin Response (GSR)	
P9	Lack of subjective feeling evaluators	IT project failures	Use of emocards	

	using visual effects such as emocards			
P10	Low consideration of negotiation support system that can be used during real-time negotiations	Less support of humans in all aspects and phases of negotiation	negotiation support system called the Pocket Negotiator	
P10	A negotiation support-application (with self-report tool in it) on a PDA is socially undesirable due to Subjective and social desirability bias	Hesitation in using such system	Subjective bias and social desirability bias can be overcome by measuring reactions such as facial expressions and physiological reactions that are beyond respondents' control	
P10	practically and socially unacceptability of autonomic measurement techniques	"wiring" for negotiation	Use of Observation based measures	
P10	Autonomic techniques aimed at emotion recognition produces difficult-to-interpret data in uncontrolled settings	Make the use of autonomic techniques difficult	Use of Observation based measures	
P10	under developed Observation-	Measurement Techniques are difficult	Highly developed observation based techniques	

	based measurement techniques (body posture and gestures, facial expressions, and voice characteristics)	to integrate in real time negotiations		
P10	social acceptability of under developed observation-based measurement techniques	Make the use of autonomic techniques difficult	emotion measurement might have to rely on self-report techniques	
P11	Verbal self reports were cumbersome sometimes	Difficult in guessing emotions	Visual self-report is quick and user-friendly. suitable for cross-cultural research and applicable for different age groups	
P12	Moment to-moment ratings were not used	immediate and continuous measurement of emotion cannot be done	A computerized tool "feelings monitor" can be used to find Moment to-moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion	
P13	self-reports suffer from subjective bias	Emotions cannot be captured in true sense	visual self-report measures and autonomic measures	

	and emotions (social desirability bias)		are more direct effects compared to verbal self-report	
P14	Semantic Differential scale was having problems	Measurement of pleasure, arousal, and dominance associated with a person's affective reaction to a wide variety of stimuli was not good	Use of quick and user-friendly visual self report techniques SAM may better track the personal response	
P15	cross cultural usage of SAM not known	Distributed environment cannot reap benefits	Use of quick and user-friendly visual self report techniques i.e. PrEmo	
P15	SAM does not measure mixed emotions	For measurement of mixed emotions some other technique may be used	PrEmo	
P16	Social emotional detection was not using emotional dependency	emotional dependency can provide important cues for social emotion detection	a Latent Discriminative Model (LDM) for social emotion detection	
P16	No Modeling for the dependency between social emotions	provide additional guidance to LDM in the training process	Emotional Dependency-based LDM (eLDM)	
P17	the diversity of people's background, emotions and motivations, and how they would react emotionally to design decisions not known	impact on product acceptance. Meeting of emotional desires and that a product appeals to the intended audience is not known	personas to emotional scenarios / personas within emotional scenarios	

P18	human centered stories method was considered impossible & a normal report of a user study leaves out details that are necessary	Human details hide for writing an engaging and crediblde story	Use of detailed Human centered stories with informal conversations	
P19	No usage of interaction design technique	Effective team members engagement and focus attention on aspects of design suffers	Personas	
P20	Appraisal model was not used	emotional state and behaviors' information was not been derived	Use of detailed domain-independent model of appraisal and emotional state	
P21	BSM (Bodily sensation maps) creation difficult for user	Not easy for user to use BSMs	Use mobile app called EmoPaint that includes the BSM creation interface and the classifier that tries to match the created BSM with the 14 recommended BSMs	
P22	Low understanding of the context of use that how users might behave in specific situations	Unpredictable behavior of user	Scenarios with Personas	
P23	Less supportive collaborative requirement elicitation	Requirement elicitation cannot be done in a good way	ithink game platform based on gamification concepts and	

			the Six Thinking Hats method	
P24	Difference in language	Deficiency in Trust building	Raise Competences of the individual team members	
	The lack of soft competencies i.e. "Adaptability" and "Cultural Awareness	Lack of trust	Training to raise the soft competencies	
	different cultural and educational backgrounds	uncertainty regarding the competences of team members	create good level of competency	
P25	geographical distance and the limited opportunities for face to face contact	development and maintenance of trust suffers	use of online communication tools	
	Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment	
	No proper team formation	Fear of collaboration and no facilitation in communication	Effective formulation and management of Cohesive and collaborative teams	
	No informal contact	Poor working relationships and reestablish trust between team members	Instant Messaging tool to facilitate informal contact	
	information sharing was not facilitated	Trust at a stake	Development of intranet sites having personalized information pages	

	informal and formal review of activities not obvious	Decreases trust	Team's personalized pages for informal and formal review of activities	
	No or less Relevant information sharing	No time wastage in unnecessary sharing	Encouragement of Knowledge sharing by giving bonuses	
	Telephonic calls inadequate for informal conversation and discussion	Informal discussion and conversation difficult	Video conferences for face to face conversation feeling	
	Less use of bespoke online tools	Facilitation cannot be availed	A number of bespoke online tools for configuration management, document exchange and approval	
	No Role assignment	No facilitation in reestablishment of trust	Effective role assignment to Project manager	
	Performance evaluation based on geographical location	No Reinforcement of a unified team	Performance evaluations of individual team as a single unit	
P26	fear and distrust	have severe negative effects on collaboration	Develop trust	
	poorly introduced global distribution of the work	distrust	Organized distribution of work on global level	
	'opportunism' of management	fear	a three-phase model in preventing the development of fears	
P27	insufficient information	positive affect, is not always	Negative affectivity inspires greater	

	elaboration inspired by a focus on common ground and emerging group consensus	preferable to negative affect when it comes to the quality of group performance	attention and openness to new decision-relevant information and motivates more evidence-driven and less preference-driven information processing	
P28	sensemaking and the emotions of the team were not shapen up	Help to shape the sense making and the emotions of the team	support tools	
	perspectives of other people in a virtual team were not considered	individual sensemaking not facilitated	Effective support tools	
P29	No emotion regulation techniques. for improving the quality of life and care of the elderly	No quality of life and care of the elderly who can or wants to continue living at home	The use of Heterogeneous vision and body sensors and Emotion detection through color, music and light	
P30	measuring emotions with a good efficacy percentage for the purpose of emotion recognition was not there	Emotion measurement cannot be done with required efficacy	The use of evaluated FaceReader for capturing instant emotions	

