



Title: Managing risks in virtual-agile it projects: the paradigm of responsiveness

Name: Hassan Amar

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MANAGING RISKS IN VIRTUAL-AGILE IT PROJECTS:
THE PARADIGM OF RESPONSIVENESS

HASSAN AMAR

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MANAGING RISKS IN VIRTUAL-AGILE IT PROJECTS:
THE PARADIGM OF RESPONSIVENESS

by

Hassan Amar

A thesis submitted to the University of Bedfordshire in partial fulfilment of the
requirements for the degree of Doctor of Philosophy

February 2018

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ABSTRACT

Managing risks in IT projects has always been a critical area of study for many researchers and practitioners. Due to the rapid advances in information and communication technologies (ICTs), there is an increasing number of challenges and issues for the IT organisations. Virtual-Agile IT projects being virtually operated and based on Agile methodology principles are facilitating IT industry having their main application in the software development industry, where entities from diverse backgrounds have varied working practices, languages and culture, and works together for achieving common aims. There have been several benefits integrated with the application of Virtual-Agile IT projects but the intersection of these two unique working concepts (Virtual-Agile) gives rise to several risks and uncertainties which have now become a point of concern for these organisations. The need for minimising the possibility of such evolving risks and uncertainties became the foundation of conducting this study from a theoretical viewpoint, where the researcher aimed to propose a conceptual framework helping organisations meet their business objectives constructively.

The study is exploratory in nature which discovers all those appropriate practices, strategies and guidelines which support reducing risk and uncertainties between the distributed stakeholders during the product development phase. The research methodology used is primarily dependent on qualitative methods combined with the grounded theory methodology to gather rich and rigorous information from experienced and professional personnel from different geographical regions. Depending upon the procedures of grounded theory methodology, the data were collected and analysed simultaneously under the principles of constant comparison and theoretical sampling. The procedures helped to determine thought-provoking results and highlighted various dimensions of the phenomenon under investigation.

Responsiveness which emerged as the central phenomenon to overcome risks and uncertainties in Virtual-Agile IT project environments proposes for a proactive system which could be able to deal with project uncertainties, thus reducing the likelihood of potential risks, and enhancing opportunities for the organisations. Responsiveness, which is an ability of the system to perceive, reflect and adapt changes in the project environments is dependent upon efficiently management of three major components, i.e. technology, timeliness and communication. Technology which is the most critical element when operating in virtual environments requires standardization and should be extensively used to develop strong networks and integration between various locations around the world. Timeliness is elementary and a pre-requisite for completion of on-going multiple projects in IT organisations Communication which is the utmost component, is required at various levels for evolving synchronisation in the overall system, such as when developing correlation and satisfaction among distributed stakeholders, estimating the level of required competency and ensuring an efficient knowledge transfer process. Responsiveness, which is required throughout the development cycle, also further influences formal risk management practices undertaken at various levels of the project. Risk management planning and implementation of the response strategies are dependent upon Responsiveness i.e. how well, timely and using technical resources the entities communicate for determining a solution to a problem. The paradigm developed, thus reflects industrial practices undertaken in the software development industry to meet project objectives and would support organisations and their prominent stakeholders to overcome risks and uncertainties in the future Virtual-Agile IT projects.

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CONFERENCES AND PUBLICATIONS

- Conference:** Management International Conference (MIC), May 2017, Venice, Italy
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-
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-
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CHAPTER 1: INTRODUCTION

1.0 Introduction

This chapter is an introduction to the research study. The chapter discusses the basic purpose, significance and application of Virtual-Agile projects in the IT industry. The chapter also highlights the importance and need for risk management in Virtual-Agile projects with a review of previously available studies. Research problem and gaps are discussed in the light of previous authors' recommendations. Consequently, the research aims, and objectives are elaborated with justification for undertaking this research study. At the end, the significance of the study is discussed highlighting major contributions and expected benefits. Further, the area of the study has been elaborated with the help of a diagram showing the focus of this research. The proceedings of Chapter 1 are discussed as per following sections:

Section 1.1: The Evolution of Virtual-Agile Projects

Section 1.2: Significance of Risk Management in Virtual-Agile Projects

Section 1.3: Review of Previous Researches in Related Area

Section 1.4: Research Problem

Section 1.5: Research Aim & Objectives

Section 1.6: Justification of the Study

Section 1.7: Significance of the Study

Section 1.8: Area of Focus

Section 1.9: Research Scope

Section 1.10: Structure of the Thesis

1.1 The Evolution of Virtual-Agile Projects

Virtual-Agile IT projects are meant to get access to diverse resources from different geographical regions that reduce operational costs, enhance business dynamics, support getting access to multiple markets, and produce prompt and flexible solutions (Vijayaraghavan et al. 2014; Hossain et al. 2009). These solutions are mainly related to the development of software and web applications, enterprise resource management and financial management solutions (Keshlaf and Riddle, 2010). Previously, virtual teams were preferred for inter-organisational collaborations and developments for engineering projects to enhance business operations (Leenders et al., 2003). Powell et al. (2004) recognised a virtual team as a group of individuals distributed geographically and operating from different locations or regions for the achievement of shared tasks or working for the accomplishment of a common purpose. Virtual teams became the valuable part of those organisations operating worldwide, or those having joint alliances and affiliations with other organisations for collaboration (Ale Ebrahim et al., 2009).

With the innovations and developments in information and communication technologies (ICTs), the demands of customers implanted the necessity of using virtual projects for providing IT solutions to their problems (Powell et al., 2004). For this reason, virtual teams were extensively preferred in IT industry since organisations aimed to get access to multiple individuals, talents and markets, and complete projects in less time (Ale Ebrahim et al., 2009). The shortcomings of such types of projects were that they were based on conventional methodologies in which customers have to wait until the whole development cycle was completed (Reed and Knight, 2010). If the product development was not undertaken as per client requirement, projects faced severe consequences in the form of delays and cost overruns and affected the organisation–client relationship and the trust-building process (Vinaja, 2003).

At the same time, where traditional project management methodologies were not able to fulfil the dynamics of the IT industry, Agile methodology was introduced in 2001, providing opportunities for high interaction and collaboration between project team and clients; so that the development process could provide more flexibility and support alterations in scope (Drury-Grogan, 2014). The benefit which Agile mainly provided to organisations is that the development process is completed in small portions, thus, providing the opportunity to clients and project team to interact more often and agree on the results frequently. Agile is therefore known as an iterative methodology where the clients and teams can move back and forth in a development process to achieve project aims (Gandomani and Nafchi, 2015).

Where organisations started using virtual teams for meeting their business objectives, they found Agile methodology as an effective solution to attain maximum satisfaction of customers. They believed that utilization of Agile principles may support reducing disasters and having more control over project processes (Paasivaara and Lassenius, 2014); rather than depending upon the traditional methodologies of the waterfall or spiral model, where projects were performed in one go and fewer opportunities were provided for collaboration between the project stakeholders (Binder et al., 2014). Agile was originally developed for in-house or collocated software development, while achieving it in virtual format became very difficult as teams were geographically dispersed. Consequently, Virtual-Agile projects together gave rise to outsourcing and off-shore development which brought several complications to the organisations (Drury-Grogan, 2014).

In literature, numerous terms have been used against the word 'Virtual-Agile', i.e., distributed Agile development (DAD), global software development (GSD), global IT projects and global distributed software projects (GDSP) (Hossain et al., 2009; Lee and Baby, 2013; Persson et al., 2009; Shrivastava and Rathod, 2015). Hence, to reduce misinterpretations and misperceptions about the area of focus, this researcher has introduced a more comprehensive term of 'Virtual-Agile' which comprises all types of software development

projects based on the Virtual-Agile working format. Virtual-Agile IT projects consists of all those projects which are undergoing virtually and operating under the principles of Agile methodology. The application of Virtual-Agile projects is most relevant in the context of software development projects. For example, an IT organization when developing new software or product for its customers can outsource some of the sections or an entire software from other IT organizations that can be based in a different region or the same organisation can undergo a joint alliance or mutually develop a product with another organisation. An example could be shared here from the empirical evidence/interview#4 conducted for this study. Participant#4, who was a senior project manager in Germany was outsourcing one part/section of the software for one of his customers in UK from a software company in India, where he used to interact with skilled developers and testers. Some of the sections/parts of the software were developed under his supervision in Germany. He was also managing and monitoring the overall affairs of the projects and responsible for maintaining collaboration; further ensuring the successful delivery within a given timeframe. Providing virtual teams with relevant information and required facilities, acting upon uncertain situations and defining response strategies for the potential risk factors were some of his major responsibilities. The participant mentioned about the criticalities and challenges he used to face when operating in Virtual-Agile projects specially when collaborating and integrating the distributed team members. The example helps to understand the philosophy behind working of Virtual-Agile projects; how the projects can be virtually developed following an Agile approach. Similarly, the participant also mentioned the reasons of using Virtual-Agile format due to the rivalry and competition for presenting creative and innovative solutions, getting access to skilled labor at low rates, and acquiring supplementary business globally.

Further, Virtual-Agile IT projects bring benefits to organisations in terms of flexibility and being cost-effective, meeting timelines and achieving scope in terms of quality and

satisfaction of stakeholders; thus, finding them more productive and responsive to disparities and variations (Badrinarayanan and Arnett, 2008). At the same time, organisations get access to diverse customers and markets which ultimately help them to enhance their business operations and credibility (Verburg et al., 2013). Virtual-Agile projects mainly dependent on the principles of Agile methodology promote stakeholder interaction and extensive collaboration, handle variations and alterations, and respond to the demands of customers (Pikkarainen et al., 2012). Virtual-Agile projects have thus facilitated the IT organisations with dynamic principles of working.

1.2 The Significance of Risk Management in Virtual-Agile IT projects

Although the benefits of using a Virtual-Agile format together brought several opportunities to organisations and concerned stakeholders, at the same time the intersection of these two concepts gave rise to dynamic risks (Shrivastava and Rathod, 2015; Lee and Baby, 2013). As the Virtual-Agile project demands high interaction between the development teams and customers, therefore, risks are more prominent in such type of projects. Some of the dynamic risks and challenges which have been identified are linked to differences in time zone, geographical location and culture due to which the project stakeholders could not interact with each other more often. Similarly, due to diverse backgrounds and working practices, the teams might have different mindsets because of which they cannot comprehend each other effectively (Vijayaraghavan et al., 2014).

As development in ICTs have changed the organisational dynamics and provided more opportunities for organisations to operate in the distributed way, additional risks and uncertainties are expected to be part of IT projects, mainly due to involvement of multiple entities (Tomanek and Juricek, 2015). As Virtual-Agile IT projects comprise of several diversities in terms of geographical location, time shift, culture and ethnicities (Reed and Knight, 2010; Pinjani and Palvia, 2013), therefore, the team members networked together

have different intentions and interests, desires for career growth, customs and working practices, and abilities to perform (Drury-Grogan, 2014). The organisations following Virtual-Agile formats also face certain issues in Agile implementation and adoption, where team members are not able to understand the working of such dynamic environments (Chin, 2004). When the projects evolve over time, uncertainties grow as the team members interact and indulge with the project activities, thus giving rise to dynamic and unexpected risks. (Binder et al., 2014). These risks disrupt the overall collaboration and interrelated task dependency between teams and thus lead to project disasters.

According to Hossain et al. (2009), not every organisation might be able to accept the transitions without specialised planning and properly undertaking risk management procedures. Similarly, software or web development projects themselves contain several active risks developed through the typical characteristics of the product and the processes (Keshlaf and Riddle, 2010). Risks can also be inherent to Agile in terms of having limited documentation and lack understanding of the requirements. Correspondingly, potential risks may also exist with managing the overall affairs of such project environments. As the entities cannot interact physically and are dependent upon computer-mediated technologies, achieving effectiveness in such project environments becomes difficult for the project managers and organisations, leading to project failures and catastrophes (Sakthivel, 2007).

Chua (2009) recommends that the early identification of risks in IT projects may help organisations to avoid pitfalls. Further contributing to the context, Debbie et al. (2007) informed that risk management is considered a '*facilitation function*' in IT projects which plays a vital part in achieving project success. In Virtual-Agile IT projects, risks are the perilous elements for achieving the real purpose and objectives, particularly for software and web development projects where flexibility, responding to rapidly changing business environments, attaining customer satisfaction, and providing quality and creativity are some of the obligatory features needed to meet dynamic global and market conditions (Chin,

2004). In case of not addressing the risks initially, Hopkins (2012) argues that the project may lead to

- Certain incompetence level which may not be able to deal with sudden uncertainties
- Failure to define suitable strategies as a reaction to exposure to risks
- Inefficiency in monitoring and controlling of risk impacts
- Lack of understanding of how and when to engage in for risk actions.

1.3 Review of Previous Research in Related Areas

For this study, a review of previous studies was carried out by the researcher in order to recognise the current risk management practices/frameworks, approaches and the authors' recommendation for conducting future research. As the researcher's motivation and interest directed him towards this area of study, there was a need to look at already published literature since the work for risk management in projects has been widely established over time. The researcher, after identifying his area of the study, looked for articles which related to risks and risk management for "Virtual-Agile", "distributed Agile" or "virtual or distributed software development" projects. Similarly, during the research, several articles were also considered which did not particularly focus on risk management approaches. The reason for specifying the keywords was to identify the current gaps and problems in academia which needed further investigation. Some of the most relevant articles reviewed for this study are shown in table 1.3.

Table 1.3: Review of previous Research and Future Recommendations

S/No	Authors	Title	Methodology/ Approach	Contributions	Recommendations for Future Research
1	Mudumba and Lee (2010)	A New Perspective on GDSD Risk Management	Interaction Analysis	Framework generated on the bases of interaction between People, Process and Technology which highlights dynamic risk factors and Agile risk management practice on GDSD	Application of developed framework through case study approach
2	Shrivastava and Rathod (2017)	A Risk Management Framework for distributed Agile projects	Descriptive Study using Surveys	Extension of the previous study. Development and validation of RM Framework based on Leavitt's organisational change model	Call for identification of risk management methods which are compatible with Agile practices for DAD projects
3	Lamersdorf et al. (2011)	A Risk-driven Model for Work Allocation in Global Software Development (GSD) Projects	Qualitative Study using Interviews	Risk-driven model for supporting work allocation decisions in GSD including two components, a. Stochastic Assignment Model and b. Risk Identification Model	Applicability of developed models in different environments

4	Vijayaraghavan et al. (2014)	Case study on Risk Management Practice in large offshore-outsourced Agile Software projects	Case Study Approach	Exploration of challenges to Agile culture and practices and strategies to manage such challenges and improve performance	<ol style="list-style-type: none"> 1. Risk Profile and Resolution techniques developed can be used for a Delphi study 2. Identification of risk strategies for Agile team between development and maintenance phases 3. Risk management for closely-coupled Agile off-shore-outsourced projects 4. Longitudinal case studies identifying influence of risk resolution techniques on project performance
5	Shrivastava and Rathod (2015)	Categorization of risk factors for distributed Agile projects	Qualitative Study using constant comparison	Generation of five risk categories and then mapping them into Leavitt's organisational change model	Identification of most critical risk factors and their corresponding risk management techniques
6	Baloch et al. (2014)	Comparative Study of RM in centralized and distributed software development environment	Systematic Review	Generation of Collaborative software development framework (CSD)	Application of developed model to new risk areas
7	Aslam et al. (2017)	Decision Support System for Risk Assessment and Management Strategies in Distributed Software Development (DSD)_	Systematic Review	Decision Support System for managing Risks based on Leavitt's organisational change model	Application of proposed model in planning stage of DSD and testing of the model in real project setting

8	De Farias et al. (2012)	Elicitation of communication Inherent Risks in Distributed Software Development	Thematic Analysis	Identification of risk factors from literature and then proposed appropriate mitigation strategies	Application of the model into other existing risk situations of DSD
9	Arumugam and Kaliamourthy (2016)	Global Software Development: An Approach to Design and Evaluate the Risk factors for Global Practitioners	Systematic Review	Generation of Risk Assessment Model under four stages of forming, storming, norming, and performing for identification of risk factors	-----
10	Lee and Baby (2013)	Managing Dynamic Risks in Global IT Projects: Agile Risk- Management using the Service-Oriented Architecture (SOA)	Qualitative Study	<ol style="list-style-type: none"> 1. Identification of dynamic risks from internal (people, process and technology) and external (project environment) interactions. 2. Adoption of SOA principles for developing a new framework which helps to understand Agile Management Strategies for Global IT projects 	Validation of the proposed framework through qualitative and quantitative approaches
11	Persson et al. (2009)	Managing Risks in Distributed Software Projects: An Integrative Framework	Systematic Review	Generation of an integrated Framework depending upon three major components: Assessment, Resolution and Management planning	-----

12	Hossain et al. (2009)	Risk Identification and Mitigation Processes for Using Scrum in Global Software Development: A Conceptual Framework	Systematic Review	Generation of a proposed framework highlighting seven broad classifications of risk factors and corresponding strategies	<ol style="list-style-type: none"> 1. Need for more research in area 2. Conduct multiple in-depth industry-based case studies in real-life settings in order to understand project-based risks 3. Explore more effective strategies to reduce identified risks and support use of Scrum in GSD projects
13	Keshlaf and Riddle (2010)	Risk Management for Web and Distributed Software Development Projects	Literature Review	Weaknesses in current approaches to deal with risks	Need for more research as large gap exists between the existing and real-industry practiced approaches
14	Verner et al. (2014)	Risks and Risk Mitigation in Global Software Development: A tertiary	Systematic Review	Categorization of risk factors into four major themes and proposal of more than 400 suggestion	-----
15	Tavares et al. (2017)	Risk Management Analysis in Software Projects which use the Scrum Framework	Survey and Case Study	Risk Management practices in Scrum are different to those of traditional approaches. It depends upon teams' experience and maturity	Need for grouping of RM procedures as per Agile practices, ceremonies and roles on Scrum
16	Yalaho and Nahar (2008)	Risk Management in Offshore Outsourcing of Software Production Using the ICT-Supported Unified Process Model: A Cross-case study	Case Study	Identification risk factors that affect success of projects, analyse how they create risks and explored strategies to eliminate those risk factors	-----

1.4 Research Problem

Virtual projects already consisted of several types of issues, mainly in terms of time differences, cultural diversity and time constraints (Reed and Knight, 2010); Agile when mixed with these, gave birth to several potential and dynamic risks (Jalali and Wohlin, 2010; Shrivastava and Rathod, 2015). As risks are the consequences of evolving uncertainties (PMBOK, 2004), therefore, such uncertainties create disturbances between the entities and deviate the expected outcome of Virtual-Agile projects (Lee and Baby, 2013). Agility offers customisation and flexibility to its customers in co-located format; achieving it in virtual or distributed settings became very difficult as it demanded a frequent level of interaction between the project stakeholders. Due to being geographically dispersed, lack of interaction and collaboration gives rise to evolving challenges and issues leading to project failures (Vijayaraghavan et al., 2014). Lee and Baby (2013) further acknowledged that the reasons for such failures are mainly linked with the inability of Virtual-Agile development teams to be able to sense and respond to dynamic situations.