APPENDIX G

Evaluated, Updated and Refined List of Problems, Consequences and Solutions as Per Reviewers' Evaluation

Paper	Problem	Consequence	Solution strategy	Comments	Actions taken
P1	Reduction in trust Reduction in integrity	(a) aggravate the feeling of being separate teams with conflicting goals, (b) decrease the willingness to share information and cooperate to solve problems, and (c) affect goodwill toward others in case of objections and disagreements	Information collection should be from social media and linkages should be to work artifacts	-Reviewer1 commented on problem to be broken down into two different problems like reduced trust and reduced integrity. -Besides reviewer1 suggested to rename the problems as "reduction in trust" and "reduction in integrity" -Reviewer3 commented on detailed information to be removed. -Reviewer3 suggested to add term "should be" in the mentioned solution	The recommended modification is done. The problems are renamed as "reduction in trust" and "reduction in integrity". The recommended removal of the detailed information is done. Besides term "should be" is added.
P1	Lack of project performance measurement	project advancement cannot be checked and increase in approximating the overall performance of a project	Generate approximation of the overall performance of a project with history of successful collaborations occurring between project developers	-Reviewer2 comments on the problem to be rephrased as "Lack of project performance measurement "and use term "generate" in mentioned solution strategy.	The recommended modification is done. The problem is rephrased as "Lack of project performance measurement".

					Besides term "Generate" is added.
P1	Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	collaborative development platforms should be used	-Reviwer3 commented on solution to add clause "should be used".	The recommended modification is done and clause "should be used" is added in solution strategy beginning with capital letter.
P2	Risk of others' uncooperative behaviors	Trust building is at a stake	Develop non-work related communication behavior with remote collaborators	-Reviewer2 commented on solution to begin with term "develop". -Reviewer1 commented to change the consequence as it is giving an impression of solution as "trust building is at a stake".	The recommended term "Develop" is added in solution. The recommended consequence is rephrased as "trust building is at a stake".
P3	Lack of mutual trust between distant sites	promoting the business case difficult	- project estimates should be considered including time to build detailed specifications - strong communication should be done to understand the level of specification by documenting requirements -Questions should be asked and not to make assumptions -"Mutual success criteria should be defined	- Reviewer1 commented on problem to be shortened as "lack of mutual trust between distant sites". - Reviewer2 commented on the problem that "lack of mutual trust between distant sites" should be combined with "reduction in trust" and rename them as "lack of mutual trust". -Reviewer3 commented on solution to be rephrased as	- The recommended modification is done .The problem is shortened as "lack of mutual trust between distant sites". -The recommended solutions are rephrased so that they are easily

				-“project estimates should be considered including time to build detailed specifications” -“strong communication should be done to understand the level of specification by documenting requirements”. - Questions should be asked and not to make assumptions -“Mutual success criteria should be defined”.	understood as -“project estimates should be considered including time to build detailed specifications” -“strong communication should be done to understand the level of specification by documenting requirements”. - Questions should be asked and not to make assumptions - “Mutual success criteria should be defined”.
P4	Human politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	Understanding user beliefs and values is vital for the success of software Development.	Reviewer1 commented on problem to be a generic term and should be changed.	The recommended modification is done and term “Human Politics” is introduced instead of “Politics”.

P4	Inadequate understanding of people's motivations Inadequate understanding of values of self-esteem and autonomy The emotional reaction to lack of involvement in RE process	Software failure	Take care of people's feelings	-Reviewer2 commented on the consequence to be replaced by software failure instead of technology failure. -Reviewer2 commented on the problem to be broken down into multiple problems. Researcher should decompose it into three problems, namely "Inadequate understanding of people's motivations", "Inadequate understanding of values of self-esteem and autonomy" and "the emotional reaction to lack of involvement in RE process"	The recommended modification is done term software failure is introduced in place of "Technology failure" in the consequence. The mentioned problem is decomposed into three problems, namely "Inadequate understanding of people's motivations", "Inadequate understanding of values of self-esteem and autonomy" and " the emotional reaction to lack of involvement in RE process"

P5	Difficulty in emotion assessment	It becomes difficult to sense the emotions and how to sense it	Use of combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions	- Reviewer1, 2 and 3 suggested to combine problem "No availability of measuring emotions with a good efficacy percentage for the purpose of emotion recognition", "Emotions are a crucial element" and "Emotion assessment difficult" and rename them as "difficulty in emotion assessment". -Reviewer2 commented on the consequence to be rephrased as "It becomes difficult to sense the emotions and how to sense it". -Reviewer3 commented to add term "use" in the start of solution statement.	The recommended modification is done and problem is written as "difficulty in emotion assessment". The mentioned consequence is rephrased as "It becomes difficult to sense the emotions and how to sense it". The recommended term "Use" is added in the beginning of solution and strategy.

P6	Difficulty in emotion assessment	serious investments to projects are wasted	Use of emotion assessment framework should be done for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms	- Reviewer1, 2 and 3 suggested to combine problem "No availability of measuring emotions with a good efficacy percentage for the purpose of emotion recognition", "Emotions are a crucial element" and "Emotion assessment difficult" and rename them as "difficulty in emotion assessment". -Reviewer2 commented on the consequence to be rephrased as "serious investments to projects are wasted" -Reviewer3 commented on the solution to add term "use".	-The recommended modification is done based upon the comments i.e. difficulty in emotion assessment -The recommended modification is done and consequence is changed as "serious investments to projects are wasted" - Mentioned term "use" is added to solution.
P9	Lack of subjective feeling evaluators using visual effects	Failure of IT projects occurs	Use of emocards which are used to capture the experience regarding the mobile application development process	-Reviewer commented on the consequence to be rephrased as "Failure of IT projects occurs".	The recommended modification is done and the consequence is rephrased as "Failure of IT projects occurs".

P12	Moment to Moment ratings suffer	Immediate and continuous measurement of emotion cannot be performed.	A computerized tool “feelings monitor” that can be used to find Moment to-moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion	-Reviewer1 commented on the problem to be written as “Moment to-Moment ratings suffer”. -Reviewer2 commented on the consequence to add term “performed” instead of “done”.	- The recommended modification is done and problem is rephrased as “Moment to Moment ratings suffer”. - The mentioned term “performed” is added in the consequence.
P16	Difficulty in emotion assessment	Important cues (Information) for social emotion detection cannot be provided.	emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms	Reviewer3 commented on the similarity of “Problems with Social emotional detection using emotional dependency” with “Emotions are a crucial element” and “Emotion assessment difficult”. The reviewer suggested to combine it with “difficulty in emotion assessment”	The recommended modification is done and the mentioned problem is combined with “difficulty in emotion assessment”.
P22	Low understanding of the context of use that how users might behave in specific situations	Unpredictable behavior of user	Scenarios with Personas should be used to get knowledge that how users might behave in specific situations	Reviewer1 commented on the solution to be rephrased as “Scenarios with Personas should be used to get knowledge that how users might behave in specific situations”	The recommended modification is done and the solution is changed as “Scenarios with Personas should be used to get knowledge that how users might behave in specific situations”.

P23	Less supportive collaborative requirement elicitation	lack of effective requirement elicitation process	use of ithink game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability	-Reviewer1 commented on the consequence to be rephrased as “lack of effective requirement elicitation process”. -Reviewer2 commented on the solution to be rephrased as “use of ithink game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability ”.	The recommended modification is done and consequence is rephrased as “lack of effective requirement elicitation process”. The recommended modification is done and solution is rephrased as “use of ithink game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability”.
	Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment	Ok by reviewer	
	No informal contact	Poor working relationships and reestablish trust between team members	use of Instant Messaging tool should be used to facilitate informal contact	Reviewer2 commented on the solution to be rephrased and the term “Use of “should be added.	The recommended modification is done and the solution is rephrased as “use of Instant Messaging tool should be used to facilitate informal contact”.

	Information sharing is not facilitated	Trust at a stake	Development of intranet sites having personalized information pages should be used	Reviewer1 &2 commented on the solution to be rephrased and the term “should be” must be added.	The recommended modification is done and the solution is rephrased as “Development of intranet sites having personalized information pages should be used“.
	No clarity in informal and formal review of activities	Decreases trust	Team’s personalized pages should be used for informal and formal review of activities	Reviewer1 &2 commented on the solution to be rephrased and the term “should be” must be added, i.e. Team’s personalized pages should be used for informal and formal review of activities	The recommended modification is done and the solution is rephrased as “Team’s personalized pages should be used for informal and formal review of activities “.
	Invalid information sharing	Time wastage in unnecessary sharing	Encouragement of valid knowledge sharing should be done by giving bonuses	Reviewer1 commented on the problem to be rephrased as “Invalid information sharing” |Besides the term “relevant” in the solution should be replaced with “valid”.	- The recommended modification is done and the problem is rephrased as “invalid information sharing”. -The recommended modification is done and solution is rephrased as “Encouragement of valid knowledge sharing should be done by giving bonuses”
	Inappropriate role assignment	Lack of facilitation in reestablishment of trust	Effective role assignment should be done to Project manager	Reviewer1 commented to rephrase the problem as “Inappropriate role assignment”.	The recommended modification is done and problem is rephrased as

					“Inappropriate role assignment”.
	Incorrect performance evaluations	No Reinforcement of a unified team	Performance evaluations of individual team as a single unit on global level	Reviewer2 commented on problem to rephrase it as “Incorrect performance evaluations”	The recommended modification is done and the problem is rephrased as “Incorrect performance evaluations”
P26	Software failure fear	have severe negative effects on collaboration	Develop trust via meetings	Ok by reviewer	
	Lack of mutual trust	Creates Damaging Effects On Collaborations And Communications	Develop trust via meetings	Reviewer 1, 2 and 3 suggested to combine problem “distrust”, “reduction in trust” and “lack of mutual trust between distant sites” and rename them as “lack of mutual trust”.	The recommended modification is done and the problem is combined and renamed as “lack of mutual trust”.
	Poorly introduced global distribution of the work	distrust	Organized distribution of work should be done on global level	Ok by Reviewers	

P30	Difficulty in emotion assessment	Emotion measurement cannot be done with required efficacy	The use of evaluated Face-Reader for capturing instant emotions	Reviewer1, 2 and 3 suggested to combine problem "No availability of measuring emotions with a good efficacy percentage for the purpose of emotion recognition", "Emotions are a crucial element" and "Emotion assessment difficult" and rename them as "difficulty in emotion assessment".	The recommended modification is done and the problem is renamed collectively as "difficulty in emotion assessment".

APPENDIX H

Respondents' Particulars

Respond-ent #	Organization Name	Organization Size as per declared by the respondents in survey form	Designation	Years of Experience	URL
1.	Zigron, Islamabad, Pakistan	Medium	Customer Support Engineer	7	www.zigron.com
2.	Zigron Islamabad, Pakistan	Medium	Full stack Developer	2.5	www.zigron.com
3.	Zigron Islamabad, Pakistan	Medium	Hybrid Mobile App Developer	3	www.zigron.com
4.	Zigron Islamabad, Pakistan	Medium	Database Developer	3	www.zigron.com
5.	Zigron Islamabad, Pakistan	Medium	Graphic designer	(Internee)	www.zigron.com
6.	Zigron, Islamabad, Pakistan	Medium		6	www.zigron.com
7.	Zigron, Islamabad, Pakistan	Medium	Software Developer	2	www.zigron.com
8.	Zigron Islamabad, Pakistan	Medium	Software Engineer	3	www.zigron.com
9.	Zigron, Islamabad, Pakistan	Medium	Software Engineer	4	www.zigron.com
10.	LMKR, Islamabad, Pakistan	Medium	Application specialist, Support Analyst	10	https://www.lmkr.com
11.	GetRanked, Islamabad, Pakistan	Medium	Web & Graphic Designer	2	www.getranked.com
12.	Zepto Systems, Islamabad, Pakistan	Large	Drupal Developer	3	zeptosystems.com
13.	Vizteck Solutions, Islamabad, Pakistan	Medium	Andriod Developer	1.6	https://vizteck.com
14.	Vizteck Solutions, Islamabad, Pakistan	Medium	Software Developer (IOS)	1	https://vizteck.com