In the literature, several risks have been reported which deviate project progress during development and implementation phases. These risks vary in nature, and responding to those risks becomes difficult for organisations when there are differences in time, location and culture. It has been reported that 50% of Agile projects fail in virtual format; though previously the failure rate was less than 25% when undertaking development in co-located format (Shrivastava and Rathod, 2015). Though Virtual-Agile projects brought several benefits, at the same time organisations started facing difficulties managing the overall project environments. The review of prior research in the area as per table 1.3 has found major gaps in the literature for which the current approaches available do not provide a deep insight into the strategies or practices that should be useful for overcoming risks. One of the major aspects which has been identified by Keshlaf and Riddle (2010) is the difference between the available practices in the literature and the actual practices

undertaken in the software development industry to manage risks. As Virtual-Agile projects have their main application in the software development industry, Keshlaf and Riddle (2010) suggested for more empirical research in the area to identify the real approaches. The causes which Keshlaf and Riddle (2010) identified are mainly the lack of consideration in existing approaches of the factors of geographical location, culture, process and product. Shrivastava and Rathod (2015; 2017) explored and tested their risk management framework but called for the identification of new risk management approaches to deal with evolving risk factors due to the frequent developments in ICTs. Shrivastava and Rathod (2017) further acknowledged discovering appropriate risk management practices that are well-suited with the principles and dynamics of Agile methodology. Vijayaraghavan et al. (2014), while conducting a case study research for large off-shore-outsourced Agile projects, identified that Agile practices are difficult to implement in distributed environments and can lead to project failures. Therefore, the need to explore effective risk management practices using a Delphi study should be undertaken by researchers to gather expert opinions and reviews for the solution. Vijayaraghavan et al. (2014) further proposed that a knowledge gap exists in the area when the software projects are completed and transitioned to the maintenance phase. This knowledge management area can also become a basis for conducting future research. Consequently, Vijayaraghavan et al. (2014) have proposed the research of risk management procedures for close-coupled projects where the teams require a high frequency of task coordination. The current literature which has been reviewed lacks in providing effective solutions to undertake real risk management practices. The main difference recognised is the difference of approaches between the existing literature and actual industrial practices. Tavares et al. (2017) in a very recent study identified that the reasons for this may be the lack of understanding of teams, due to which they cannot comprehend appropriate procedures. Agile brings several challenges and risks in virtual

projects and managing them becomes difficult as there are no strict procedures or guidelines to manage evolving uncertainties.

1.5 Research Aim and Objectives

Taking the research problem and gaps into consideration, the aim of the study was to explore strategies/or practises which could help IT organisations overcome risks and uncertainties in Virtual-Agile project environments. Further, the researcher aimed to contribute in the risk management literature by developing a framework which could guide project managers and project planners when undertaking such form of projects. Together with strategies and practices, some of the additional risk factors were explored which need consideration by organisational leadership and governing bodies.

Based on the research aim, the objectives of this study were drafted as:

- To explore the most critical risk areas/factors which disrupts the Virtual-Agile IT project environments
- To explore strategies and practises which could help to overcome risks and uncertainties in Virtual-Agile project environments.
- To propose a framework which could guide project managers and organisational leadership and further contribute in the literature of risk management.

1.6 Justification for the Study

Shrivastava and Rathod (2015) considering Virtual-Agile projects as a nascent area of study and have suggested for more empirical research that explores more effective risk management practices. They further acknowledged that there is lack of literature in terms of managing risks in Virtual-Agile projects which provides opportunity researchers to look for more appropriate theories and frameworks. Most of the studies shown in table 1.3 have used a qualitative type of research to generate a theoretical framework either using a case

study approach, thematic analysis or simply a systematic review. The problem which has been found with these studies is their reliance on primitive, and pre-existing theories and frameworks which limit them from addressing the research problem efficiently; and due to this reason, several authors even after conducting exploratory research have called for more empirical research using qualitative means, with some of them proposing the testing of their developed framework. Taking mainly the recommendations of Keshlaf and Riddle (2010), Hossain et al. (2009), Vijayaraghavan et al. (2014), Shrivastava and Rathod (2015; 2017) into consideration, the researcher decided to carry out an exploratory study which could help fill research gaps and address the research problem with more evidence. According to Lincoln and Guba (1985), exploratory research is undertaken for a problem that has not been defined clearly or to gain further insights of the social phenomena. Cavana et al. (2001) have argued that exploratory studies are undertaken about a problem which has information available previously on the subject area, but the available studies do not limit the researcher from undertaking additional exploratory studies. In context, qualitative methods with grounded theory methodology were found most appropriate as it focuses on the development of a theory, using conceptual thinking rather depending upon pre-existing hypotheses and ideas (Gray, 2009; Khan, 2014). Thus, grounded theory methodology facilitated developing the paradigm of *responsiveness*, which emerged after an in-depth analysis of the empirical evidence. The detailed reasoning and procedures are discussed later in Chapter 3 and Chapter 5, respectively. Figure 1.6 shows the overall research process for this study.

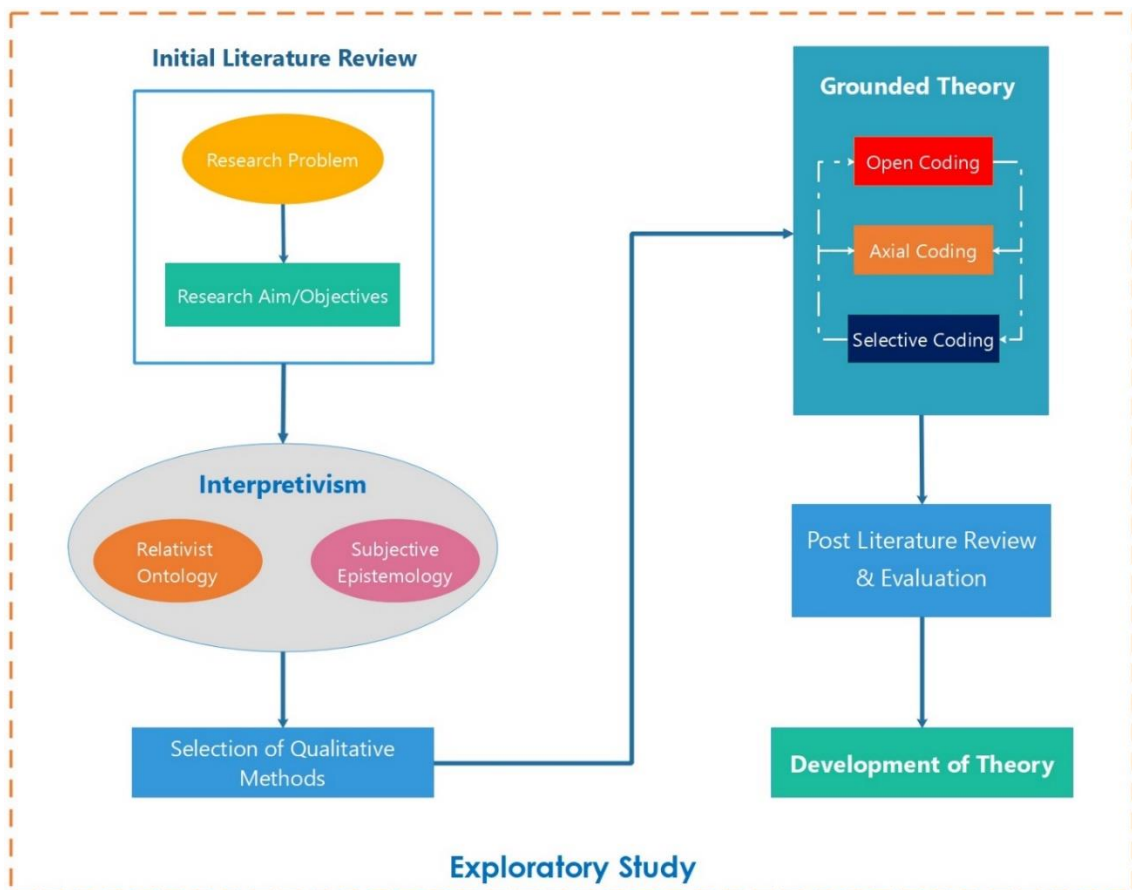


Figure 1.6: Overall Research Process

1.7 Significance of the Study

The implications of this study have been briefly compiled as:

- The study benefits organisational leadership, decision-makers, project planners and concerned stakeholders to observe various insights into the phenomenon investigated. The developed phenomenon helps organisations to look at different types of risk factors that hinder the achieving maximum benefits out of these projects. Further, the proposed study also supports organisations to realise the most prominent characteristics and their significance in such project environments. They can also estimate the usefulness of this study to reach closer to their project objectives and achieve quality, especially in terms of achieving the satisfaction of

product owners and clients. This may create maximum opportunities for the project development teams while considering the various types of risk factors.

- The study is also useful for researchers and scholars from academia who are looking to explore further insights or test the developed conceptual framework into different contexts. The novice or experienced researchers can also get assistance from the procedures, approaches and logics used in the study.

1.8 Area of Focus for this Study

The focus of this research is on the entire Virtual-Agile project environment where several entities are involved to achieve mutual objectives. The reasons for focusing on the entire environment is to analyse the variations and then bring the common risk management practices into consideration. As discussed, the Virtual-Agile format is most applicable in the software development industry mainly operating on the principles of Agile; therefore, Agile offers several methods under its umbrella for undertaking such projects. Such methods vary in principles and terminologies. Some of the most common methods used in the IT industry are Scrum, Extreme Programming (XP), lean programming, KANBAN, Feature-driven development (FDD) and Dynamic systems development method (DSDM) (Chin, 2004). All these types of Agile methods are relevant for undertaking software development. The suitability of each method depends upon the requirements for each project, and organisational preferences.

To conduct this study, the researcher has focused on those projects which were distributed or scattered geographically, where the organisations were following the Agile methodology for development and delivery of their product worldwide. Similarly, the researcher also focused on those organisations which were undertaking off-shore development in different locations in relation to their parent organisation, and depended strictly upon Agile principles. The researcher has demonstrated his area of research using the representation in figure 1.8;

so that it might help readers to understand the area of focus (intersection) where the study has been originally conducted.

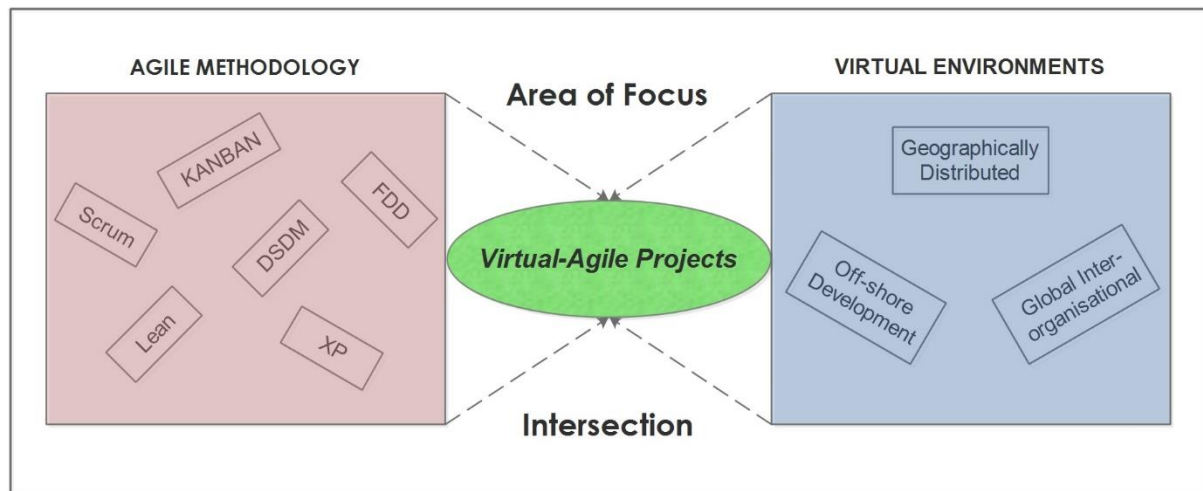


Figure 1.8: Area of Focus for this Study

The figure shows that virtual environments operate mainly under three types of formats, i.e., they can be geographically distributed, they may undertake off-shore development, or they can be a global inter-organisational collaboration.

- Geographically distributed is a virtual format where individuals or teams are operating from different locations or regions whether inside or outside the base location of a country to meet common goals or objectives.
- Global inter-organisational collaboration is the format where the entities that are a part of distinct organisations or those having joint alliances are operating from different geographical territories.
- Off-shore development is a setup hired or undertaken by organisations in other countries/different geographical regions in contrast to their main operating location to provide business services to their own customers.

Correspondingly, Agile majorly operates under six sub-methodologies for software development, i.e. Scrum, FDD, KANBAN, Lean, XP and DSDM. Virtual-Agile projects can be based on one or two components of Agile methodology and one component of the virtual

environment. For example, the project can be geographically dispersed operating on Scrum method or the projects can be off-shore and operating under XP method. The reason for focusing on all types of Agile methods was the application of grounded theory methodology which demanded the researcher to observe the phenomenon from a broader perspective (Glaser and Strauss, 1967; Strauss and Corbin, 1998). As the researcher moved along the data collection and analysis process, he identified the most appropriate area of data collection from where the rich and rigorous empirical evidence could be gathered. These were some of the initial assumptions which were made to enhance theoretical sensitivity and determine appropriate area of research. The detailed sampling and analysis procedures are discussed later in Chapter 5.

1.9 Research Scope

The focus of this research study is around those IT projects which operate under Virtual-Agile boundaries. Those IT projects mainly include software development, new product development and program management type projects. The main goal was to examine these projects, explore risk areas and determine strategies to overcome these risks and uncertainties. The research included examination of wide-ranging IT projects from diverse organisations around the world from various regions. The main reason for going across various regions was to figure out various critical risk areas and look for diverse and effective strategies/practises used by skilled project managers to overcome risk and uncertainties. Secondly, as the Virtual-Agile projects operate across various regional and continental boundaries, and include diverse individuals, the research scope included identification of those challenges and issues which occurs in overall project environments.

Some of the boundaries defined when conducting this study were:

- Not to consider those IT projects which were collocated and following conventional project management methodologies such as waterfall, spiral model etc. The reason

for not considering such conventional projects was to remain focus on the areas of study as per section 1.8.

- While considering a project environment, a focused was maintained such as consideration of association between different components and individuals where a project is processed. A project environment has an impact on the project outcome and is influenced by numerous factors such as operational, social, cultural, economic, organisational etc. A project environment can also be replicated to P3M (project, program and portfolio management) (APM, 2010), where an organisation has several projects and programs undergoing in collaboration and association with other organisations/joint alliances under same premises. A project environment include consideration of all those components that affect the project processes and procedures.

Some of the assumptions considered in the beginning of the research study were:

- Access to various participants who could answer and contribute in the study in an honest and candid manner
- The sampling criteria was appropriate, and the participants chosen all had experienced the same phenomenon for which the investigation has been conducted.
- Collection of viewpoints from diverse participants, regions and organisations to reflect common practises
- Development of a framework from the varied viewpoints of participants which help to reduce risks and uncertainties

Some of the limitations/constraints assumed were:

- Completion of the research study within a defined duration of three years
- Some unexpected or uncertain situations environments where the participants could be biased about their responses

- The defined sampling criterion might not be so effective where the researcher is not able to get relevant information from the participants

1.10 Structure of the Thesis

This study has been presented in seven chapters.

Chapter 1 elaborates the basic concept behind Virtual-Agile projects and its significance in the IT industry; its major area of application with the explanation of the problem and gaps identified from the literature. Chapter 1 also highlights the area of focus for this study with the introduction and significance of the applied research methods. Hence, Chapter 1 will provide deep insights and justification to readers for conducting this study.

Chapter 2 highlights the significance of risk management in IT projects with introduction to some of the standards and practices for risk reduction. As this study follows a grounded theory approach, the initial review of literature is undertaken to enhance the theoretical sensitivity and understand the working of Virtual-Agile projects as well. Consequently, some of the basic notions and methods of Agile have also been discussed, which later became useful during the data collection and analysis processes. Thus, this chapter focuses on the elementary ideas, concepts and processes that are undertaken in view of risk management, together with gaining information about Virtual-Agile projects.

Chapter 3 is an outline to research methods and methodology for this study, highlighting the researcher's philosophical beliefs and the major paradigm which he uses. Being an interpretivist, major research methods are discussed with the explanation of choosing qualitative methods together with the justification of selecting grounded theory methodology. Consequently, three major schools of grounded theory are discussed towards the explanation of choosing the Strauss and Corbin (1990; 1998; 2008) version. A brief overview of Strauss and Corbin's version is provided with the corresponding steps

undertaken for the study. Thus, this chapter is descriptive in nature and provides an overview of the researcher's philosophical beliefs and choice of methodology.

Chapter 4 highlights the major concepts and the procedures undertaken for conducting this study. Discussion about theoretical sensitivity, sampling techniques, and constant comparison procedures are elaborated with discussion over participant selection criteria and the data sources used for this research. The role of the researcher's reflexivity has also been elaborated in detail to reflect the practices and procedures undertaken to develop the phenomenon. As the data collection and analysis process went side by side, all the important characteristics are highlighted with the elaboration of the details of the participants with their regions, roles and corresponding sampling criteria. The process of data analysis, which includes three major stages of open, axial and selective coding, has been shown with the evidence of generated concepts, main and sub-categories step-by-step to provide readers with in-depth knowledge about the research process that has been undertaken to develop the paradigm of Responsiveness. Hence, this chapter highlights the entire process of data collection and analysis undertaken for this study.

Chapter 5 is a continuation of Chapter 4 concerning the researcher's interpretations and participants' beliefs in relation to the investigated phenomenon. The relationship of the core-category (Responsiveness) with other main and sub-categories has been elaborated using the empirical evidence. Similarly, original quotations from the data are shown for each developed concept and category to show the strategies and actions undertaken by the professionals and their corresponding organisations to reduce risks and uncertainties. Similarly, the relationship and influence of Responsiveness in Active Risk resolution has been discussed considering the risk management planning and implementation phases. Hence, Chapter 5 shows a detail collection of empirical evidence in relation to the emergence of the paradigm.

Chapter 6 includes a post-review of literature in relation to the findings from Chapter 5. In this chapter, major conventional approaches and methods are discussed from the literature and highlighted in relation to the results of the study. Similarly, some of the relevant theories and procedures from an Agile perspective are discussed to give readers some of the implications and an overview of the types of strategies acknowledged by previous authors. A conceptual framework has been developed with its major propositions for overcoming risks and uncertainties. The critical evaluation of each of the concepts that exists in the paradigm of Responsiveness has been performed to analyse the strengths and shortcomings of the developed phenomenon. Consequently, appropriateness of the developed framework for particular Virtual-Agile types has been discussed. In the last, the procedures for ensuring trustworthiness from a qualitative research perspective have been elaborated to assess the value of the study under its four main stages of credibility, transferability, dependability, and confirmability.

Chapter 7 is the concluding chapter which highlights major theoretical and practical contributions to the field of academia. The chapter also provides an overview of the research problem/gaps and discusses how well the developed paradigm addresses the desired research objectives. Finally, some of the limitations of the study are highlighted together with recommendations for future studies.

CHAPTER 2: INITIAL LITERATURE REVIEW

2.0 Introduction

This chapter provides readers an understanding of the relationship between risk and uncertainty in projects, together with an overview of standard risk management processes available in project management literature. The chapter also discusses the place of literature for this study, i.e., how often, when and where did the literature support to the researcher. The chapter also highlights the place of risk management in Agile development process, together with a discussion on the functioning of virtual teams and Agile software projects. The chapter also helps readers to know about some important risk management approaches from the previous literature available. The proceedings of the chapter are undertaken as follows:

Section 2.1: The Place of Literature for this Study

Section 2.2: Conception of Risks in Projects

Section 2.3: Conception of Uncertainty in Projects

Section 2.4: Risk Management in Projects

Section 2.5: Risk Management in Agile Project Development – A Challenge

Section 2.6: How and Why Virtual-Agile Format is required?

Section 2.7: The Functioning of Virtual vs. Traditional Teams

Section 2.8: The Progression in Agile Project Management

Section 2.9: Overview of Preceding Research

Section 2.10: Summary

2.1 The Place of Literature for this Study

The use of literature in qualitative studies varies as few methodologies recommend postponing the review until the data collection process is completed (Taylor et al., 2011). Grounded theory study is one of them where the original discoverers of the method recommend delaying the literature review. This would help the researchers to let concepts emerge themselves from the data rather preconceiving them (Creswell, 2009). In literature, there are two perceptions about the timing of the literature review in relation to grounded theory studies,

1. Delaying the detailed literature review until the data collection and analysis initiates
2. Undertaking a preliminary literature review and then expanding it during data collection and analysis phase

Glaser and Strauss (1967), the discoverers of the grounded theory suggested to delay the literature review in grounded theory research until and unless the data collection begins, or the researchers can delay reviewing the literature after the substantive theory has been developed. Glaser and Strauss (1967) further suggested that the researchers themselves will be able to observe the similarities and differences during the analytical process when the literature is delayed. The basic motive for delaying the literature review is to minimise the preconceptions and enhance theoretical sensitivity which then helps to conceptualise and articulate the theory, as it evolves from the data. Glaser and Strauss (1967) further recommended using documents in the early stages of the research so that it might help the researchers to know about their substantive area and help formulate initial hypotheses for the study. Barney Glaser and Anselm Strauss were divided later in their viewpoints, and a contradiction was found between them on the review of the literature. Glaser (1978; 1992) recommends not to consult or review any literature prior to the study as it halts researchers' thinking and open-mindedness. Glaser (1998, p.67) suggested

Do not do a literature review in the substantive area and related areas where the research is to be done; and when the grounded theory is nearly completed during sorting and writing up, then the literature search in the substantive area can be accomplished and woven into the theory as more data for constant comparison.

In view of the academic research, Glaser (1998) further suggested that the researchers could undertake an introductory literature for meeting the university requirements such as dissertation proposal approval or when presenting to funding agencies; but the researchers should not waste their time reviewing extensive literature.

While Barney Glaser seems to stick with his approach of delaying the literature review, Anselm Strauss changed his viewpoint over the time. Anselm Strauss where (together with Glaser) originally encouraged delaying the literature review, later with Juliet Corbin in 1990 realised that he overstated the inductive perspectives of grounded theory in the initial version. Strauss and Corbin (1990; 1998; 2008) have come up with an argument that acquaintance with literature may supports researcher's inventiveness and enhance theoretical sensitivity to subtle nuances data. Strauss and Corbin (1990) recognised that during the research process, when a researcher gets involve with the literature, he brings up his professional or personal life experiences. This knowledge or experience encourage theoretical sensitivity, instigate research questions and the theoretical sampling process. Therefore, Strauss and Corbin (1990; 1998; 2008) in their book editions later suggested that preliminary literature review help formulate research questions and supports to observe events i.e. 'what is actually going on' with the data during the process of analysis. They also added that initial literature directs theoretical sampling where a researcher comes to know about several characteristics or situations which he hasn't thought of before. Strauss and Corbin (1998) further concluded that if the researcher is prudent enough not to permit the

literature come between him and the data, the literature can act as an analytical tool to stimulate conceptualization.

Kathy Charmaz (1990; 2006) who is the founder of constructivist grounded theory and a student of Barney Glaser, advocated Glaser's belief that an early initial literature review can be undertaken to fulfil the institutional needs and ethical requirements, but if undertaken in detail preceding to data collection can halt a researcher from adding creativity to the data, and a researcher could become prejudiced by pre-existing theories. Charmaz (2006) didn't properly described to what extent the literature should be undertaken but acknowledged later with Antony Bryant in 2007 that knowledgeable researchers prefer to delay the review of the literature as they have got familiarity with the main themes and notions in the literature. Charmaz (2006) believes that each researcher brings a specific past to his experience and therefore cannot separate himself from the preconceived ideas; therefore, she endorses that a balance literature review should provide an initial framework and direction to the research study. Charmaz (2006) therefore supports a preliminary literature review which is then put aside until the concepts and categories emerge from the data. She further suggests for an in-depth literature review during data collection and analysis process to strengthen the arguments and credibility of the research. This in-depth review helps the researcher to indulge in existing ideas or notions and acknowledges his contributions to the knowledge.

Where does the literature stand for this study?

The three major schools of the grounded theory have their own perceptions for undertaking a literature review during a grounded theory study. The use of literature review has varied with respect to the authors' own experiences while undertaking a research. The basic principle of delaying extensive literature is to minimise predetermined notions about a research problem that comes from taking an in-depth review of the literature. Therefore,

keeping into consideration all the beliefs and suggestions, the researcher found out that Strauss and Corbin (1990; 1998; 2008) advised a more appropriate approach in relation to carry out a literature review. Their suggestions to conduct literature have been acknowledged throughout the research study; although some of the notions and suggestions from other grounded theorists have also been considered time to time in methodological processes. The literature for this study was conducted mainly in two stages. The first stage literature review was an Initial one which facilitated researcher as following,

- Firstly, the literature helped the researcher to recognise the work already being done in the area; locate knowledge gaps and problems, and helped identifying the appropriate area for conducting
- Secondly, the literature supported researcher to formulate his research question and design objectives, which further helped to formulate basic interview questions.
- During the initial literature review, the researcher also identified some of the major ideas or concepts about risks, and risk management, and came to know about the functioning of virtual teams and agile methodology
- Initial literature review also helped the researcher to fulfil the academic and ethical requirements

The second stage literature helped the researcher as following,

- During the data collection and analysis process, the literature review helped to understand some of the processes involved within the Agile software development. For example, while analysing the data the researcher needed to know about the roles and responsibilities of the entities involved, such as Scrum Master, Product Owner etc. Similarly, some of the notions about the grooming and climbing meetings were reviewed, and their timings in the Virtual-Agile development process. These themes were reviewed on run time basis as they emerged from the data.

- After completion of the data analysis phase, especially (after the selective coding stage) where categories needed to be integrated, the literature helped to allocate and relate main and sub-categories to their corresponding concepts. The literature helped to provide an in-depth evaluation of the various concepts and categories emerged from the data.
- The literature also helped the researcher to formulate and evaluate the findings by comparing it with previously available models and theories.

2.2 Conception of Risks in Projects

The definition of risks in organisational literature has been a point of discussion since more than three decades (March and Shapira, 1987; Kahneman and Tversky, 1979). March and Shapira (1987) explain that "risk" is something which can be related to a negative outcome which doesn't produce favourable results. They also proposed that risk could be an event or circumstance which produces losses but can be controlled using aptitude and skills. March and Shapira (1987) elaborated that by seeing risk as a manageable incident, managers avoid accepting risks. Managers do not agree to the conception that risks they face are intrinsic in the nature. They believed that risks can be associated with uncertainty which needs to be controlled using skills and information. Further, Sitkin and Weingart (1995) suggested that discussions could be essential to the literature of organisation theory in relation to managerial viewpoints on risk-taking and awareness of risk. Risk-taking capacity depends upon the entities and situations together with their personal abilities such as skills, experience, incentives and understanding of the events.

According to PMBOK (2004, p.238) which is known as well-established project management standard for elaborating guidelines, 'Risk' is defined as,

An uncertain event or condition that, if occurs, has a positive or negative effect on at least one project objective, such as time, cost, scope or quality.

Several versions of PMBOK (2001; 2004; 2013) outlines risks through the viewpoint of uncertainty, yet it doesn't postulate what uncertainty is. Henceforth, it can be assumed that not only uncertainty appears to be the reason for existence of risks, but also the opportunities; as happenings can have encouraging consequences on project objectives. The definition depicts that risk is objective in nature, and so are the uncertainties, and opportunities. This definition is well-accepted in the field of research but in organisational literature, diverse set of interpretations exists. Miller and Lessard (2001, p.438) defines risk as,

Risk is the possibility that events, their resulting impacts and dynamic interactions may turn out differently than anticipated. While risk is often viewed as something that can be described in statistical terms uncertainty applies to situation in which potential outcomes and causal forces are not fully understood: we refer to both as risks.

The authors have classified risk is not due to the cause of an uncertain event (condition, interaction) rather it is a possibility of an event that turns to have a different outcome than expected. They categorised risks under two main streams – internally originated i.e. "specific" and "controllable" – and externally originated "surprises" that cannot be forecasted before time. Hence, it can be drawn from the situation that risk is both an uncertain event which brings negative effects (surprises) and opportunity in terms of positive outcomes (specific and controllable).

Consequently, in accordance with this classification of risk, Unger and Eppinger (2006) suggest that categorisation of risks can be the possibility of uncertainty underlying from the project organisation's internal processes or can be the reason of external factors such as financial, technical, market and schedule. Unger and Eppinger (2006) description of risks can be referred to the concept of uncertainty where entities tend to have a deficiency of

knowledge or information about the forthcoming developments. Pertinent to the Unger and Eppinger's viewpoint, PMBOK (2004) labels risks can be the source of the weak management or procedures developed from project organisation's internal environment or external participants. Contrary to the standing of these definitions, some authors suggest that risks are inherent in the project work and cannot develop because of the internal or external factors. Barber (2005, p.584) espouse his viewpoint as follows in terms of risk,

A risk is a threat to project success, where the final impact upon project success is not certain. Some risks may appear to be internally generated but in fact are inherent to the nature of the project. For example, creating a breakthrough new technology carries a risk of failure simply because it is pushing the boundaries of what is possible. That risk would apply to any project team, in any organisation, that was trying to do the same work. It is inherent in the nature of the work and does not arise from the rules, policies, processes, structures, actions, decisions, behaviours or cultures of the project organisation or its host.

Barber (2005) advocates the adverse nature of the risk by relating it as a "threat" and designates it as an imperative project triumph feature. Similarly, there are several other definitions available which present the same viewpoint as of Barber (2005). In accordance, Chapman and Ward (2004) define risk as a set of uncertain events that could influence the process of achieving project's objectives. There are numerous perceptions in terms of risks in project management field. From the above discussion, following viewpoints can be inferred,

- 1) A risk is an uncertain event that could bring both positive (opportunities) and negative (threats) consequences to the project environments
- 2) Risk is a possibility due to an event/interaction/situation which diverges to that of the anticipated ones (surprises)

Similarly, several authors differ in their viewpoint but most of them have a consensus on one understanding that risk is an uncertainty which can transport loss and jeopardies to the project organisation. In accordance, International Organisation for Standardization (ISO) in its guide related to Risk Management (2009) describes risks because of the likelihood of occurrence of an (undesirable) incident and the consequences thereof. Hence, the above definitions can also be referred to the standing of ISO in which they have considered risks as hazardous proceedings that bring threats to organisations. Thus, the term 'risk' seems to be more crucial to elaborate in the field of project management as compared to other disciplines but can be perceived as some event or happening which brings numerous challenges to management, and therefore may have a positive or negative influence onto the projects.

In the field software development projects, the definition of risks is assumed like the concept of risks in projects apart from some technical factors which are a compulsion of every project environment. Software risks are dynamic and evolving in nature which generates hassles and causes probable losses to the projects. According to Williams et al. (1999), Software Engineering Institute (SEI) defines software risk as an event or incident which causes loss to the development projects in terms of increased costs, delays, loss of business and complete failures. Sherer (1995) advocates SEI definition by elaborating that software risk is a possible loss that could affect the product during development, utilization and maintenance stages. According to Cleden (2009), risks in software development projects has no independent existence, rather it arises from the complex and challenging situations. The risk is also understood as an ambiguity or indeterminacy which creates disruptions in projects without any prior prediction.

2.3 Conception of Uncertainty in Projects

Project management literature doesn't seem to have a straightforward distinction between uncertainty and risk. It treats uncertainty as an integral source of risk due to which the procedures to deal with them are alike too. Jaafari (2001) considering this issue proposed for more empirical research in this field whereas Atkinson et al. (2006) later advocate that in the recent times many attempts have been made to formulate the strategies for managing uncertainty in projects. Such research helped to know about the actions, processes and strategies that are required to manage uncertainty. Milliken (1987, p.136) defines uncertainty from organisational literature as,

Uncertainty is an individual's perceived inability to predict something accurately.

An individual experiences uncertainty because he/she perceives himself/herself to be lacking sufficient information to predict accurately or because he/she feels unable to discriminate between relevant data and irrelevant data.

Further to this aspect, three distinct perspectives have been suggested by Milliken (1987) in relation to uncertainty,

- 1) The events or happenings where we are unable to predict the probability of their occurrence (Pfeffer and Salancik, 1978)
- 2) The events or happenings for which a deficiency of information is there (Duncan, 1972)
- 3) The events or happenings for which we cannot predict accurately about the outcomes of a decision (Duncan, 1972)

In another aspect, Chapman (2006, p.309) suggests that,

Uncertainty is a lack of certainty in the simple common language sense... Risk is the possibility of departures from expectations which matters.

Hence, it can be deduced that uncertainty is a consequence of lack of knowledge or information about any event or incident expected to occur in future. Uncertainty can also be perceived as an inability to predict or forecast events where the deficiency of experience of familiarisation with the environments is less. Uncertainty can also be a consequence of lack of procedures or practices within a project environment due to which the project cannot achieve its scope. Milliken (1987) further propose that uncertainty might disturb the strategy and procedures of an enterprise. The approaches to deal with uncertainties are linked to effective decision-making processes which strengthen and recover the health of an organisation.

2.4 Risk Management in Projects

Risk Management is a process of identifying, assessing and managing those uncertainties which can put a negative effect on the outcomes of a project. Generally, risk management process in projects is undertaken before and during several stages of the projects, where suitable mitigation plans are suggested to control the effect of identified risks. It also helps the organisations to reduce, observe and control the probability of occurrence of unforeseen events. In other words, risk management is undertaken to maximize the opportunities and benefits for a specific project (PMBOK, 2004).

Risks can vary across several boundaries i.e. the rise of uncertainties in financial affairs, not being able to achieve the project scope or non-compliance to legal obligations; not finding the appropriate workforce, effects of incidents and natural disasters or breakdown of communications (Hubbard, 2009). PMBOK (Project Management Body of Knowledge) (2004) has provided guidelines in order to plan the strategies to monitor and control the risks. These guidelines vary from project to project (depends on nature of the project) but are standardized for a certain project environment. The guidelines provided help the

organisations to reduce the effect of unpredictable events which are likely to occur during the course of a project (PMBOK, 2004).

Risk management is an iterative process which stores the risks and describes how they will be identified, scrutinised and ranked. The process also suggests responses to risk indicators, identifying the responsible persons, and monitoring and control the risks throughout the project lifecycle using an action plan. Risk management process is completed in four stages (PMBOK, 2004).

- **Risk Identification**

It is an iterative procedure which is carried out throughout the project. The individuals connected to the process should be stimulated to recognise the potential risks. It is the process that identifies the risks which can disrupt the project and then observe the occurrence of those risks closely. Risks identification process can be completed with relevant stakeholders of the projects, such as project leaders, team members, investors or experts (Hopkins, 2012).

- **Risk Analysis**

Risk analysis is a phase of prioritizing and sorting out risks, and then observing their likelihood of occurrence and impacts on the project activities. Risks analysis process illustrates the threshold and tolerance levels of risks, which helps to define responses in the risk response planning phase. Like risk identification, risk analysis is an iterative process that occurs throughout the project lifecycle. Risks analysis can be performed using,

- Qualitative Risk Analysis

Which includes prioritizing the risks that have been identified for an additional action. The process ranks the risks with defining their probability of occurrence and its influence on project scope, time, cost and quality. Qualitative risk analysis is performed using experiences or lessons learned

from the previous projects. It is a projection which can be proved either accurate or incorrect in the future.