15.	Vizteck Solutions, Islamabad, Pakistan	Medium	Front-End Developer	1	https://vizteck.com
16.	Vizteck Solutions, Islamabad	Medium	Software Developer	1	https://vizteck.com
17.	Techmeits Solutions	Medium	Software Engineer	2.9	techmetics-group.com
18.	Techmeits Solutions	Medium	Associate Software Engineer	3	techmetics-group.com
19.	Techmeits Solutions	Medium	Associate Software Engineer	3	techmetics-group.com
20.	Techmeits Solutions	Medium	Software Engineer	2.5	techmetics-group.com
21.	Techmeits Solutions	Medium	Associate Software Engineer	3	www.techmetics-group.com
22.	EMM ZEE Communications	Small	Web Developer	1	www.emmzeecommunications.com
23.	Techmeits Solutions	Medium	Developer	2.5	techmetics-group.com
24.	Emumba	Medium	Developer	1.3	www.emumba.com
25.	Emumba	Medium	UI/UX Designer	3	www.emumba.com
26.	Emumba	Medium	UI/UX Designer	2	www.emumba.com
27.	Emumba	Medium	Jr. Software Engineer	1	www.emumba.com
28.	Zigron	Medium	QA Engineer	3	www.zigron.com
29.	Civic Codes (Pvt) Ltd	Small	Senior Developer	3+	www.civiccodes.com
30.	Civic Codes (Pvt) Ltd	Small	Programmer	4	www.civiccodes.com
31.	Civic Codes (Pvt) Ltd	Small	Director	5+	www.civiccodes.com
32.	Civic Codes (Pvt) Ltd	Small	Programmer	2	www.civiccodes.com
33.	Civic Codes (Pvt) Ltd	Small	CEO	5+	www.civiccodes.com

34.	Civic Codes (Pvt) Ltd	Small	Team Lead (Programming)	3	www.civiccodes.com
35.	Sumo Tec.	Large	Software Engineer	1	www.sumotech.com

APPENDIX I

Survey Form Including List of Problems, Consequences and Solutions

<u>Emotion based Requirement Engineering in Global Software development-Survey form</u>

The following are the problems, consequences and solution which can occur due to lack of emotion based requirement engineering in global software development. Respondents are requested to go through the problems, consequences and solutions and comment on their practicality in real time industry. Furthermore, it is also requested to respondents to fill some particulars as well. I will be highly obliged for this favor.

Respondent Name:_____

Organization Name: _____

Organization Size:

☐ Small ☐ Medium ☐ Large

Designation: _____

Years of experience: _____

Problem	Consequence	Solution strategy	Comments
Lack of mutual trust	- aggravate the feeling of being separate teams with conflicting goals, - decrease the willingness to share information and cooperate to solve problems, - affect goodwill toward others in case of objections and disagreements - promoting the business case difficult -Creates damaging effects on collaborations and communications	-Information collection should be from social media and linkages should be to work artifacts - project estimates should be considered including time to build detailed specifications - strong communication should be done to understand the level of specification by documenting requirements -Questions should be asked and not to make assumptions	
Reduction in integrity			

		-Mutual success criteria should be defined -Develop trust via meetings	
Lack of project performance measurement	project advancement cannot be checked and increase in approximating the overall performance of a project	Generate approximation of the overall performance of a project with history of successful collaborations occurring between project developers	
Lack of usage of collaborative development platforms	Low collaboration which ultimately decreases trust	collaborative development platforms should be used	
Risk of others' uncooperative behaviors	Trust building is at a stake	Develop non-work related communication behavior with remote collaborators	
Human politics	Politics Causes system failure And understanding user beliefs and values proves to be successful	Understanding user beliefs and values is vital for the success of software Development.	
Inadequate understanding of people's motivations	Software failure	Take care of people's feelings	
Inadequate understanding of values of self-esteem and autonomy			

The emotional reaction to lack of involvement in RE process			
Difficulty in emotion assessment	-It becomes difficult to sense the emotions and how to sense it -serious investments to projects are wasted - Important cues (Information) for social emotion detection cannot be provided - Emotion measurement cannot be done with required efficacy	-Use of combination of devices for recording physiological signals such as speech and heart rate like electrocardiogram, and a revised Self-Assessment Mannequin to assess people's emotions -Use of emotion assessment framework should be done for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms - emotion assessment framework for the automatic evaluation of emotions through a software system that uses galvanic skin response and electroencephalograms - The use of evaluated Face-Reader for capturing instant emotions	
Lack of subjective feeling evaluators using visual effects	Failure of IT projects occurs	Use of emocards which are used to capture the experience regarding the mobile application development process	

Moment to Moment ratings suffer	Immediate and continuous measurement of emotion cannot be performed.	A computerized tool "feelings monitor" that can be used to find Moment to-moment ratings are cheap, user friendly and provide immediate and continuous measurement of emotion	
Low understanding of the context of use that how users might behave in specific situations	Unpredictable behavior of user	Scenarios with Personas should be used to get knowledge that how users might behave in specific situations	
Less supportive collaborative requirement elicitation	lack of effective requirement elicitation process	use of ithink game platform based on gamification concepts and the Six Thinking Hats method that provides supportive collaborative requirement elicitation through usability	
Lack of effective communication in virtual team environment	Problems in communication in virtual team environment	Training of effective communication in virtual environment	
No informal contact	Poor working relationships and reestablish trust between team members	use of Instant Messaging tool should be used to facilitate informal contact	
Information sharing is not facilitated	Trust at a stake	Development of intranet sites having personalized information pages should be used	
No clarity in informal and formal review of activities	Decreases trust	Team's personalized pages should be used for informal and formal review of activities	