- **Quantitative Risk Analysis**

It is the statistical way of analysing and giving an arithmetic score to risks based on their probability of occurrence and influence on the project proceedings. Quantitative risk analysis can be performed using various tools such as Monte Carlo Simulation, Sensitivity analysis etc., which further helps to provide several probabilities about a risk event.

- **Risk response planning**

Risks response planning is a procedural process that involves recognizing and allocating an action or response to each identified and analysed risk. According to PMBOK (2004), risk response planning is a process that eliminates the threat and generates more options to heighten opportunities. The responses for the identified risks can be generated under following intentions,

- Mitigation
- Contingency
- Allocation
- Prevention
- Approval

These responses depend upon the organisational preferences and their tendency to deal with the risks. Concerned project stakeholders can decide upon a strategy on the bases of their experiences or lessons learned from the previous projects.

- **Risks Monitor and Control**

Risk Monitor and Control is a process of recognizing, scrutinizing and reassuring the risk responses while keeping their records, re-inspecting and revisiting the results of actions applied. The process is about frequently reassuring and informing about the occurred risks to the management. This phase helps project stakeholders to review project progressions, report ambiguities and manage risks time to time within a project life cycle (Hopkins, 2012).

2.5 Risk Management in Agile Project Development – A Challenge

Agile development is a team-based approach and is effective for small co-located teams (Lalsing et al., 2012). Therefore, the team-based approach can affect the performance of the teams when adapting rapid changes (Shahrbano et al., 2012). As business requirements have become more dynamic and interdependent, conventional approaches as per research problem needs an attention to address the evolving complexities and uncertainties. For making agile successful, organisations are required to network most of their change efforts to the development teams. Arikpo and Osofian (2011) suggest that teams act as 'fulcrum' on which the organisation apply efforts, and through which these efforts are converted into software products for the clients.

Cockburn and Highsmith (2001) proposed that agile project management doesn't seem to have any traditional risk management practices rather it focuses on the collaboration and interaction to deal with the risks and issues when evolved within projects. Estimation of required efforts is a great challenge when the project is in the initial phases (Deemer et al. 2010). Lindvall et al. (2002) acknowledge that non-compliance with the established practices can give rise to potential risks as determined from lack of motivation for attending daily meetings and elaborating the concerns related to developmental work. Therefore, Cockburn and Highsmith (2001) and Nerur et al. (2005) propose that most common risks in agile projects are related to the peoples and procedures undertaken in development process.

Cho (2008) undertook a research to discover issues and challenges in Agile software development. Cho (2008) found out that there are four main types of issues or challenges found in the Agile software development:

- 1) Human resource
- 2) Development process
- 3) Environmental Factors
- 4) Information system and Technology

Boehm and Turner (2005) proposed that human-related issues are the most crucial to manage in Agile development which hurdles the successful product delivery. Cockburn and Highsmith (2001) further advocate Boehm and Turner's (2005) viewpoint and mentioned that individual competency can play an imperative role in the success of the Agile projects. Further, when Agile is merged into the virtual project environment where maintaining collaboration and interaction among teams become difficult due to the difference in geographical locations (Shrivastava and Rathod, 2015); Lee and Baby (2013) advocates that due to the reasons of being geographically dispersed, dynamic risks become more prominent in such project environments.

2.6 Why and How Virtual-Agile Format is required?

Rico (2011) who has been a leader in U.S. governmental agencies for 25 years, presented his views on the working of virtual and agile projects together. He elaborated that in order to meet changing and varying demands of customer, virtual working is preferred in Agile projects due to the following reasons **(WHY)**

- All the talented individuals cannot be collocated at the same place
- It is impossible to develop a unique team for developing every product or services
- Virtual teams are preferred to solve the issues from the contributions of several brains

- In today's world, customers require rapidness and swiftness with dynamics and variability. The project needs to be flexible in order to be acceptable according to customer's request. Virtual teams can meet those unanticipated and unplanned project scope fluctuations.

He further elaborated that successful implementation of Agile methods in virtual format requires **(HOW)**

- Efficient and extravagant Leadership who is trained and experienced from working in virtual as well as agile projects
- Clear deliverance and explanation of project aims and objectives to individuals
- Periodic physical meetings
- Excellent communication
- Reducing the effect of time and distance differences
- Vigilant attention towards cultural differences

2.7 The Functioning of Virtual vs. Traditional Teams

Hackman (2002) elaborated that teams and teamwork have always been a significant contributor to achieving organisational objectives. A team comprises of entities from various backgrounds working independently to accomplish tasks and objectives. Teamwork generally enhances self-confidence, skills and capabilities, adaptability towards work, flexibility and self-awareness in individuals. As the developments in information and communication technologies (ICTs) have provided a unique opportunity to organisations to adapt new dynamics of working and relationships among team members, this has ultimately given rise to virtual or distributed form of working (Berry, 2011).

A wide range of definitions are available on virtual teams. Powell et al. (2004) specified that virtual teams consist of individuals dispersed physically, organisationally and constrained by time; brought up mutually together by advance computer-mediated technologies for

attaining one or more business objectives. In another perspective, Ale Ebrahim et al. (2011) stated that virtual teams are positioned at more than one site or location, functioning collaboratively for the achievement of a common task. Organisations that work around the globe require the information and competence from numerous individuals, regions and areas. Virtual projects give an opportunity to individuals from different organisations to function collaboratively for the development of a new product or expansion of a process (Precup, 2006). Following Table has been drafted by referring to Berigel (2008), Kratzer et al. (2005), Rice (2007).

Table 2.7: A Comparison between Traditional Vs Virtual Working

VIRTUAL PROJECT TEAMS	TRADITIONAL PROJECT TEAMS
Geographically dispersed	Works at same location
Constrained by distance, time, information technologies and organisational limits	Constrained by time and organisational boundaries only
Tasks are highly structured with lack of guidance	Tasks are straightforward and easily guidable
Meetings & Discussion: Fully dependable on computer media for communication	Face-to-Face meetings and discussions, more elaborative and explanative on issues
Process management is complex and visionary	Process management is easy and observable
Work around the clock	Work during office hours only/Overtime
Highly skilled individuals from diverse backgrounds and countries	Commonly consist of individuals from same backgrounds
Less costly in terms of arranging workplace and hiring labour	Arrangement of workplaces and skilled labour cost more
Freedom of work results in team development	Have to follow the guiding principles
Efficiency depends upon strict procedures, team development and competence in management	Efficiency is usually associated with timely face-to-face meetings and discussions

More exposure and interaction with foreign markets	Very little exposure and interaction with different parts of the world
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2.8 The Progression of Agile Project Management

The criticism to traditional project management methodology with uprising needs of increasing novelties gave rise to the discovery of new project management methodologies. The advent of new project management methodologies is associated with the field of software development and information systems (Aguanno, 2004; Amaral and Conforto, 2008; William, 2005). The most commonly used and adaptable approach is an Agile methodology in the IT industry (Chin, 2004; Highsmith, 2004). Agile is an iterative and cumulative methodology introduced for managing the projects and shape events in the sectors of engineering, information technology and new product development, in a flexible and collaborative environment. Agile software development is one of the major areas in which the Agile methods are successfully applied. Agile software development comprises of methods which provide solutions to problems that grow through communication, collaboration and interaction of teams. It offers robust planning, progressive development, and prompt delivery of assignments, frequent enhancements and is responsive to swift and flexible variations (Chin, 2004). Following table shows a brief comparison of characteristics of traditional and agile methodologies (Spundak, 2014).

Table 2.8: Distinct Characteristics of Traditional and Agile Working

Features	Traditional	Agile
Pre-requisites	Resourceful, innovative; prerequisites uncertain	Pre-requisites clear; less
Consumers	Not concerned	Close association
Credentials	Formal documentation needed	Implicit Data
Project dimensions	Greater in size	Usually smaller projects

Organisational support	Utilize existing processes	Exhibit Agile procedures
Participants	Not fixed, can be altered or distributed	Usually collocated and smaller in size
Complexity	Serious Consequences on failure	Less complex and understandable
Project strategy	Linear; straightforward	Complex; Iterative

When development around the world was changing and traditional project management methods like waterfall, spiral model, incremental model were getting old-dated, there became a need to introduce new methods and develop new practices which could help,

- Fulfilling the customers demand taking superiority over in compliance with original procedures
- Focusing on prevention to cope with system and reduce the expenses of alterations during the course of improvements in the process
- Eradicating initial alterations that are unresponsive to changing business conditions, and results in business failure
- Confronting with innovative market demands and expectations, and helps in developing high-quality software meeting customer satisfaction.

Agile Manifesto was developed in 2001 in the exploration of developing new software methods. The representatives of seventeen different organisations summarized their perspectives by mentioning that Agile movement is not an anti-methodology, but in reality, it is developed to reinstate the word methodology. According to Beck et al. (2015), through the development of Agile Manifesto, the values were created in terms of,

- People and their alliance over procedure and tools
- Operational software over comprehensive credentials
- Customer cooperation over contract negotiation
- Countering a variation over following a plan

Highsmith (2002) elaborates that Agility actually means to

- Deliver promptly and rapidly
- Be able to adapt changes and variations
- Change frequently and bear alterations

As Agile procedures vary in functionality, they do share some common features that include iterative procedures and emphasize on collaboration, communication and reducing the resource-intensive works. Working iteratively gives an opportunity to be flexible to fluctuating requirements. Working in co-location and aiming at communication can assist teams getting a response immediately rather waiting for correspondence for a long time; thus, decreasing the transitional artefacts that do not contribute in achieving deliverables (meaning that additional resources can be allocated to the improvement of product and accomplished earlier) (Glass, 2001).

Cockburn and Highsmith (2001) also highlighted that Agility is actually not concerned with the new practices, but it is concerned with the identification of individuals which brings a key success to projects together with efficiency and flexibility. According to Beck et al. (2015), the Agile platform combines the following methods that are applied and best suited according to requirements, organisational preferences and process variability. Costa et al. (2004) also highlighted that all of these methods which comes under Agile umbrella can be used in software development projects in accordance with the nature of flexibility, consumer requirements, adaptability and being receptive to alterations and variations. The methods are,

- Extreme Programming (XP)
- Scrum
- KANBAN
- Feature Driven Development (FDD)

- Lean Development
- Dynamic Systems Development Methods (DSDM)

2.9 Overview of Preceding Research

In the section 1.3, an overview of the previous research has been shown. A preliminary literature review helped researcher to know what has already been done in the field. The author here mentions some of the key articles pertinent to the context of this study.

2.9.1 Risk-Driven Model for Work Allocation

Lamersdorf et al. (2011), while analysing the global software development projects, discovered issues related to work allocation within the distributed teams, such as inexperienced individuals handling complicated tasks or depending upon manager experience and how they allocate the work. Lamersdorf et al. (2011) proposed that these actions could result in low productivity and have a negative influence on the project objectives. There are several risks associated with work allocation in global software development and therefore proposed of risk-driven model for systematic working. The risk-driven model by Lamersdorf et al. (2011) comprises of two main levels as shown in figure 2.9.1(a).

- 1) Task allocation to teams based on the project and site characteristics
- 2) Observation of the task allocation with respect to potential risks

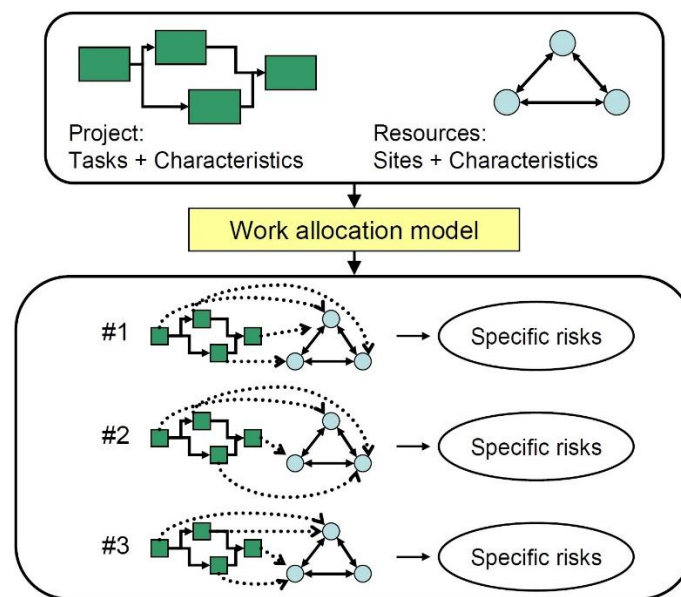


Figure 2.9.1 (a): Work Allocation Input-Output Model by Lamersdorf et al. (2011)

The model as shown in figure 2.9.1 (b) comprises of three sub-models, i.e. stochastic assignment model and shared casual model for recording organisation-related issues, and risk identification model to forecast possible risks. The focus of this model is also on the work allocation and project related aspects. The author proposes that the model does not seem to manage nonconforming risks or evaluate the performance of the risk management process. Similarly, the model has not provided sufficient information for dealing with project work and resources. In the case of possible risks, how the resources come across each other to deal with the complications.

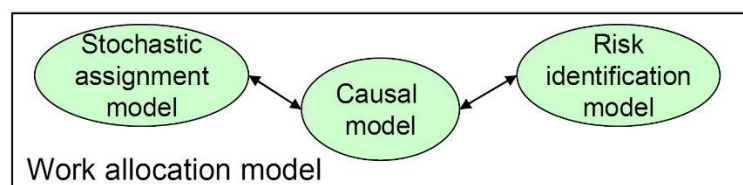


Figure 2.9.1 (b): Work Allocation Basic Structure by Lamersdorf et al. (2011)

2.9.2 Mudumba and Lee's Perspective on GDSD Risk Management

Mudumba and Lee (2010) when conducting research for managing risks in global distributed software development (GDSD) proposed an Agile Risk management framework which tends to identify the dynamic risks through interaction analysis among multiplicity elements in GDSD project and mitigate the dynamic risk identified. They studied the interaction between different components of GDSD projects, identified risks and mitigation strategies described in the table below:

S/No	Risk Type	Mitigation Strategies
1	People related	Requirement of Agile People Management Skills <ul style="list-style-type: none">- Localization- Partnership management- Multi-culture management
2	Process related	Use of Agile Project and Process Infrastructure <ul style="list-style-type: none">- Modular approach- Decentralized knowledge management- Agile Task Planning
3	Technology related	Requirement of Agile IT Strategy and IT Infrastructure <ul style="list-style-type: none">- Loosely centralized IT Strategy- Standardized IT platform- Comprehensive application infrastructure for communication and collaboration
4	External related	Use of Agile Environment Management Skills <ul style="list-style-type: none">- Building market analytical capabilities- Vendor management- Centralized supervision over backup systems and recovery policy- Delegation of legal compliance responsibility to local champions

Mudumba and Lee (2010) suggested that for the people-related dynamic risks, there is a need to apply Agile people management skills that arises from the people-people interaction. Using localization skills to develop a local management structure and system help to fulfil the needs of the local teams. Here it is important to understand the social and cultural background of the locally distributed teams. Localization also includes understanding of managerial and technical skills. Mudumba and Lee (2010) further identified that partnership management is of great significance in the GDSD and therefore need building up a strong

strategic partnership between the distributed members. Similarly, for the process-related risks, there is a need to understand Agile infrastructure to overcome dynamic risks. Mudumba and Lee (2010) suggested that using a modular approach between the multi-teams in GDSD can help avoiding repetitive tasks and there is a need to develop a centralized knowledge management system to help team members perform planning with respect to their interests, expertise and motives.

Consequently, Mudumba and Lee (2010) elaborated some strategies to overcome technology-related risks by understanding the needs of the GDSD teams and providing constructive application of infrastructure for communication and collaboration. This helps to specify guidelines for maintaining integration between different components of the GDSD. Further, for external type risks, they advised to get support from the people who have worked previously in an Agile environment who can help estimate market analytical capabilities to help providing support to leadership for sensing both the local and global competition. Mudumba and Lee's (2010) perspective on GDSD risk management is based on conventional elements from the literature. The dynamic risks identified were mainly from the secondary sources and then tested into different project environments to determine the mitigation strategies.

2.9.3 Categorisation of Risk Factors for Distributed-Agile Projects

Shrivastava and Rathod (2015) identifying distributed software development projects following Agile methodology as critical area of study identified some risk factors on the basis of Leavitt's organisational model of organisational change. They proposed that risks in DAD (distributed agile development) can be categorised into five main streams:

- i. Group Awareness
- ii. Technology Setup
- iii. External Stakeholder

- iv. Project Management
- v. Software Development Life Cycle

The mapping of the identified risk categories to the components of Leavitt's model of organisational change has been shown in the following figure:

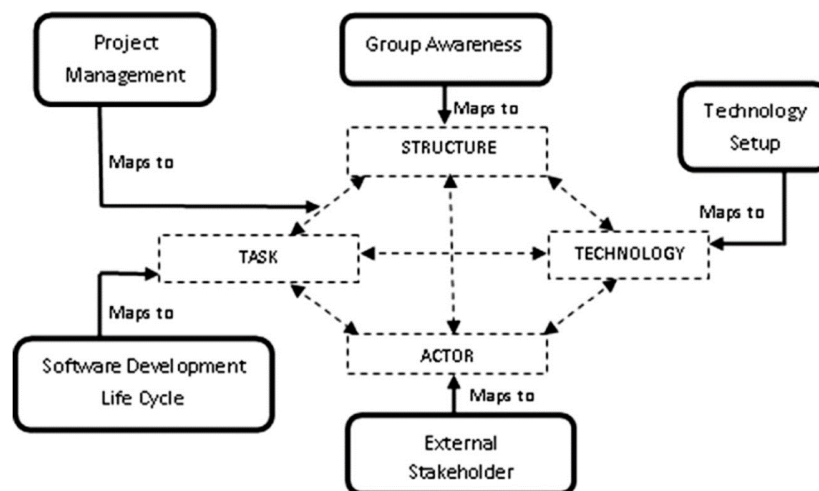


Figure 2.9.3: Mapping of Risk Categories by Shrivastava and Rathod (2015)

Shrivastava and Rathod (2015) further elaborated that adopting a DAD environment enhances business opportunities for an organisation and help recognising its abilities in the global context. Shrivastava and Rathod (2015) also identified several risk factors under these five main categories and proposed for the mitigation strategies as well. For example, having unclear objectives in a project requires extensive involvement of product owner within a project where he can interact with distributed teams. Similarly, issues with pair programming requires project manager to carefully create pairs of developers to ensure compatibility. Shrivastava and Rathod (2015) work consists of various types of risk factors identified in DAD but its focus remains limited to software development projects only which is different to the scope of this research.

2.9.4 Process-Planning Methodology

Betz et al. (2011) proposed a method to deal with risks in global software development process planning. The methodology claimed to enhance the process planning by recognising the associated risks. Betz et al. (2011) proposed that the risk associated with the global software development disrupt the project processes throughout the development cycle which needs to be controlled using the four basic steps as shown in figure 6.3.3.

- 1) Process modelling
- 2) Risk analysis for undertaking the risk management process
- 3) Simulation and evaluation of process enhancements
- 4) Selection and Transformation

Betz et al. (2011) further evaluated that the proposed method is a tool developed for specific phases, and as such depends upon the professionals and skilled to analyse the probable risks, which brings the assessed value independent of user experience. The author believes that the proposed tool only supports partial evaluation of the risk performance but does not consider them from a product perspective. The method does not seem to consider major risks and challenges that are linked with the software development projects and is only valid for the specific type of risks in nature.

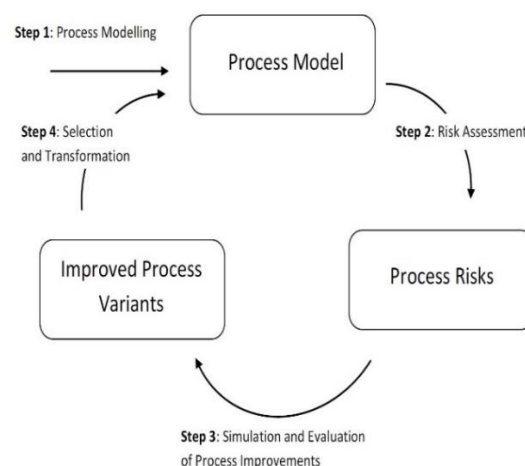


Figure 2.9.4: Process-Planning Methodology (Betz et al., 2011)

2.10 Summary

This chapter has demonstrated various viewpoints in relation to the concept of risk and uncertainty. The chapter has also provided an understanding of the generic risk management processes from various Body of Knowledges. The chapter showed the emergence of Agile project management over the last decade in the IT industry and its significance now in the software development industry. The chapter also provided readers an overview of the Agile project management methodology and its relationship with the Virtual projects. Together with an elaboration of Virtual-Agile IT projects, the chapter has shown an understanding of the previously available literature in the context of project and software risk management. The chapter has thus provided readers' a preliminary overview of the literature in relation to this study.

CHAPTER 3: RESEARCH DESIGN

3.0 Introduction

This chapter highlights researcher's philosophical beliefs and the reasons for selecting qualitative methods for conducting this study. The chapter also discusses various qualitative methods and the details for choosing grounded theory methodology as a tool for data collection and analysis. Various versions of the grounded theory are highlighted with a justification of choosing the Strauss and Corbin's (1990; 1998; 2008) version. Basic steps of the paradigm development process are discussed to provide an overview of the methodological aspects to the readers. The chapter has been structured as follows,

Section 3.1: Research Paradigms

Section 3.2: Paradigms and Research process

Section 3.3: Proposed Paradigm: Interpretivist

Section 3.4: Philosophical Assumptions of Interpretivist Paradigm

Section 3.5: Choice of Methodology: Qualitative

Section 3.6: Grounded Theory Methodology (GTM)

Section 3.7: Strauss and Corbin's GTM Version

Section 3.8: Inductive Theory Generation

Section 3.9: Summary

3.1 Research Paradigms

According to Collis and Hussey (2009), research paradigm is based on individual's beliefs about the world and the nature of knowledge. The paradigm is also regarded as a philosophical framework which directs the researcher to undertake a scientific research. In another aspect, Denzin and Lincoln (2005) claim that research paradigm is a web of researcher's own ontological, epistemological and methodological stance. Before the investigation of a phenomenon, the researcher should be able to determine that how the research would be conducted. It is valuable to identify and acknowledge the researcher's own paradigm that can be associated with the research problem.

For developing a strong research design, the researcher should choose a paradigm which is compatible with his beliefs about the nature of the reality (Mills et al., 2006). Fossey et al. (2002) in another viewpoint claims that research paradigm reflects the classification of thoughts, or views of the world used by a group of investigators to produce facts or knowledge. It is also believed to be a set of expectations, guide research procedures and standards for rigour that are shared and presumed as beliefs of the investigator. Merterns (2005) also claims that the paradigm is the view of the researcher's own theoretical perspective that is based on the description of the actual nature. Paradigm directs applying an appropriate methodology to create an association among movements that lights up the phenomenon by moving across the adjacent events and effort to link it with similar events. An appropriate chosen paradigm actually sets the goals, motivation and prospects for the research. There are no grounds for choosing the right methodology, methods or literature without deciding on a paradigm. In another view allied to the paradigm, Biklin and Bogdan (1998) recognises it as a group of randomly gathered concepts and propositions that influence the way of thinking and conducting research.

In social science research, the two most commonly known paradigms are Interpretivism and Positivism. Collis and Hussey (2009) suggested developing an understanding of the various type of paradigms together with acquiring an understanding of science and beliefs of the humanity. Further, they argued that Positivists uses the social sciences' methods and techniques to study the social world as natural sciences use to investigate the physical world whereas Interpretivists claim that the social world is subjective and therefore natural sciences' techniques cannot be applied. They prefer to look at the world by getting in contact with the social world and interpret the reality.

Positivists as compared to Interpretivists (anti-positivist) have an objective viewpoint where their emphasis is on computing variables and testing propositions related to wide-ranging causal explanations (Creswell, 2007). Positivist researchers underpin quantitative methodologies where they prefer to find truth through verification and statistical analysis by using valid and reliable methods to describe and explain the events (Bryman and Bell, 2011). In contrast, Interpretivists underpin qualitative methodologies carrying assumptions of relativist ontology and subjectivist epistemology, assuming that meaning is implanted in the participants' experiences and researcher's own perceptions (Merriman, 1998). Researchers who undertake qualitative methodology involve themselves in a culture by observing people and their interaction, getting indulged in activities, analysing existing documents, undertaking case studies or interviewing relevant people. The main aim of the qualitative researcher is to get an insight of the phenomenon or the group under study. As compared to positivist, qualitative researchers do not believe in experimental research studies, they believe that reality is multiple and variate, and cannot be fragmented, studied or investigated in a laboratory, rather it is developed or constructed through an investigation of the natural context (Candy, 1991).

3.2 Paradigms and Research Process

According to Creswell (2009), the researchers who are more likely to explore facts may fall under positivism whereas the researchers who are interested to study the feelings, attitudes and human behaviours, they would most probably follow the interpretivism paradigm. Further, Johnson and Clark (2006) stated that the differences between these two types of paradigms may be visible in research strategies, data collection and analysis methods. Guba (1990) claims that research paradigm can be understood by elucidation of its

- Ontology i.e., to know about reality
- Epistemology i.e., to determine how do you know something? and
- Methodology i.e., how you are going to find it out?

Denzin and Lincoln (2005) also recognises paradigm as the researcher's 'web' that embraces the ontological, epistemological and methodological interpretations. The following figure is adapted from Hay (2002, p.64) to show a relationship between ontology, epistemology and methodology.

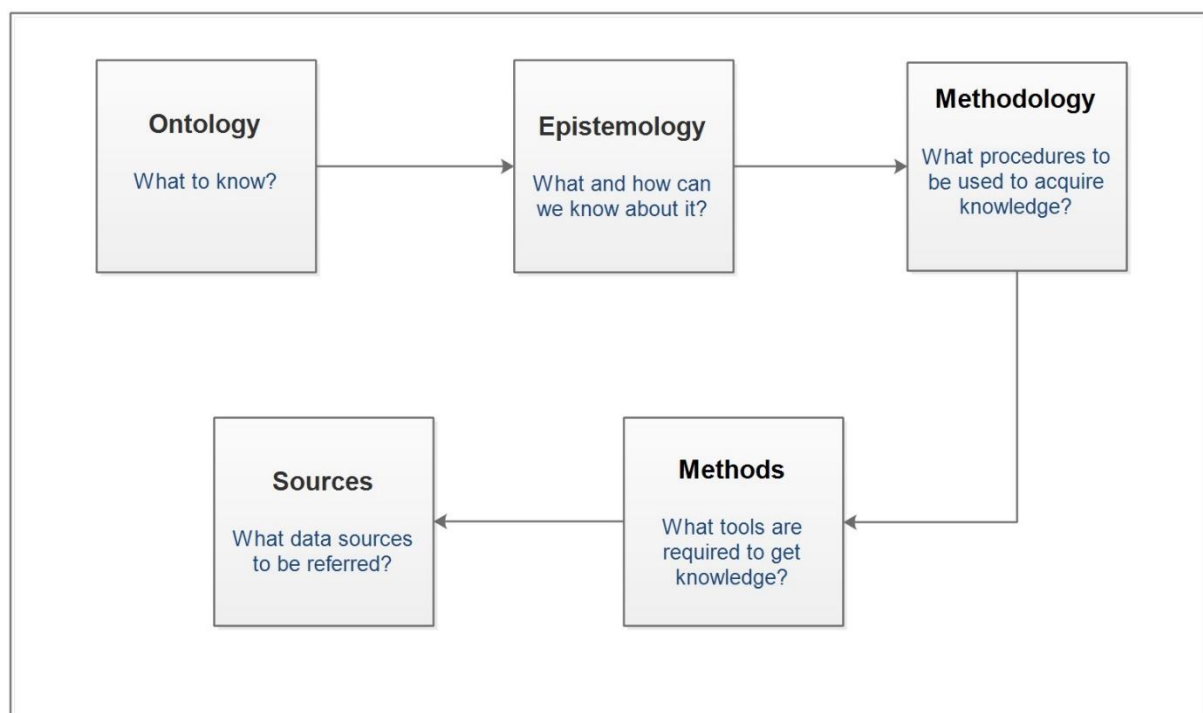


Figure 3.2: Philosophy and Research Process

The term research methodology can be referred to the style thinking about a reality of a phenomenon and the means of reviewing that reality (Ryan et al., 2002). The methodology is also referred as a research strategy undertaken by a researcher practically that assist him finding out whatever he believes can be known. It is a combination of ontological and epistemological principles, that helps him develop guidelines to conduct the research and ideologies, actions and practices that rule his research (Sarantakos, 2005).

3.3 Proposed Paradigm: Interpretivist

The information in this research study has been socially constructed rather objectively determined. The investigator approach to knowledge was based on subjectivity throughout the study which assisted him to translate the view of multiple participants. According to Denzin and Lincoln (2005), Interpretivism was developed in reaction to positivism paradigm in the social sciences research. It is also recognised sometimes as constructivism as it focuses on the aptitude of the researcher to construct meaning where he claims to interpret the opinions, beliefs and viewpoints of individuals. According to Mackenzie and Knipe (2006), interpretivist approach to conduct research is based on recognising 'the domain of human experience'. In other words, it is the paradigm which proposes that the information is socially constructed through the individuals' contributing vibrantly in the research journey; where the investigator tries to know about the phenomenon from those who have experienced it.

Klein and Myers (1999) proposed that the Interpretivist paradigm construct the nature of reality by interactions with the social world and maintain a connection between the researcher and what is being discovered; together with the situational constraints shaping this process. Denzin and Lincoln (2005) recommend that Interpretivists are directed by the collection of views and state of mind in relation to the social universe, and the process of how it should be assumed and investigated. In the interpretivist paradigm, information is

based on specific conditions either they are ancient, ethnic, time-based or subjective, and occurs in numerous ways as a symbolisation to real evidence. Interpretivist paradigm generally emphasises on identifying and translating the significance of human involvements and their actions in the situations (Fossey et al., 2002).

For the research study, the researcher presumed that his philosophical assumptions relate to Interpretivist paradigm as he believes in the subjective view of the world and can better construct reality by remaining open to knowledge and viewpoints of respondents. Further, Interpretivism supported researcher's stance that experiences, and realities vary from person to person, and therefore there could not be any specific risk management procedure or strategy that can be applicable to various Virtual-Agile project environments. After conducting gap analysis, the researcher found out that every project has its own characteristics and variations, therefore, differences are obvious and expected to vary in managing risks. Because of the globalisation and developments in information and communication technologies (ICTs), risk management differs in intensity and applications as per the requirements of every Virtual-Agile project. Likewise, during the data collection process, Interpretivism supported to translate participants' opinions about a condition or a problem which was under investigation and identify the influence of their own background and familiarities. Further, the researcher's role in developing the paradigm was equivalent as his respondents, due to the nature of the qualitative studies. Additionally, the proposed paradigm supported researcher's assumption to not to start with a theory or hypotheses rather *construct or generate a theory* from the outlines and words lying within the boundaries of the phenomenon being explored. According to Hudson and Ozanne (1988), use of such emerging and unique attitude is frequent within the Interpretivist belief that assist the researchers to familiarise themselves with the environments, and then acquire the knowledge of phenomenon when getting involved within the settings. Thus, being an

interpretivist, the researcher interpreted and translated the meanings in participants' actions rather objectively determining them (Neuman, 2011).

3.4 Philosophical Underpinnings of Interpretivist Paradigm

Being an interpretivist, the researcher claims to share the philosophies of Relativist Ontology and Subjective Epistemology about the nature of getting information and reliability. The belief that Interpretivist assumptions are based on multiple realities (Hudson and Ozanne, 1988); Lincoln and Guba (1985) further states that these multiple realities rely on additional classifications for the elaboration of meaning which makes it further challenging to interpret the stationary realities. Therefore, the researcher considers that knowledge is a communal reality, based on judgments which can come under examination through individual interpretation.

3.4.1 Relativist Ontology

Crotty (1998) assumes ontology as the 'study of being' whereas Denzin and Lincoln (2005) acknowledge ontology for raising elementary inquiries about the nature of realism and nature of entities in the world. They further believe that reality is built through ability of human beings to describe their feelings, thoughts and meanings constructed socially and observationally. It tends to fix a subjective experience and a view that nothing occurs externally of our thoughts. Therefore, the ontological stance of the Interpretivism is directed towards Relativism. According to Guba and Lincoln (1994), relativism is an understanding that reality is subjective and variates from individual to individual. Reality is generated with consciousness and without consciousness, so everything in the world is meaningless. With an ontological point of view, the reality is individually constructed; with having a perception that there are as much as realities as individuals.

Denzin and Lincoln (2005) further describe that the relativist view of ontology is not differentiable from the subjective experience of that reality. In this view of philosophy, the

reality is individuals' knowledge and individuals' knowledge is reality. By translating the numerous experiences of humans, numerous realities can be understood. The paradigm of realities evolves with the number of people having different experiences. Thus, the perspective of having relativist ontology is to understand the personal experiences of realities and numerous truths.

3.4.2 Subjective Epistemology

According to Crotty (1998), epistemology or the study of knowledge is an approach to understanding and describing, how I know what I know. The explanation to Crotty's (1998) view is that we cannot distinguish ourselves from what we actually know. Epistemology identifies the link between an individual who knows and the knowledge itself, and inquires that how he or she knows about the world? In other words, Denzin and Lincoln (2005) describe the situation when the researcher and object of research are connected together to know who we are and how we look at the world which is a principal perspective in understanding ourselves, others and the world. Further, it is all about how the meaningful sense of the world is made.

The Interpretivist epistemology is based on subjectivist assumptions that real-world phenomenon doesn't exist separately beyond our knowledge (Crotty, 1998). Multiple persons construct meanings in different ways, but the truth is established through mutual agreement formed by co-constructors (Pring, 2000). Crotty (1998) further clarifies that knowledge and expressive reality are constructed through contact between individuals and their external world, and then formed and conveyed in a social context. Therefore, the social world can be realised from the interpretations or opinions of the participants contributing to the study. According to Annells (1996), ontological perspectives narrow down epistemological beliefs yet there is an epistemological degree within ontological demarcations. The researcher cannot separate himself from the knowledge he has and therefore has a relationship with the knowledge or phenomenon he is uncovering.

Keeping under considerations of several philosophers, for this study, the researcher framed his interaction with the phenomenon depending upon his ontological view. The researcher further highlights that being an Interpretivist assisted him up to explore the phenomenon in depth, and subjectively through direct interaction with people working under certain settings, rather observing it from outside objectively. Thus, the perspective of the researcher in the Interpretivist paradigm underpinned his procedures and assisted to thoroughly know, describe, and interpret social processes and settings through the eyes of multiple respondents varying from person to person (Cohen et al., 2007). Having beliefs of relativist ontology and subjective epistemology helped him to look for various practices or strategies around different regions, and then translate them according as per his own perceptions about the phenomenon being investigated. Following table has been designed by the researcher which highlights the philosophical assumptions of Relativist Ontology and Subjective Epistemology underlying Interpretivism. The table has been drafted under the guidelines of Creswell (2009), Crotty (1998) and Denzin and Lincoln (2005).

Table 3.4: View of Ontology and Epistemology in Interpretivist Paradigm

Ontological Assumptions	Epistemological Assumptions
<ol style="list-style-type: none"> 1. Based on the human experience and interpretation, the reality is indirectly created and is subjective. 2. Individuals translate their own meaning of occasions. 3. Occasions or happening are unique and cannot be anticipated. 4. There are abundant opinions on one event or incident. 5. In social sciences, relationship is determined by translated connotation and codes 	<ol style="list-style-type: none"> 1. Information is collected through an approach that acknowledges the dissimilarities between humans and the objects of natural sciences and thus necessitates the researcher to know the subjective meaning of social events. 2. Information is reflected from precise settings and is not adaptable to simplistic clarification. 3. Information is collected through interpretation of particular experiences

3.5 Choice of Methodology: Qualitative

Schwandt (2001) describes qualitative research methods as a vast range of knowledge which help to define, interpret, and translate the realities rather than measuring or quantifying them in the social world. Qualitative research, in simple words, looks towards the context rather than statistics. Qualitative methods were preferred for this research study as they seemed to be compatible with the beliefs of the researcher and suited well to address the problem (Creswell, 2007). Further, the exploratory nature of the study suited best to the qualitative methods, where the researcher wanted to interact with the participants to know about their experiences and multiple pictures of the social world where they have been involved in. Further, Creswell (2007) proposed that the use of qualitative methods can also be influenced by the researcher's own background, interests and experiences that could support him to interpret the realities.