Invalid information sharing	Time wastage in unnecessary sharing	Encouragement of valid knowledge sharing should be done by giving bonuses	
Inappropriate role assignment	Lack of facilitation in reestablishment of trust	Effective role assignment should be done to Project manager	
Incorrect performance evaluations	No Reinforcement of a unified team	Performance evaluations of individual team as a single unit on global level	
Software failure fear	have severe negative effects on collaboration	Develop trust via meetings	
Poorly introduced global distribution of the work	distrust	Organized distribution of work should be done on global level	

Any further Comments:

_____

_____

_____

APPENDIX J

The respondents' different responses which proved to be an addition

Responses Adding into Knowledge Base

Problems	Noteworthy comments adding information
Lack of mutual trust	Respondent 1 said," Respecting privacy of the individual and organization, within and outside, increases trust. Confidential and personal work details should not be discussed. There should be a group/team leader to decide and intervene in case of matter that require arbitration. Jobs/tasks should be divided in such a way that ruled out contribution of other team members in decision making. Decision should be in favor of team instead of an individual." Respondent 4 said "While collecting information & giving estimation take feedback from all resources and most importantly having faith on their skills. Give them big picture and ultimate goals." Respondent 7 said "All the details of project should be communicated and documented properly to avoid any kind of misunderstandings between different teams to avoid conflicts " Respondent 8 said " For building team should be on same page about what they want to achieve and somehow should be involved in some extra-curricular activity " Respondent 10 said "I agree with the solution strategies discussed. This will ultimately develop such an environment in which every employee will work with full confidence, command and control, leading to a successful project completion or a 100% client satisfaction. " Respondent 11 said "Time is most important thing to consider regarding project management." Respondent 12 said" As lack of trust often leads to lying and deception so trust is essential in an employee and employer/leads and it's an important

	part between development team and employer. However, not only is trust important, but it also influences our deceptive behavior. According to me, problem of mutual trust is common issue in almost every organization. It effects and create issues as mentioned in the consequences column. In our organization, to get rid of these issues, there are some strategies are being followed as mentioned and we feel better trust." Respondent 13 said "Keeping in mind the End user and Perfectly Analyzing the requirement and extended user Engagements is the Key." Respondent 14 said "Information collects from social media cannot be reliable every time. We just get kick-off & just short." Respondent 16 said "Information collected from social media cannot be reliable every time Detailed specification are ignored in real world strategies. We just get kick off and just start. " Respondent 22 said "Solution works very well but there should be Brain storming sessions or some activities so that they can have a chance to collaborate with each other's or talk about ideas to know. A person can trust, when he know other fellow to sink in with. Providing a common source can a plus point? Keep Switching group members and team leaders so that everyone gets a chance to know others and work together." Respondent 23 said "- Yes, it decreases the willingness to share things, but to my thinking social media itself is not much reliable. - try to make others in confidence" Respondent 28 said "The conflicting views should be resolved." Respondent 31 said "-Conflict between customer and user can only be resolved by customer themselves. Information regarding software requirements (in case of application software) can never be gathered from social media. Respondent 33 said "-In case of application softwares, requirements cannot be gathered from social media.

	Respondent 34 said “-Trust is absolutely in order to establish not only reputation but also strong network .People are relying each other in a workplace. Action plan to build positive relationships helps improve the overall work environment for all employees
Reduction in integrity	Respondent 6 said "Requirement should be cleared and documented properly" Respondent 8 said "The function can be eliminated by conducting meeting and making talk only related to project Eliminate such discussion which hit the integrity of any team member person from whom to take requirement" Respondent 12 "In general, it shows amorality and it should not be happened in the any organization. According to my experience, yeah, it really happens in a team between different seniority levels. In my organization, however, this issue can be hardly found because we use different use strategies to tackle this kind of issue. For instance, • We are provided the documentation with description/highlighted the main points. • We do daily meetings and clear our confusions, we call it scrum. • We do chats with each other and discuss on different topic but within the project boundaries. • Our leads held sometimes a surprise meeting to talk about the informal activities that helps to make environment friendly. So, by these strategies, there is no way to make assumptions when employer/lead asks something to do, we always clear thing because we have trust each other." Respondent 15 said "Criteria should be defined."

	Respondent 16 said "Communication for understanding specification is directly proportional to time. More discussion need more time. " Respondent 23 said "- data should be attributable and legible, any type of weak integrity should be try to sought out - it must have to be accurate - quality assurance must be made" Respondent 31 said "-Strong plus repeated communication with not only the client/customer but also users of the product. Especailly users because they are scared of computerization. Respondent 33 said "-Recurrent communication with not only the client/customer but also users of the product. Mainly users because they are scared of automation.
Lack of project performance measurement	Respondent 1 said, "Resources at hand, and declaration of sources, ability to take fast route of work, quick decision making during time of crisis also helps." Respondent 2 said, "Analysis of project completion should be done before starting the new project. Every team member should be present in that meeting and everyone's point should matter." Respondent 3 said, "I think we should adopt divide & conquer policy. Divide the complete project into small milestones and achieve every milestone daily. So that the day you won't achieve your milestone, you will get know that you can't complete it on time." Respondent 10 said "Approximation of performance maintaining a history of collaborations would be an ideal scenario. Maintaining a timeline against all individual events\product enhancements would also serve as "add on"." Respondent 12 said" During working in different projects with different clients, I find, usually, the incomplete documentations of the project. I go back to them and ask for the remaining stuff so I

	can develop the application comfortably based on the facts and figures regarding performance issues. So, in other words, our company use such strategies that helps us to check the requirements in depth due to adding the whole information in the project documentations." Respondent 13 said "Teams should properly conduct status Meetings and properly follow IIRA (tools for status and product measurement)." Respondent 14 said "Project performance is considered to be good if client is happy." Respondent 15 said "Proper standup meeting." Respondent 16 said "In real actual situation, project performance is considered to be good if client is happy. Otherwise it is all gone to waste." Respondent 19 said "Project Performance criteria should be made on realistic bases not on assumptions" Respondent 21 said "There is no Proper measurement tools used in companies " Respondent 22 said "It Works too. But you also need to keep check and balance on that in case of any changes" Respondent 23 said "Should be enhanced by gaining experience specifically, Make meetings, allow collaborations and suggestions Developing enough confidence to make up all that."
Lack of usage of collaborative development platforms	Respondent 1 said, "I don't agree, "Iterative" platforms may help with this." Respondent 3 said, "No, I don't agree. Lack of usage of collaborative platform can cause delaying project deadline. I think create brotherhood & understanding through small events, so they will free to help each other and have patience to wait." Respondent 4 said, "Conduct sessions & interact each teams and individual to discuss & review each works."

	Respondent 10 said "Collaboration\interaction is a key factor. Latest more intuitive platforms should be deployed for increasing the team interactions which ultimately create trust between resources. This will also help to create a priority list for product development from client perspective" Respondent 11 said" Platforms should be collaborative with the whole team. Agree and good solution" Respondent 12 said "Yeah, that's right. I guess two of ten software companies only use the collaborative development platform in the Pakistan and that's very low ratio. Our company is using the very impressing platform for development." Respondent 14 said "for short term projects, it is not good." Respondent 16 said "Should be used if project is for long-term. For short term projects, it is not good. " Respondent 19 said "Collaboration between universities and industries are important for benefit of It industry" Respondent 22 said "Collaboration can be improved by keeping developers in mutual projects so that they get multiple chances of that." Respondent 23 said "Make a strategy and a complete schedule to follow upon and to use of these collaborative platforms"
Risk of others' uncooperative behaviors	Respondent 1 said," Team work →decisions forums → →Penalties for crossing deadlines. • Appreciation rewards." Respondent 2 said, "Unofficial meetups should be done between team to gain everyone's trust." Respondent 3 said, "I think seniors should step forward and train every co-worker in their team, how to develop cooperativebehavior." Respondent 4 said, "Define everyone's role and give them responsibility."

	Respondent 8 said "Some team building activities will completely eliminate it as because of this people will understand each other temperament" Respondent 10 " Again this is true but a little difficult to implement. In person interactions would cost a lot. Remote communications doesn't make prominent impact, but individual efforts can break that distance barrier." Respondent 11 said " Yeas agreed, because trust is the main thing which will result in good performance" Respondent 12 said" As we are working with a team in the UK based as they are in the UK I don't know them personally. In the start, you can say that I had also risks when I needed others, especially the client(s), cooperation to end up the task. For example, when I found something was confusing me in the documentation or description of the task so as a developer I needed to know, sometimes, the nature of the business so I can develop the APP structure properly within the business boundaries. But on the other hand, I didn't ask them because I didn't know behaviors of them and one day they added me on a social platform where we started chats and hangouts that helped me "how to ask them personal questions without any risks and hesitations. What is meant of the above story is that an organization must involve developers socially with the employers/clients as our company do so work can be done speedily and perfectly." Respondent 23 said "Try to communicate with your familiar ones Give others some confidence to collaborate with you"
Human politics	Respondent 1 said," • Ban on political and religious discussions. • Zero tolerance for aggressive behavior." Respondent 4 said, "Politics can never be removed just to re-track it by performance and taking initiatives."

	Respondent 6 said "There should be team structure/hierarchy to follow." Respondent 7 said "This factor can only be eliminated if everyone has given the freedom and authority of the work/task he/she has been assigned. This will increase success rate. " Respondent 8 said "This function can never be eliminated but its influence on project could be controlled by selecting visionary project leaders" Respondent 10 said" What user needs is the most basic aspect, building a product that fulfills all the basic needs of customer, keeping the cost low, performance and efficiency high consuming less resources results in 100% client satisfaction." Respondent 11 said" Politics should be avoided and the leaders should not be biased with anyone working in a team" Respondent 12 said" The use of politics is a natural part of human interaction in the advancement of personal and group goals. In an organization, we spend the majority of our time at work to represent ourselves and others to be a good programmer and not a good programmer respectively. We also waste our time to find the quickest short cut to be successful by exaggerating (I did this but he didn't… blah, blah, blah…) to our managers so we can lead others or get a good appraisal, bonus, promotion instead based on performance. Moreover, we also, some employees have this kind of natures, degrading with extra exaggerating and represent other's ideas or personality so we can get close to our manager, just to find quickest way (mentioned earlier). However, that is not good idea this can cause fail the whole team because of the only one person. It can also create consequences as mentioned. To solve that issue, as a manager/senior, I have to listen, believe and cooperate everyone in the team so politics can be reduced."

	Respondent 14 said "Work place politics is not vital." Respondent 16 said "Work place politics is not vital. Human understanding is different" Respondent 19 said "Human politics are less valuable in Private Industry" Respondent 22 said "Right. Keep shifting developers so that they don't get chance to create some crew." - Respondent 23 said "Could be both positive as well as negative Yeah, everyone has its own believes, decision making ability and ideology" Respondent 31 said " Agreed but keep in mind the hidden agendas of users. Some aggravated users of product use the software and delays to their own advantage. Delays: users don't provide software requirements or necessary files and documents on time. Respondent 33 said " Agreed but keep in mind the hidden agendas of users. Some aggravated users of product use the software and delays to their own advantage. Respondent 34 said " Politics can be damage system and also cause many failures in projects. Must be strong communication with staff.
Inadequate understanding of people's motivations Inadequate understanding of values of self-esteem and autonomy The emotional reaction to lack of involvement in RE process	Respondent 1 said," • Emotional counselling • Technical training • Institute's focus on collective good • Regulation of uniform code of conduct. • Strict policies to ensure mental physical health of the employee." Respondent 4 said, "It may depend the way you communicate and transfer their reaction to positive feedback." Respondent 6 said "Every member would be treated with respect. Responsibilities of every member should be clear"

	Respondent 7 said "Not only feeling but we should value \their ideas that be helpful in success of that system" Respondent 8 said "This function can never be eliminated but its influence on project could be controlled by selecting visionary project leaders also take care of people's feelings" Respondent 10 said "This can be achieved by defining the age groups your product is going to cater. If an analysis is being done then a lot of feelings and user's likings can be estimated\approximated." Respondent 11 said " Feelings should be considered because when could not work properly if he/she is not feeling well." Respondent 12 said "Inadequate understanding of people's motivations can be the cause to make poor performance of the programmer and poor performance would lead to undelivered project on time that's why employer/manager should also keep an eye on the emotions of programmer. As in our programmer, they do care of every employee and pay bonus based on performance, on special events and held small events for freshmen as well. Anyone can't always be perfect on his/her idea so that's why employer/manager takes care of the programmer's decisions and ideas so project can be successfully delivered. However, this thing is not yet implemented in our organization due to some limitations. Programmer's involvement is the key concept in the development of useful and usable systems and has positive effects on system success and user satisfactions so employer should have consider it too otherwise it can cause lose in the project." Respondent 14 said "None of the 3 are related to software failure." Respondent 15 said "Take care of people." Respondent 16 said "None of the 3 are related to Software failure. It may lead to demise of a company as a whole because less people will prefer to join the firm."