Contributing to the Section 1.6 of the study, the researcher believed that the nature of the research problem can be studied using qualitative methods by interacting with professionals who could provide solutions through their experiences and beliefs. The researcher also assumed that by getting indulged with such individuals who were the part of IT organisations or managing Virtual-Agile projects can help better interpreting the behaviours and actions required to reduce risks and uncertainties in Virtual-Agile projects. The presumptions of the researcher were found fruitful as qualitative research methods helped him to develop theoretical relationships, investigate and describe the research phenomenon rather than being only dependent on the pre-defined hypotheses. Additionally, the gaps in literature supported the perspective of undertaking qualitative methodology to contribute to the existing literature. The researcher also assumed that the individuals who were currently or had previously been the part of such project environments could better contribute from their experiences, behaviours and perceptions to depict the knowledge in terms of managing, responding or reacting to risks in Virtual-Agile project environments.

Consequently, the results of this study were established depending upon new empirical grounds which were investigated through the opinions of the participants rather depending upon pre-conceived arguments of the preceding researchers. The researcher would also like to highlight here that at the methodological level, it was really beneficial to record the viewpoints of practitioners or project managers with having one-to-one interaction. He, therefore, after a set of initial interviews decided to interact with individuals from different organisations and regions, and discuss how they prefer to avoid uncertainties or ambiguities, and further control risks during a project life cycle.

Before getting into that social world for gathering data, the researcher inquired few questions to himself that helped him to look for the basic information in relation to the research problem i.e., what can be relevant methods or practices often undertaken to eliminate uncertainties or risk factors; what strategies the people might undertake to reduce the effect of risks and manage them efficiently; how people should interact with each other while being geographically dispersed; what level of interaction should be required to reduce risks in that social process; how the change in time zone which is itself a big risk can disrupt project work; or what level of collaboration can be required to make project successful. Thus, the researcher decided to go for qualitative methods as they were found most relevant to the context of the study and researcher's philosophical beliefs, which further helped to investigate the insights of the social phenomenon by interpreting the realities and perceptions.

3.5.1 Why Qualitative Methods appropriate for this Study

According to Lincoln and Guba (1985), Qualitative research focuses on the richness of the evidence rather concentrating on numbers as in quantitative research. As the research was mainly concerned with the exploration of strategies/practises of project managers that reduces risks, qualitative methods were found preeminent to determine these characteristics

by making interactions and questioning the concerned people working under such circumstances. Qualitative methods include the following parameters

- Exploration and findings are more comprehensive and close to reality
- An in-depth research process noting attitude and behaviours rather focusing on the utilization of tools numerically (Creswell, 2007)

Crotty (1998) further suggests that qualitative research is undertaken when there is very little known about a research problem or the phenomenon, and the researchers want to discover or learn more about it. Traditional risk management methods and frameworks which already existed in literature; Keshlaf and Riddle (2010) identified major gaps between the available literature and the actual risk management practices undertaken in software development industry. The researcher presumed that this would have been one of the major causes for the existence of research problem and therefore requires further investigation. Similarly, the researcher further identified that the available risk management framework or theories are difficult to comprehend and operationalise in the software development industry. Therefore, authors such as Shrivastava and Rathod (2015), and Vijayaraghavan et al. (2014) even conducting qualitative type studies called for more empirical studies using qualitative methods to discover innovative risk management techniques that could best suit with the Agile practices in virtual format.

Consequently, due to the innovations, project and risk management practices and methods might change over time, place and settings (Maylor, 2010). Such processes can be known or compiled only upon interaction with suitable people or a group working under the desired circumstances. Taking this belief into consideration, the researcher wanted to understand respondents' experiences and their observations in his own interpretations. Qualitative research supported him in achieving the objectives of this study in a more detailed and comprehensive manner. As per review of the previous studies in Section 1.3, it was

determined that a limited number of studies were available in the area of risk management for Virtual-Agile projects. The area is nascent, so this justified the researcher's intention to undertake qualitative research methods. Qualitative research methods further supported to examine and understand the fundamentals of the Virtual-Agile project environments, where multiple individuals were conducting actions and their behaviours to evolving uncertainties in a wide-ranging way. Hence, the aforesaid arguments can best describe the reasons for choosing qualitative research methods.

3.5.2 Review of Qualitative Methods

According to Creswell (2007), Qualitative research methods are generally used for generating theories using an Inductive approach. Inductive reasoning is used when the researchers look for outlines in their data and make generalisations and interpretations as to the best of explanation, beliefs and assumptions. Some of the widely used qualitative research methods used in social science research are,

- *Case Study Research*
- *Ethnographic Research*
- *Grounded Theory Research*
- *Narrative Research*
- *Phenomenological Research*

Following table shows a general comparison of the above qualitative approaches. The table has basically been adapted from Creswell (2007), but expanded and altered with the reviews of Denzin and Lincoln (2005), Lincoln and Guba (1985) and other specific authors as shown in the table.

Table 3.5: Review of Major Qualitative Methods Available

Features	Case Study	Ethnography	Grounded Theory	Narrative	Phenomenology
Purpose	Study of an issue by getting insights of one or more cases within a settings or context	Describing and interpreting a culture-sharing group	Development of a theory through general explanations of a process, action, interaction determined from the views of persons who have experienced them	Exploring the life of an individual	Study of a specific context, setting or phenomenon
Elaboration of a Problem	When looking at one or more cases of similar context	When looking at shared patterns of values, behaviours, beliefs and language of a culture-sharing group	Lack of theory to explain a process/ Theories available do not completely address the problem/ Theories available but are incomplete or inadequate to address potential valuable variables	Generating stories about individual experiences	Understand common or shared experiences of individuals'
Unit of Analysis	Observing an event, program or activity	Observing a group that shares the same culture	Studying a process, action or interaction involving many individuals	Studying one or more individuals	Studying several individuals who have shared the experience
Major Data Collection Methods Used	Multiple sources such as interviews, observations, documents	Observations and Interviews	Interviews and Observations	Interviews and Documents	Interviews, documents, observations
Data Analysis Techniques	Holistic Analysis, Embedded Analysis, Cross-case analysis	Identifying themes about the cultural sharing group	Open, Selective, Theoretical coding (Glaser, 1998); Open, Axial, Selective Coding (Strauss & Corbin, 1990; 1998); Open, Focused and Theoretical Coding (Charmaz, 2006)	Recognizing themes, develop a story from individual's story	Highlighting common or significant statements, sentences, quotes from data, Textual or Structural Description
Presentation of findings	Description of the lessons learned from the case or situations	Holistic cultural portrait of group including views of participants and researcher	Explanation of Theory from generated figure	Presenting the story as narrative about individual's experiences	Describing the essence of experiences

3.6 Grounded Theory Methodology (GTM)

The choice of research methods is influenced by preceding assumptions in terms of ontology, epistemology, and researcher's own nature and beliefs. As discussed in Section 3.5, the subjective and exploratory inclination of the research problem advocated the use of qualitative methods; as they were found most appropriate for achieving the research aim and objectives. In perspective of the qualitative methods from 3.5, GTM was considered as most appropriate as the researcher aimed to develop a conceptual framework by knowing the processes, actions and interactions of the individuals who have experienced the phenomenon or process. Further, according to Ryan et al. (2002), GTM is considered suitable for qualitative researchers who aim to develop theory by exploring the nature and following strict principles. Flick (2009) explained that grounded theory can be used when an issue has been identified and needs to be examined from a research perspective and intended at constructing a new theory, where currently lack of theoretical knowledge is present. He also added that the use of grounded theory supports in elaborating the research problem when examining from a theoretical view.

The grounded theory works in the opposite direction as from social science research (Turner and Martin, 1986). Creswell (2009) highlights that grounded theory is a strategic approach in which an investigator generates or develops a theory of a procedure or a process revealed from the views and experiences of participants involved in the research. The process comprises of gathering data throughout the study; as the progression takes place, data is refined and broken down into categories which leads to the generation of a new theory. Grounded theory generally begins with a question or starts with the collection of qualitative samples (Glaser and Strauss, 1967). The purpose of the grounded theory is to get insights which elaborate the characteristics of the functionality of social world.

Grounded theory is significant in qualitative research due to following reasons,

1. An effective contributor to the development of qualitative research as a methodology, and a substitute for further types of social research methods (Creswell, 2007; Lincoln and Guba, 1985).
2. It has assisted several researchers and practitioners over the years with systematic tools i.e. by developing precise procedures for conducting research; sampling of data and then coding the data and materials, which results in a more conceptual approach to conducting research (Creswell, 2007).

3.6.1 Grounded Theory and its Distinct Characteristics

Creswell (2009) identified two main features of using grounded theory

- Constant comparison and analysis of collected information with evolving categories
- The research journey in grounded theory involves theoretical sampling of diverse groups/individuals at all the stages to match the resemblances and dissimilarities of data.

As grounded theory involves strict and lengthy procedures, a summary of its strengths and weaknesses has been elaborated by Allan (2003).

Strengths:

- Effective methodology to generate new theory and know innovative phenomena
- Theory developed from richness and abundance of data
- Evolving approach towards theory generation replicates the features of the study
- Empirical data collected, is polished and delivered to fineness
- Study is evolved because of conducting detailed systematic procedures and data analysis
- Gives the investigator an open-minded approach to grasp several ideas and views
- Data collection is a time-consuming procedure but assures expressive outcomes at the end

Weaknesses:

- Extensively high volume of data
- Complex, time taking and a thorough process of data collection and analysis
- With an open view, several directions and noises are expected in the data
- Data collection process needs recommended approvals and guidance
- It might become tough to determine when the categories get 'saturated' and sufficient for theory development
- Pre-existing literature, concepts and conventions are not given importance as the theory development is an emergent process

Grounded Theory has evolved in different versions since it has been revealed. The discoverers of Grounded Theory Glaser and Strauss (1967) felt that theories undertaken in social science research were unsuitable and inappropriate for researchers undertaking study. The maiden collaboration of Glaser and Strauss (1967) which was yield from the work of *Awareness of Dying* and *Time for Dying* effectively had contributed extensively in the literature. The two researchers later eventually differed in approach, philosophical positions and methods to conduct grounded theory. The main versions of GTM that currently exist now are,

3.6.2 Glaser's Classic Version

Glaser classical version is mainly dependent upon the initial principles of grounded theory which he discovered with Strauss in 1967. Glaser (1978) claimed that all the material collected during the research process is '*data*'. Glaser emphasized that it is not mandatory that the data should only be qualitative (interviews or observations), it can also come from quantitative evidence like surveys and numerical data. All the data which comes across study in a functional area should be used and develop a conceptualization of situations, actions and interactions. The final theory which is developed should be applicable externally to the functional area where it was developed.

3.6.3 Strauss and Corbin's Version

Similarly, Strauss and Corbin (1990) presented a systematic approach towards conducting grounded theory. The version stated that theory can be systematically generated from qualitative data like interviews, observations, audio-visual proofs etc; using a precise style of study (research paradigm) together with realistic concepts of the events assumed, and some procedural guidelines. They further explained that theory generation process is not separate and coherent; rather than it is a process where several steps are repetitive until the phenomenon is explained. The phases of data collection and data analysis are dependent on each other; where the data is coded, categorized and developed a consensus to the researched phenomenon. Glaser (1992) over the time criticized Strauss's approach as being too prescribed and organized. Glaser further emphasized that generation of new theory doesn't implicate more systematic methods; it is a process which comes off as the researcher go into field and interact with the participants under specific settings.

3.6.4 Charmaz's Constructivist Version

Charmaz (2006) in a most recent version of grounded theory proposed for the constructivist grounded theory, thus keeping a more realistic approach. She suggested that the theories are constructed by the researcher as a consequence of social interactions and collaborations with the individuals involved in the study. She proposed that real actions and events are re-fabricated by the investigator and respondent, and then refined by researcher's background, assumption, privilege and physical locality. Charmaz (2006) also believed that development of theory is a more social constructivist perception that comprises of prominence of wide-ranging native domains, excessive facts and figures, and the interpretations of complications of the specific domains, opinions and activities.

3.6.5 Motives for undertaking a Grounded Theory Methodology

According to Strauss and Corbin (1998), selecting a research methodology can be dependent upon several factors and few of them can be the desired research aim and objectives. After looking at the research problem, the researcher assumed that qualitative methods would assist him to explore the actions and responses of participants involved in Virtual-Agile settings. Thus, mainly concentrating on the requirements, qualitative methods were found useful to record the reactions of participants and assess the level of the competence that has been achieved in the context or not.

According to Creswell (2007), there can be numerous reasons for implementing the grounded theory which was adapted according to the nature of this study,

- 1) Using Grounded Theory and qualitative methods benefited in investigating and improving the entire research process without using scientific methods (Glaser and Strauss, 1967). As from definition, grounded theory is designed to elaborate the problems which have not been explained in detail before. Alternatively, grounded theory helps in generation of a new theory stating issues which are not resolved by existing theories either referred as incomplete or deficient (Creswell, 2007).
- 2) A second reason for implementing grounded theory was researcher's own perception and believes where he prefers to get into contact and communicate with individuals for solving a problem. Similarly, another reason was researcher's own apprehension where he realised the need to address certain issues. With qualitative and grounded theory methodology, the researcher interpreted the realities into his own ways (Creswell, 2009).
- 3) Thirdly, there were gaps in the literature and deficiency of practical theories for highlighting the real-life practices in terms of risk management (Section 1.4). There have been several studies previously in the area which mainly focused on confirmation and verification of pre-existing ideas. Literature to date mainly depends

on primitive theories. Therefore, there was a need for novel theories and frameworks which could consider a distinct viewpoint on the subject area of risk management in Virtual-Agile project environments.

- 4) Further, the exploratory nature of the study identified the acuity and productivity of qualitative research with having communal interaction and understanding the complications of social life. When implementing grounded theory, the interpretations of human behaviour were brought under the perception of subject and their deeds, which later on aided to translate the behaviour of respondents and matured a novel understanding from the denotation of codes and concepts.
- 5) Generally, grounded theory is regarded as an approach which comes from 'bottom to the top' in which the data is raised up from the field. Numerous researchers and practitioners like Georgieva and Allan (2008), Sarker et al. (2001), Jones and Alony (2011), Manuj and Mentzer (2008), Dorairaj et al. (2012), Pauleen and Yoong (2004) have used grounded theory when conducting research in the area of project management, global risk management, distributed agile projects and virtual teams' development respectively. Thus, the aforesaid arguments highlight the reasons for the choice qualitative and grounded theory methodology.

3.6.6 Ontological and Epistemological View in GTM

Corbin and Strauss (2008) in their recent publication have acknowledged the suitability of ontological and epistemological assumptions with Interpretivist paradigm when conducting a grounded theory study. Corbin (Corbin and Strauss, 2008) recognises the stance of being relativist ontological by mentioning that there is no truth out there that is awaiting to be exposed and that truth under no particular conditions can be completely realised or re-created by the researcher. In another perspective, Corbin (Strauss and Corbin, 2008) acknowledges her stance under subjective epistemology, and anticipates that it is not possible to distinguish 'who we are' as an entity from the research and the analysis we do.

Corbin (2008) further identifies that due to epistemological underpinnings, the explanation does not reflect from the relationship between the object and subject but is enforced by the subject. As the explanation or detail is obviously emerging out of the subject, epistemological underpinnings are evidently subjective. Interpretivist paradigm also matches with De Haan's (2006) philosophical typology due to its evolving nature, where the researcher participates as a principal element for the creation of the theory. Thus, relativist ontological stance together with subjective epistemology helped the researcher to recognise and describe the actions, being an essential part of the research process. Further, Corbin and Strauss (2008) argued that the theory developed is no doubt investigator's unrestricted translation of the information that is unopposed by the external reality.

3.7 Strauss And Corbin's GTM Version

3.7.1 Why Strauss and Corbin's version of GTM

Creswell (2009) suggested the researchers to employ Strauss and Corbin's (1990; 1998; 2008) version of grounded theory as it provides a more systematic approach towards exploration. He further proposed that any of the grounded theory versions can be implemented depending on researcher's understanding of procedures but Strauss and Corbin's (1990; 1998; 2008) approach to conduct grounded theory is an organized way of reaching close to the research aim and objectives and determining solutions to the research problem. Though, Glaser (1978, 1992 and 1998) and Charmaz (2006) also have numerous attractive features, but the researcher preferred using Strauss and Corbin's version due to its simplified and standardised procedures. Strauss and Corbin's version also provide various options to researchers to adapt themselves according to the understanding, beliefs and suitability of grounded theory procedures. For example, Strauss and Corbin (1998) provides a range of options from which a research problem can be identified. It could be from literature, highlights from professional experience, a research area to work on with

supervisory team or identification of the problem from conducting initial interviews. Similarly, due to the differences mainly in philosophical beliefs coding paradigm from Axial Coding phase was considered optional by Corbin and Strauss (2008); as she believes that it doesn't fully address the principles of grounded theory. Consequently, coding paradigm had also been criticized over times by Charmaz (2006), considering it as highly structured and too prescribed. Charmaz (2006) also recommended that the use of coding paradigm is an option for the researcher, but it doesn't particularly fit with the dynamics of grounded theory. Hence, Strauss and Corbin's (1990; 1998; 2008) versions are better elaborated and have been widely matured in the academic research; thus, finding easy to comprehend and supports attaining a research focus. Strauss and Corbin (1990; 1998; 2008) guidelines for conducting a grounded theory study consists of precise steps towards the development of a theory which supports the researcher to follow a focused path rather searching for data in different fields. Additionally, as this research was time-constrained, and the researcher planned to complete his studies within a specific duration, this version was found most appropriate out of all the three due to its methodical procedures.