	Respondent 19 said “Companies should take well care of their employees by giving them max benefits.” Respondent 21 said ” Benefits should be given in companies” Respondent 23 said “Read their psychology Try to go in deeper layers of mind Communicate them to avoid misunderstandings” Respondent 31 said “Client’s administration is responsible for this. Respondent 33 said “Client’s administration is responsible for this. Respondent 34 said “Must be understand people, s motivations criteria. Give them motivation task as per requirement. Always respect them for better or healthy environment. Always take care people feeling for healthy environment
Difficulty in emotion assessment	Respondent 4 said, “Strongly Disagree!!! Have sessions with them, give them time to express by providing open environment.” Respondent 7 said "Instead of applying solutions we should assure trainings for professional environment. Putting the emotion aside, they must think only about the goals" Respondent 8 said "Solutions could be worthy but it's better to teach the team: how to draw a clear separation line between personal and professional life Push the team to attend such seminars in which these talks are done" Respondent 12 said" Unfortunately, this is not yet implemented in our organization." Respondent 13 said "Human can only feel the emotions of other Humans, devices can’t so, let them come to discuss their issues by providing them such kind of environment.”

	Respondent 15 said "Provide environment for transparent discussion." Respondent 16 said "And even if no tool used by, simply considering employees as part of yours company and letting them express their feelings will help " Respondent 19 said “Proper Psychological tests should be arranged on a certain time period” Respondent 23 said “ try more and more to go into live conversations rather than at a distance Understanding is an art build a sense to reach up to the emotional strength of person in front of you”. Respondent 31 said “Not possible in real world but then again requirements Engineer should know a thing or two about Non-verbal communication and must have a keen eye for it. Sense the tone, keep an eye on body language, and check out eye contacts. Respondent 33 said “Not possible in real world. An understanding of nonverbal communication on Requirements gathering team would be of advantage here.
Lack of subjective feeling evaluators using visual effects	Respondent 10 said" Yes, ratings page can be made attractive and intuitive in such a way that everybody who uses the applications gets forced to rate the application." Respondent 11 said" Visualization of a project is very important. Good solution" Respondent 12 said" Unfortunately, this is not yet implemented in our organization." Respondent 16 said “True to some extent. IT projects do not fail that easily, but may come out to be bad products.” Respondent 22 said “May be work don’t have faced yet.” Respondent 23 said “Don’t always rely on technology, Self-assessment is needed” Respondent 24 said "Track people experiences regarding development process are good way to know what irritates them, what motivates them etc.”
Moment to Moment ratings suffer	Respondent 7 said "Still we cannot do it on regular basis."

	Respondent 8 said "There is no hard and fast feeling monitoring tools. Neither it is required to make the, understand the goal and work of on it regardless of feeling " Respondent 12 said" Unfortunately, this is not yet implemented in our organization." Respondent 13 said "Human Management/ Emotions Management can't be measure from tools to be precise. I suggest to use Humans and Emotion/psychologist to access that." Respondent 34 said "system should be user friendly ,
Low understanding of the context of use that how users might behave in specific situations	Respondent 4 said, "By giving them diff situation ask their ans. It will help to predict their response.It is the era of AI and Machine Learning." Respondent 7 said "That will be really helpful to get ideas from past experiences" Respondent 8 said "Only certain things about user/human are unpredictability. User behave in different way facing same scenario." Respondent 10 said "I think this can't be predicted as this is highly random, unless there is a mechanism to record every incident\event whether good or bad." Respondent 12 said "As in every company, everyone work professionally so almost all manager don't know the employee all at personally so sometimes manager ask/say something that employee will not understand its context completely so it causes unpredicted behavior of the employee. So company should has all the personal information about the employee nature so employer can say anything according to his/her behavior." Respondent 19 said "There is lack of difference between user demand and IT Company demand so that they should sit together first and made proper documentation process to reduce failure" Respondent 21 said " Much Difference between customer and user" Respondent 23 said "Understanding development is an ultimate option, System should be somewhat elastic to bear these type of behaviors. "

	Respondent 25 said "Everyone perceive things differently according to their past and knowledge." Respondent 28 said "Understanding the personalities of people would be helpful and can be attained by normal sittings (preferably outside the office)." Respondent 34 said "Unpredictable behavior of user can be check our knowledge .
Less supportive collaborative requirement elicitation	Respondent 12 said "Requirements gathering or elicitation is also important part to complete software requirement in depth. Any user or customer of the software application can't tell us all required thing so company should also use the mentioned solutions. While our company is not yet using any of it." Respondent 13 said "I suggest to follow Agile Approaches/Scrum." Respondent 14 said "False." Respondent 15 said "Follow Scrum."
Lack of effective communication in virtual team environment	Respondent 1 said,"→Monitored communication." Respondent 11 said "Use modern means of communication." Respondent 14 said "and management of resources." Respondent 15 said "Good communication." Respondent 16 said "And management resources." Respondent 23 said "Well trained staff should be hired Communication skills are first and foremost requirement Merit is highly recommended" Respondent 24 said "Read 7 rules of communication and apply them."
No informal contact	Respondent 1 said," Merge areas →discussion forums →games" Respondent 5 said, "Organizational level communication." Respondent 6 said "There should be communication other than work"

	Respondent 8 said "Also involve the team in some sports activity." Respondent 12 said " I thing in software development field, its ridicules too, we should not be always formal because need some rest as informally. So, we do chats, messaging, hangouts etc. by using instant messaging applications live business skype or personal skype or private social groups of employees. This is just for the informal contacting with everyone we work with. This would help to create great relationship with each other within the organization or outside." Respondent 13 said "There should always be a contract (Formal one). Respondent 16 said "Instant messaging tools are always monitored by the organization. So employees refrain from it." Respondent 26 said "Organizing informal meetings i-e lunch or dinner within teams to strengthen their bonding." Respondent 27 said "Organizing informal meetings i-e lunch or dinner within teams to strengthen their bonding." Respondent 28 said "Team lunch, dinner and trips would e really helpful for bounding."
Information sharing is not facilitated	Respondent 4 said, "Information sharing is most important so we may use diff techniques or conduct sessions." Respondent 7 said "Information must be shared properly. Respondent 8 said "Use extra-curricular talk and drag the information source to the point required traditional RE techniques." Respondent 12 said "In the living world, I guess, anyone doesn't believe anyone in the sense of he/she would know too but this is inappropriate for the sake of trust. So company should use something like intranet for their employees to share information and different data. For instance, our company has different server where we can put our data and share with others so anyone can take benefits as learning new things" Respondent 14 said "It effect productivity."

	Respondent 16 said “Some companies do not even allow intranet, and any social interactions.” Respondent 23 said “Take others into confidence for data collection Don’t step into a risk” Respondent 34 said “Different type of knowledge should be update website.
No clarity in informal and formal review of activities	Respondent 4 said, “We must define formal and informal ways.” Respondent 8 said "Extra effort must be applied" Respondent 14 said “It does not affect product.” Respondent 16 said “It does not decrease trust. It effects productivity.” Respondent 23 said “Decreases liability Lack of precision“ Respondent 31 said “In case of software development team, that’s a good idea but developing mutual trust between development team and user of software through social networking- development team is not paid for this. Respondent 34 said “Review of activities must be add normal routine .
Invalid information sharing	Respondent 4 said,” Over time in meetings &consecutive meetings and also irrelevant personals in meeting may cause this.” Respondent 7 said "Valuable information sharing must be appreciated." Respondent 8 said "Also use interviewers of better communication skill to stitch the talk to point." Respondent 12 said "In the living world, I guess, anyone doesn’t believe anyone in the sense of he/she would know too but this is inappropriate for the sake of trust. So company should use something like intranet for their employees to share information and different data. For instance, our company has different server where we can put our data and share with others so anyone can take benefits as learning new things" Respondent 13 said "Properly conduct the requirement elicitation, Meeting.” Respondent 14 said "Not agreed.”

	Respondent 15 said “Proper criteria.” Respondent 22 said “Can work. In other way keeping them busy will avoid them to do so.” Respondent 34 said “Time should be use on necessary sharing .
Inappropriate role assignment	Respondent 1 said,”→clear job description.” Respondent 10 said "Project Manager should have an insight to rate his team members like which member can perform what task in a professional way, a skill set can be created for all members." Respondent 12 said "It happens in some companies that an unknown role would assign to the developer for that he/she is not experienced or work with. This is done because managers don’t know the developer what he/she is capable of. So, manager should always know the capabilities of the developer so development would be complete as fast." Respondent 13 said "I think this should be done by the team lead.” Respondent 15 said “Should be done by team lead” Respondent 16 said “What if project manager is also an inappropriate person himself?” Respondent 19 said “There is no effective role of project manager in companies” Respondent 21 said “There is no effective role of project manager in companies” Respondent 22 said “Right. Project manager should be advised to keep eye on them.” Respondent 23 said “Indication of invalid management Need for highly qualified staff and management” Respondent 24 said "Roles should be assigned according to user interest and project manager should set examples of mutual trust that can be followed.” Respondent 26 said "That will also include understand the skill sets of people and their capabilities.” Respondent 28 said "It is done according to skill set of people.”
Incorrect performance evaluations	Respondent 4 said, “There should be clarity in evaluation.”

	Respondent 2 said, “Evaluations should be just. It will help in better understanding and trust b/w manager and employee.” Respondent 3 said, “Performance Evaluation should be fair like if you do it collaboratively, do it but do not evaluate some on team game and some on individual.” Respondent 13 said "It should be on individual level.” Respondent 15 said “Should be on individual level” Respondent 16 said “And as a person also.” Respondent 19 said “There is no proper measurement of measuring performances” Respondent 23 said “Experience needed May cause waste of time“ Respondent 34 said “Evolution forms should be add for employees performance
Software failure fear	Respondent 2 said, “Fear of failure will never result in good product.” Respondent 4 said, “Team leader or Manager should build his team’s confidence and minimize their failure.” Respondent 8 said "Team motivation for making team fearless" Respondent 10 said" Software failure fear comes in mind of the developers because there is lack of trust between developer and employer. This can be ended up by held meetings on daily basis if possible" Respondent 15 said “With developer and solution Archival ” Respondent 23 said “Keep a backup plan Try for self-assessment” Respondent 24 said "In case of software failure, discus/analyze reason of failure and assign small achievable targets to help removing disappointment.” Respondent 26 said "To have a transparent and open culture of sharing and giving feedback.” Respondent 28 said "Transparency is key in this regard.” Respondent 31 said "Incremental development approach works wonders in this case.

	Respondent 33 said "Prototyping is a good approach.
Poorly introduced global distribution of the work	Respondent 1 said, “based on expertise of an employee.” Respondent 2 said, “Work should be distributed by performing proper analysis.” Respondent 3 said, “Arrange Meeting and justify everyone’s do’s and responsibility.” Respondent 10 said "Work should be distributed depending upon level of skill set not low cost or politics." Respondent 14 said "But globally, management does not know compatibility of each individual.” Respondent 16 said “But globally, management does not know capability of each individual.” Respondent 23 said “Lack of well-organized team work Need to develop integrity”

APPENDIX K

Filled Survey Forms

The filled forms are manually presentable and attached to the draft.