Additionally, Glaser's classic (1978, 1992 and 1998) version seems to be more time-consuming as the researcher must determine the research problem based on initial data collection and then look for his substantive area of research; whereas Strauss and Corbin (1998) provides variety of options to explore the research problem as discussed above. Glaser (1978; 1992; 1998) prefers to ignore literature to a great extent which could not have been done as approval of various progression points was required during the Doctorate research journey where the researcher needed to depict a considerable knowledge and reasons of choosing grounded theory research. The researcher also likes to highlight here that Glaser (1978; 1992; 1998) approach towards literature is too vague which was not even acknowledged by the supervisory team. Although Glaser (1978; 1992; 1998) guidelines were considered time-to-time during data collection and analysis process. Glaser (1978; 1992;

1998) prefers to ignore literature completely to minimise pre-conceptions when entering into the field. In context, Strauss and Corbin's version outlines for the utilization of the literature helped to fulfil the requirements of academia as well. Consequently, Charmaz (2006) constructivist version also provides strict procedures towards generating a theory but due to the understanding and flexibility in Strauss and Corbin's (1990; 1998; 2008) version, this version was selected as it has been matured more than three decades now. Further, the researcher can now acknowledge that initial review of the literature helped extensively in identifying the problem and gaps, which further aided to attain a focus in the substantive area, like all other qualitative approaches.

3.7.2 Basic Steps of the Strauss and Corbin GTM

As described, Strauss and Corbin's (1990; 1998; 2008) version was used for conducting research due to its systematic set of procedures. By following a more methodical approach, the researcher generated his theory under following two phases simultaneously;

- **Data Collection Phase** – further completed into
 - Designing Interview Questions
 - Transcribing and Analysing Interviews
 - Constant Comparison and Theoretical Sampling
- **Data Analysis Phase** – further completed into
 - Development Codes and Concepts
 - Categorization and refining relationships
 - Generation of theory

In grounded theory study, the data collection and analysis run in parallel so that process of constant comparison could be facilitated. Strauss and Corbin (1990; 1998; 2008) version of grounded theory study is usually completed in three stages of coding, i.e.

- ***Open Coding***

The phase in which the data is mainly fractured down into codes, then similar codes together generate concepts based on their properties and dimensions; and then concepts further take the form of a category. Properties and dimensions can be determined from the words of the participants or can be acknowledged from the data incidents. Properties and dimensions are the wide-ranging characteristics identified from the data in which the action, events or happenings take place. Further, memo-writing during data collection and analysis helps to relate the emerging concepts against categories. It is the process in which the researcher uses its own observation for an action or setting. The categories are filled with more concepts as data is collected until it reaches the Axial Coding Phase.

- ***Axial Coding***

The phase in which the categories from the open coding phase are refined and arranged in a new relationship in relation to the research phenomenon using own inductive and deductive thinking style. This analytical thinking is acquired from researcher's theoretical sensitivity and reviewing of the data incidents again and again. Open and Axial coding phases overlap at several stages where the researcher collects data, analyses it, generates concepts and categories and then goes back into the field. This process continues until the saturation is observed in categories.

- ***Selective Coding***

Selective coding starts when the theoretical saturation is observed as no new data is emerging. This is the phase in which a core-category is recognised representing the overall phenomenon under investigation. Memos generated previously helped to explain the relationship of the categories from open and axial coding phases.

3.7.3. Summary of the Paradigm Development

Before conducting the study practically, the researcher was well-aware of the versions, concepts, procedures and processes involved in grounded theory study. The key steps understanding for conducting this research are summarised under guidelines of Glaser and Strauss (1967) and Strauss and Corbin (1990; 1998; 2008).

- This study is mainly based on ***interviewing*** to experienced personnel who were related to the process of study. The interview questions were inquired to participants who were currently or had previously experienced the phenomenon and were able to identify the process and give detail of the actions or interactions applied for managing risks and uncertainties.
- Data collection and interviewing process was guided by ***theoretical sampling*** and ***constant comparison***. These were the characteristics through which the interviewees who participated in the process of data collection were theoretically selected. Theoretical sampling and constant comparison assisted the researcher to absorb several dimensions and parameters linked to the process of study.
- In ***Open Coding***, preliminary categories were created against data gathered. This included breaking down, comparing and classification of the collected data. After initially exploring the categories, the researcher went back into the field when Axial Coding Phase was initiated.
- In ***Axial Coding***, the categories which were developed in open coding phase were further refined and arranged in a new relationship by looking at the data incidents again and again. The basic purpose of the axial coding phase was to further fracture down data and fill the already generated categories with more concepts.
- In ***Selective Coding***, a core-category was determined and integrated into other categories which helped to create a storyline around that category. The purpose of selective coding was to identify the core-phenomenon taking place in data which

represented the overall solution to the research problem for which the researcher produced justification of the emergent theory. This core category united all the categories to provide a justification for the phenomenon being studied. Further, use of literature and data helped the researcher to validate associations which created a strong relationship between the categories and sub-categories, thus, leading to the development of the theory.

- The outcome of this empirical evidence and analysis phase was a ***substantive-level theory***, which has been demonstrated close to the research problem. The paradigm emerged with the assistance of ***memo-writing***, an activity in which the ideas, concepts and perceptions were noted down throughout the process of Open, Axial and Selective Coding.

3.8 Inductive Theory Generation

This research study has been based on Inductive type reasoning primarily. The inductive approach supported the researcher to determine meanings from the data in all the three stages of coding i.e. open, axial and selective. Inductive theory process helped to combine all the believed truth about the research problem and gave it a specific conclusion. Glaser (1992, p.16) has defined grounded theory as

A general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area.

According to Strauss and Corbin (1990), using the inductive approach in grounded theory study provides a strong foundation when determining results in the view of the world. Inductive reasoning is grounded on the factual data that how we experience the world we survive in. Inductive approach is considered as a structural approach for the analysis of qualitative data where the analysis is ruled by explicit objectives (Bryman and Burgess,

1994). The inductive approach in qualitative research permits the discoveries to evolve from the recurrent, dominant or substantial themes inherent in raw data, without the limitations of being enforced by other systematic methodologies. According to Denzin and Lincoln (2005), inductive approach has following purposes in the qualitative research

- To shrink wide-ranging raw data into simplified and summarised format
- To create transparent relations between the research objectives and the summary conclusions extracted from the raw data and to confirm that these relations are clear and defensible
- To generate a model or theory from the system of experiences or progressions which are apparent in the raw data

Consequently, Thomas (2003) suggests that inductive approach offers five main characteristics in qualitative research. These characteristics support qualitative researchers to convert categories into a model or framework that highlights key themes and processes from the raw data. These processes are:

- **Creating labels for the category:** An initial step in the coding process which helps to tag or label the data using word or phrase which can be referred to the category. This label or tag itself comprises of a certain indication or carries inherent meaning of the data.
- **Description of category:** The next step in inductive analysis is noting down the key characteristics of each category including its scope and limitations
- **Linking the text or data associated with category:** Sorting out each category and finding its links to the original text (from the data) that defines meanings, relationship and perspective of that category
- **Finding links with other categories:** Looking for relationships between other categories, sorting and illustrating them in the form of a tree diagram or a

hierarchical structure. Links are created based on commonalities in dimensions between categories or assumed causal relationships

- **Generating model or framework:** Bringing down the categories into a shape of a model, theory or framework that represents the phenomenon. It may be in the form of an open network or sequential sequence or showing causal relationships. It is also possible that few categories may not be embedded in the model or framework.

Strauss and Corbin (1990) further suggest that inductive approach should be apparent in grounded theory study based on general qualitative principles. Inductive approach emulates with regular informed patterns of the data. The inductive approach is incorporated in the all the coding stages of grounded theory methodology offered by Strauss and Corbin (1990; 1998). This system of coding, labelling or categorising has been adapted from general inductive principles which helps researcher to code, categorise and then shaping key categories together into a form of a conceptual model. Hence, the researcher acknowledges that following an inductive approach incorporated in the procedures of grounded theory helped to attain deep insights of the phenomenon.

3.9 Summary

This chapter has provided an overview of the research design and methodological approaches chosen for this research study. The chapter has provided an explanation of the chosen paradigm and philosophical believes of the researcher. The chapter provided an understanding to the readers about various qualitative methods available and the justification for choosing grounded theory methodology. Various versions of the grounded theory have been discussed with an explanation of choosing Strauss and Corbin's version. The author has provided a detailed overview to the readers' that how his philosophical beliefs matches with the grounded theory procedures. Further, an overview of the steps

undertaken using Strauss and Corbin's version has been discussed which provides a basic understanding to readers.

CHAPTER 4: DATA COLLECTION AND ANALYSIS

4.0 Introduction

This chapter is the mainstay of the research study where the researcher has discussed some of the theoretical and practical perspectives for conducting research. The chapter highlights major decisions undertaken for data collection process, and the decisions related to locate target population. Discussion about sampling techniques and details of the participants with regions, experiences and most recent designations has also been elaborated. Similarly, discussions about why the interviews were the only source had been undertaken together with the summaries of all the interviews conducted for this study. The process of data analysis which mainly included Open, Axial and Selective Coding Phases have been elaborated showing each and every stage; giving readers an insight of how the raw data was converted and further took the form of a conceptual framework. The chapter has been structured as,

Section 4.1: Theoretical Sensitivity

Section 4.2: Ethical Considerations

Section 4.3: Realising the Process of Grounded Theory Study

Section 4.4: The Process of Data Collection

Section 4.5: Multiple Sampling Strategies

Section 4.6: Data Sources: Interviews

Section 4.7: Interview Details

Section 4.8: Influence of using Multiple Mediums for Interviews

Section 4.9: Building of Rapport during Conversations

Section 4.10: Process of Transcriptions

Section 4.11: Reflexivity and the Researcher

Section 4.12: The Process of Data Analysis

Section 4.13: Unit of Analysis

Section 4.14: Theoretical Memos and Field Notes

Section 4.15: Process of Constant Comparison

Section 4.16: Types of Coding

Section 4.17: Transformation of Data into Concepts and Categories

Section 4.18: Memo Database

Section 4.19: Summary

Conducting an effective research study is dependent on an effective research design that helps to address the research problem. According to Lincoln and Guba (1985), qualitative researchers use an emerging approach to inquiry, where data collection is undertaken in realistic/natural conditions sensitive to individuals and places which are under examination; and then analysing that data helps to identify patterns or themes leading to the generation of theory. Strauss and Corbin (1990) further suggest that 'creativity' is a vital component of conducting grounded theory study. Creativity should exist in researcher's own ability which helps him to name categories, make free associations that are mandatory for generating stimulating questions and make comparisons which leads to the discovery of a new phenomenon. Under an effective research design (in chapter 3), the researcher using the guidance of main qualitative and grounded theory authors carried out the research process. Following are some of the mandatory aspects that the researcher prefers to discuss here which further shaped the data collection and analysis process.

4.1 Theoretical Sensitivity

In a grounded theory study, theoretical sensitivity refers to the personal quality of the researcher (Strauss and Corbin, 1990). When undertaking a research study, theoretical sensitivity can be referred to the sensitivity which the researcher brings to study depending on previous reading or experiences relevant to the area of study. Glaser (1978) refers theoretical sensitivity as an ability of the researcher to give connotation to the data, capacity to comprehend and quality of having awareness of the data. Further, Glaser (1978) argued that theoretical sensitivity also allows the researcher to develop a theory that is well grounded, theoretically populated and integrated into the data.

Theoretical sensitivity may arrive from various sources while conducting research (Strauss and Corbin, 1990). Review of literature, professional or personal experiences are some of the sources of that contribute in the theoretical sensitivity. For this study, the researcher has

reviewed the literature to a *limited extent*, where he has gained familiarity with some of the previous content published in the field of Virtual-Agile risk management. The literature review helped the researcher to 'sensitize' himself with what is in fact going on with the phenomenon under study. Review of literature supported undertaking of this research study that the existing theoretical models or frameworks in terms of risk management were based on certain methodologies or concepts that needs to be looked at from a different and new perspective. This would certainly contribute in the literature by discovering the natural risk management practices rather depending upon theoretical perceptions. Strauss and Corbin (1998) further suggest that another source of theoretical sensitivity in the research could be researcher's own professional or personal experience. Pertinent to this study, the researcher's professional experience is from an Engineering background where he has been involved in couple of years in industrial project management practices, which included designing time plans, undertaking risk management practices, dealing with various stakeholders and strategies to ensure the quality standards. In addition, the researcher's academic background in the field of project management has also supported him to understand the events and actions more quickly as compared to the individuals from different backgrounds. Consequently, Strauss and Corbin (1990) recommends that's grounded theory analytical process itself brings theoretical sensitivity as you indulge with the data. The collection and analysis of data helps to observe various themes or patterns undergoing in the phenomenon. The researcher applied various strategies to ensure theoretical sensitivity such as inquiring questions of the data, making comparisons, developing a hypotheses or small frameworks about the codes or concepts and observing the relationships between generated codes and categories. Glaser (1978) further suggests increasing the theoretical sensitivity to concepts and themes evolving from the data, which might support to enhance the insight and acknowledgement of the parameters of the emerging phenomenon. Theoretical sensitivity also helped the researcher to analyse

research situation and its association with the data in unique aspects; and to investigate the empirical evidence's potential for generating theory. According to a famous biologist Selye (1956, p.6),

It is not to see something first, but to establish solid connections between the previously know and the hitherto unknown that constitutes the essence of specific discovery.

Selye (1956) also argued that the goal of the development of the theory that contributes to the body of knowledge is called science. According to Strauss and Corbin (1990), achieving theoretical sensitivity in research require to be artistic and scientific at the same time. To avoid biases in this study and to produce valid and reliable theory, the researcher undertook following steps using the guidance of Strauss and Corbin (1990; 1998; 2008).

- The researcher tried to keep a balance between his creativity and real situations by periodically stepping and asking different sort of questions of the data. These questions were like, *'What should be the reality?', 'Does what I believe is it really suitable to the context of reality?'* For example, as this study is related to the processes by which project managers or professionals could manage risks more efficiently, it became soon evident that the participants' actions were meant to emphasize on task completion and reduce ambiguities among the distributed teams so that they could meet the targets and deliver the projects timely to their clients. Additionally, it was observed by the researcher that the risks change over the course of time and with respect to the project settings; sometimes the intensity and impact of the risks was higher and sometimes lesser. There were several factors which could hinder or support the risk management process. It was assumed that the risk management strategies would vary along with the intensity of the risks or events taking place, the higher the complex situations are, the more and intensive will be

the controlling practices. The researcher at first assumed that confirmation of these propositions would be a straightforward matter of checking against data but then realised that these propositions sometimes supports his viewpoint but sometimes not, because it changes according to the impact of that event or risk factors of the project.

- Briefly, once the researcher analysed the data, inquired questions of it, he could recognise that the individuals acted based on their own insights of the circumstances. The risks management practices evaluated were not essentially like those of other stakeholders of the projects. Thus, the participants' own assessment and tendency supported them to respond to such unexpected situations.
- The researcher has maintained an attitude of 'Skepticism' throughout this study. All the categories, hypotheses and questions about the data were considered 'provisional' until and unless they were checked against the actual data. For example, while analysing the category of 'communication, this category was considered provisional until the researcher was able to get maximum saturation into it. In simple words, all the categories were played with actual data in order to assure that they fit into research situation. This helped to generate theoretical explanations and their relation to the situation for each category (Strauss and Corbin, 1990).
- Theoretical sensitivity was also generated by following the correct research procedures. The researcher has considered all the data collection and analysis procedures as suggested by main qualitative and grounded theory authors to achieve '**rigor**' in the study. Achieving rigor in qualitative studies is considered 'crucial' as the researchers have to undertake strict procedures to avoid biases (Creswell, 2007). Further, the strict procedures and guidelines have not only helped the researcher to allow sampling on the basis of emerging data but has helped him to verify the hypothesis while they were being developed.

4.2 Ethical Considerations

Approval of Research Ethics is a mandatory part of research studies. It comprises of ethical principles which are necessary to be undertaken by a researcher. According to Cooper and Schindler (2006), the purpose of the ethics in research is to ensure that none of the participants is harmed or suffered from carrying out research activities. The participants should have the feeling of safety and security during the process of data collection. They should be able to know the goal of the study, who will be having access to the data and how it will be used for the research purpose. Additionally, the researcher should acknowledge the participants the applicability of the data, whether it will be used such as for commercial or academic purpose.

For carrying out this research, a research ethics form was completed, signed and then submitted to Research Ethics committee for approval. The form submitted included affirmation of the following characteristics which was then complied with throughout the research process,

- Demonstration of Integrity and Honesty with research i.e. showing rigor and professionalism
- Avoiding Plagiarism – Copyrights of data and ideas exclusively that has been used
- Conflicts of Interest – Financial and professional benefits were acknowledged
- Data Handling – Confidentiality and compliance with university's policies
- Ethical Procedures – Codes of conduct, approval of study, consideration of ethical issue and formalities
- Supervision – The level of support from director of studies and Research Graduate School
- Health and Safety – Proper training, health and safety issues have been elaborated

In this regard, a consent form, participant information sheet and initial interview questions were also attached with the purpose and type of participants to be approached for this study. The committee approved the ethical process with 'no objections' or 'no observations' as they believed that the researcher is well-aware of the moral procedures that are needed to be considered during the research study. This was a step forward to look for participants and plan interviews. In addition, at the time of data collection, a consent form was signed by both the interviewer and participant to abide by the Ethical rules and regulations. The consent form together with participant information sheet has highlighted the terms and conditions to participants before indulging in this research. Thus, all necessary ethical measures were undertaken before and during the data gathering stages. Sample of consent form, participant information sheet and Ethics Approval form has been attached in the APPENDIX-I.

4.3 Realising the Process of Grounded Theory Study

Before formally initiating the data collection and analysis process, the researcher believed that he should realise and grasp some of the important concepts of the methodology again before entering the field. This understanding was achieved with the discussion of supervisory team. The researcher presumes that proper guidance of the supervisory team is of great importance when conducting in-depth interviews. Following were some of the points were which recognised by the researcher,

- Enter the field with open-mindedness and you should be able to record participant experiences without being influenced or being biased;
- Use of field notes is very important in both qualitative and grounded theory study because the ideas or interpretations captured during interview sessions cannot be recollected. Additionally, supervisory team also suggested to write down your own notes after the interview as it gives an initial overview and thoughts of what being analysed during the interviews;

- Analysis of the interviews should be undertaken as soon as possible. For this transcription of the interviews should be completed by a certain deadline; as this would help the research to follow his time plan.

To avoid biases during the data collection and analysis, the researcher should consider all the opinions, thoughts and viewpoint of the participants. Every response should be captured and recorded, and the researcher should provide maximum opportunity and time to the participant to express his thoughts. In this regard, the supervisory team also suggested using '5 whys' tool to get in-depth insights of the solution to the research problem. '5 whys' tool is generally a problem-solving technique which supports to explore the cause of a problem in several dimensions.

4.4 The Process of Data Collection

The process of data collection and analysis in grounded theory study works concurrently as the researcher goes in the field to collect data, analyses it and then goes back to the field to collect more data based on his previous analysis (Glaser and Strauss, 1967; Strauss and Corbin 1990; 1998). Theoretical sampling and constant comparative method direct him throughout the data collection and analysis process where to go and what to collect next. According to Cho and Lee (2014), the difference between grounded theory and other qualitative approaches is that grounded theory study analysis is based on saturation rather amount of data; in contrast analysis in other qualitative methods especially content analysis which is like the nature of grounded theory study, is based on data reduction process by selecting relevant aspects of the data pertinent to the research question and the unit of analysis. Whereas as according to Strauss and Corbin (1990), the unit of analysis in grounded theory study is the conceptualization of the data. The events, happenings or actions occurring, points towards a central phenomenon which can be recognised as the researcher moves along the process.

4.4.1 Decision 1: How and where to start?

Theoretical sensitivity of the researcher supported him to find the relevant area of the study. The initial literature which was reviewed as a part of the methodical procedure first guided the researcher to know about the gaps in knowledge and the area which should be considered for undergoing this study. As the researcher was undertaking an exploratory study, the researcher presumed that relevant information may be achieved by interacting individuals from the substantive area of Virtual-Agile. This decision was an initial perception which was compared with subsequent interviews. The researcher started looking for the relevant individuals for collecting data but before entering the field, the researcher preferred to consider some of the theoretical and practical issues.

4.4.2 Decision 2: Theoretical vs Practical considerations

Grounded theory research requires a researcher to be present in the field for a sufficient amount of time. As this research study was time constrained and the researcher aimed to complete his study within 39 months, the researcher created a balanced approach to qualitative and grounded theory principles. The balanced approach was created to fulfil the requirement of the academia as well as the methodology and produce more authentic arguments. As grounded theory approach falls under qualitative research, the researcher with the consent of his supervisory team took some important decisions to follow his time plan and complete his study on time.

It was decided that unit of analysis should be pre-assumed at initial data collection stages as it will support the researcher to collect and analyse data, which is principally the technique of doing research in a qualitative study. This pre-assumption was gained originally from the theoretical sensitivity. Grounded theory methodology in this context suggests that concepts or data evolving is the unit of analysis (Strauss and Corbin, 1990). It was discussed with the supervisory team that as the emerging concepts or data fall under substantive area, the

phenomenon later itself would be recognisable and would be more evident after a certain amount of data collection and analysis. Secondly, the researcher analysed all the actions, behaviours and events which might become useful to solve the research problem rather selecting common themes from the data. It was also discussed that without having an appropriate criterion, it is difficult to start data collection practically and therefore some theoretical assumptions of grounded theory could be assorted with qualitative principles to make data collection and analysis process work more efficiently.

4.4.3 Decision 3: Locating Target Population

The next decision in getting the right data was linked to finding appropriate individuals. As the substantive area was identified i.e. Virtual-Agile project environments, the next step was to determine the participants who can best contribute to this research by informing diverse aspects of the phenomenon under investigation. As the researcher was practically nascent in the IT field, he preferred to utilize his links and get into contact with the persons who have been a part of such project environments (from the substantive area) presently or in the past. For this activity, he held ***pilot meetings*** with some of the people from IT organisations, where he came to know about the type of people to approach to. The researcher held 3 informal pilot meetings with the acknowledgment of his supervisory team with the people from different IT organisations, keeping the ethical requirements in consideration. The researcher believes that those meetings helped to enhance the theoretical sensitivity and determine appropriate participants who could best contribute to this study. From those meetings, the researcher concluded the following,

- The assumption of the substantive area seems to be appropriate but expected to change over time as the data collection process initiates.
- The relevant information could be gained or collected from the managerial level persons or the individuals working in senior positions as they are overall responsible persons for handling uncertainties and complications

- It would be good to know the perceptions of different individuals having different background and knowledge from different territories as Virtual-Agile projects is a collaborative effort of distributed teams around the world. By doing so, it would be helpful to collect rich data and show rigour in the study.

These pre-assumptions were found to be truthful later on for the researcher as they guided him to look for the appropriate people. These viewpoints also supported researcher's ontological and epistemological beliefs that due to different contexts, realities are multiple, not fixed and can be attained by interpretations of the individuals from diverse experiences. Therefore, finding appropriate individuals was a complex process which was undertaken by the researcher as a challenge throughout his research. The researcher applied various type of sampling strategies to locate his participants which are discussed in the following section.

4.5 Multiple Sampling Strategies

In qualitative research, sampling procedure is most commonly considered a method of deducing knowledge about a total population rather than conducting statistical measures to know every unit of the population. The use of right sampling procedures for data collection leads to appropriate results at the end (Creswell, 2009). Punch (1998, p.193) has highlighted the significance of sampling by saying that,

We cannot investigate everyone, everywhere doing everything. Sampling decisions are required not only about which people to interview or which events to observe, but also about settings and processes.

Contributing to the context, Flick (2009) argued that sampling in research is a process which is considered relevant around the area of research topic instead of a population which decides the technique in which the individuals to be investigated and selected.

4.5.1 Purposeful Sampling

According to Strauss and Corbin (1998), the participants in grounded theory should be related to the substantive area and have some links with research phenomenon. Strauss and Corbin (1998) further suggested that the participants should be those who could best inform the research question and contribute to the study from their novel experiences. The researchers could use purposeful sampling to identify the participants close to the area of study. Hood (2007) defines purposeful sampling as a procedure which supports to select the participants having knowledge or experience of the process. According to Creswell and Clark (2011), purposeful sampling helps to identify and select individuals that are knowledgeable and experienced about the phenomenon. Hood (2007) further added that in purposeful sampling it is also important to know the availability and willingness of the participants, together with their ability to communicate their knowledge in an expressive and reflective manner. During the initial data collection, the researcher used purposeful sampling to define a criterion for the selection of participants. Consequently, theoretical sensitivity in terms of having a knowledge of literature and professional experience also contributed in elaborating sampling criterion.

- Participants should be currently working or have previously worked in substantive area
- They should have experience of managing or leading projects in their organisations. Consequently, they should have the experience of working with distributed teams using Agile methodologies.
- The sample should be based on individual's own experience and beliefs. Additionally, the type of organisations or location should not influence the data collection as the focus is to record diverse practices for managing risks and uncertainties.
- As the research study is in English language, so the participants should be those who should be willing to speak and express their viewpoints in English. The researcher

didn't prefer to undertake interviews in any other language as the data should have taken long to transcribe, and very important if the supervisory team or examiners might wish to listen to the taped-recording at a later stage, it would be difficult for them to comprehend the words of respondents. Therefore, to undergo transparent proceedings, all the interviews were held in the English.

Strategies Applied for finding Participants

Finding participants who fall under above criterion was a difficult task in beginning. Different strategies were applied to find right participants who can best contribute to the research study. Strategies which were used to find participants mainly included,

- Using personal or professional relationships keeping research integrity in view;
- Finding an appropriate profile through social and professional networking platforms such as LinkedIn, Facebook and Twitter and sending request for participation;
- Meeting with the Alumni of University of Bedfordshire and asking them for a support;
- Joining APM and looking for experienced managers/owners involved in a process;
- Asking for help from other Business Institute researchers;
- Requesting supervisors if they know someone who could inform the research problem.

4.5.2 Theoretical Sampling

Strauss and Corbin (1998) define theoretical sampling a procedure in grounded theory that is used to exploit the opportunities, thus finding out the deviations among concepts, and then densifying the categories in relation to its properties and dimensions. Glaser and Strauss (1967), the discoverers of grounded theory recognised theoretical sampling as the process of which aids in development of the theory, whereby the analyst together gathers, codes and analyses data, and decides what data to collect next and where to go to find it.

According to Corbin and Strauss (2008), theoretical sampling is incorporated within all the three levels open, axial and selecting coding. Theoretical sampling does not contain full descriptive coverage, but indeed is an insight of the researcher screening through his theoretical lens (Glaser and Strauss, 1967). The sample cannot be predetermined at the beginning, but the process allows the researcher to start at some point.

Theoretical sampling after carrying out the purposeful sampling helped the researcher to further look for participants and inquire questions on the bases of previously collected data. Theoretical sampling progressively and systematically tailor data collection to help generation of an emergent theory (Glaser and Strauss, 1967). Theoretical sampling was found useful to help locate respondents after Interview # 3 who can well contribute to the study. For example, the first two interviews as shown in Table 4.5 were based on purposeful sampling which helped the researcher to know about the next participants for this study. The researcher came to know that Scrum method of Agile is the most commonly used method in Virtual-Agile format. Therefore, all the next participants were located that were principally using Scrum methods together with application of other Agile sub-methods. Though, this hypothesis was provisional, and reassured again and again in the upcoming interviews.

4.5.3 Details of participants

A total number of 25 interviews were held for this research study. Respondents from 18 different organisations and 7 different regions participated in the study. As per ethical considerations, their names and organisations are not shared here. Details of the participants with their roles, regions and other details are mentioned in the following table. All the participants have been given pseudo names according to the number of interviews conducted.

Table 4.5: Details of Participants with experiences and regions

S/NO	NAME	Acronym	DESIGNATION	FIELD	EXPERIENCE	COUNTRY	METHOD	SAMPLING
1	Participant 1	P1	Technical Support Manager	IT Support Services	Lean, XP	United Kingdom	Skype	Purposeful
2	Participant 2	P2	Risk Compliance Lead	Information Security Projects	Lean, XP, Scrum	United Kingdom	Face-to-Face	Purposeful
3	Participant 3	P3	Senior Business Analyst	UK Public Sector	Scrum	United Kingdom	Skype	Purposeful
4	Participant 4	P4	Senior Principle Manager	Software Development	Scrum	Germany	Telephone	Theoretical
5	Participant 5	P5	IT Project Management Consultant	Software Development; IT Consultant	Scrum	United Kingdom	Face-to-Face	Theoretical
6	Participant 6	P6	Team Lead	Software Development	Scrum	Germany	Telephone	Theoretical
7	Participant 7	P7	Senior Project Manager	IT Projects	Scrum	United Kingdom	Face-to-Face	Theoretical

8	Participant 8	P8	QA Lead	Software/Web Development	Scrum, XP	Pakistan	Face-to-Face	Theoretical
9	Participant 9	P9	Managing Director	Software/Web Development	Scrum, XP	Pakistan	Face-to-Face	Theoretical
10	Participant 10	P10	Program Manager	Software/Web Development	Scrum, XP	Pakistan	Face-to-Face	Theoretical
11	Participant 11	P11	Senior Project Manager	Software/Web Development	Scrum, XP	Pakistan	Face-to-Face	Theoretical
12	Participant 12	P12	Project Manager	Software/Web Development	Scrum	Pakistan	Face-to-Face	Theoretical
13	Participant 13	P13	Senior Program Engineer	IT Services	Scrum	Pakistan	Face-to-Face	Theoretical
14	Participant 14	P14	Project Manager	Software/Web Development	Scrum, XP, Lean	UAE	Face-to-Face	Theoretical
15	Participant 15	P15	Principal Product Manager	Financial Solutions	Scrum	Kuwait	Skype	Theoretical
16	Participant 16	P16	Project Manager	Automobile Industry/ Consultancy	Scrum	USA	Skype	Theoretical
17	Participant 17	P17	Operations Manager	Software Development/IT Services	Scrum, XP, KANBAN	Pakistan	Skype	Theoretical
18	Participant 18	P18	Senior Project Manager	Software Development/IT Services	Scrum	Pakistan	Skype	Theoretical
19	Participant 19	P19	Team Lead	Software/Web Development	Scrum	UAE	Skype	Theoretical
20	Participant 20	P20	Lead Software Manager	Software/Web Development	Scrum	Pakistan	Skype	Theoretical

21	Participant 21	P21	Project Manager	IT Consultancy	Scrum	Romania	Skype	Theoretical
22	Participant 22	P22	Project Director	Software Development/IT Solutions	Scrum	Pakistan	Skype	Theoretical
23	Participant 23	P23	Principal Engineer	Software/Web Development	Scrum	Pakistan	Skype	Theoretical
24	Participant 24	P24	Senior Program Manager	Telecom Sector	Scrum	UAE	Skype	Theoretical
25	Participant 25	P25	Project Manager	IT Consultancy/ Software Development	Scrum, KANBAN	Pakistan	Skype	Theoretical

4.6 Data Sources: Interviews

Interviews are the only and the major source of data for this research study. In qualitative research, varieties of interviews range from face-to-face, over the telephone, structured or semi-structured, open-ended, via conference calls, video link calls, group or focus group interviews etc. Cavana et al. (2001) highlighted that interviews in qualitative research are a unique form of revealing rich, rigorous and complex knowledge from a participant. Further, supporting the argument of Cavana et al. (2001), Willis (2007, p.17) signifies the role of interviews and suggest that

Your view of the world plays an important stance for preparation of the interviews within the area of research being conducted. Choosing the right interviewee, designing of questions, structuring the interview and then interpretation of the data are some of the important elements.

The main goal of the interviews was to investigate the opinions, knowledge and beliefs of individuals to reduce and eliminate risks. Grounded theory study using 'interviews' helped to provide an in-depth understanding of the risk management process which was under investigation (Lincoln and Guba, 1985). According to Cavana et al. (2001), interviews are also preferred for the studies where little is known about the research phenomenon or detail insights are required from the contributors. They are also considered appropriate for those studies where a researcher tries to explore sensitive topics and thus participants do not feel secure to discuss such information in a group environment.

Strauss and Corbin (1990) have acknowledged the interviews strategy in grounded theory research by suggesting that interviews may vary in different boundaries, different experiences, from person to person and situation to situation. However, grounded theory is compatible with a wide-ranging data collection practices, but the researcher decided to use the interviewing technique for data collection. Creswell (2007) has also advised that semi-

structured type of interviews is most appropriate to the settings of grounded theory which supports in the development of the emerging theory during and with respect to the number of interviews being conducted. Whether over the telephone or through video link, internet calls or using software tools, face-to-face or through conference calls, the researcher strictly followed the planned strategy for data collection.

4.6.1 Why Interviews only data source?

As discussed previously, the participants in this study were those who were selected on a specific criterion. Initially, purposeful sampling helped the researcher to determine appropriate individuals who could participate in the study. The researcher looked for various strategies that can be applied to gather relevant data. This included getting data through observations, focus groups or carrying out individual interviews. Observations were time-consuming and required the researcher to be a part of those settings or situations where he can take descriptive and lengthy notes of the undergoing risk management practices. In observations, the researcher presumed that he might not be able to observe the thinking of the participants if they do not perform any action or take part in a situation. Another reason for not going with observations was that the researcher wanted to get access to multiple organisations from different parts of the world. As the researcher was based in the UK, he, therefore, couldn't travel to different locations and look for organisations that would allow him to be the part. The researcher also tried to look for relevant documents to observe but found out that those reports were confidential and could not be shared with the third parties. As this study was time-constrained, and the researcher planned to complete his study within 39 months of the start, the researcher omitted this method and looked for the possibilities of using other means of data collection.

Focus group could have been beneficial, but as the researcher preferred to find appropriate participants around the globe, it was difficult for all to be present at the conference call at the same time. The researcher after conducting initial interviews also tried to arrange a

conference call for four of the participants but due to participants' busy schedule, he couldn't do it as it was a difficult task to decide on a mutual time and arrange meeting via video link. But the researcher didn't omit this possibility and decided to use this method if the suitable information was not found. The last possibility of data collection left which suited with the grounded theory principles was one-to-one interviewing method which aimed to uncover in-depth beliefs and experiences of the participants.

Theoretical sensitivity of the researcher together with purposeful sampling directed researcher to go for interviews initially to explore in-depth knowledge about a research phenomenon. The researcher came to know that several qualitative and grounded theory authors have recommended Interviews as a base of data collection method. After the initial data collection and analysis process, the researcher assumed that interviews would be beneficial throughout this research study. The researcher also came to know that it is easier to get access to one individual at the same time. As the participants might have their own aims or interests, confidentiality issues, they might not prefer to speak in front of others or in a group environment.

One of the other reasons for conducting interviews was its relevance to the research objectives. As there was little known about the research phenomenon (chapter 1), and the researcher was looking to gain an in-depth knowledge of the risk management process, strategies or practices, the interview technique supported this viewpoint. The interviews for this study have been carried out in different ways, i.e., face-to-face, video conferencing and via telephone which are discussed in the Section 4.8. The researcher was able to collect data from multiple participants having diverse perceptions and variety of experiences, which then helped to combine the emerging concepts and resulted in generation of an emerging theory.

4.6.2 Designing of Interview Questions

Inquiring appropriate questions in interviews are critical to the productivity and to gain richness in terms of the research. The designing of the interview questions was difficult in the initial interviews but as the researcher got used to the research process and environment, designing and inquiring questions from the participants was found a much more convenient process. As discussed previously, informal pilot meetings with concerned individuals helped to enhance researcher's theoretical sensitivity. This theoretical sensitivity further supported to formulate interview questions and assisted him to prepare a draft of such questions which could cover various insights of required approaches. Review of the basic literature in terms of risk management and Virtual-Agile IT projects was also looked upon to think about the areas of investigation. This action was undertaken considering the limitations of methodological allowance of grounded theory; as it only permits the researcher to go in the field with an open mind, but not with an empty head.

4.6.3 Semi-Structure & Open-ended Style Questions

Following the rules and limitations of methodological procedures, the researcher believed that semi-structure type of questions may help him to explore relevant information about the phenomenon. Turner (1981) suggests that while undertaking the grounded theory study, use of observations, face to face interaction, and unstructured or semi-structured are all relevant strategies and well-suits with the nature of the study. In a qualitative research, semi-structure types of interviews are widely chosen with open-ended questions as they provide an opportunity to the interviewee to talk freely about a problem and discuss their ideas and opinions on contrast to highly structured interviews (Creswell, 2007). Similarly, several authors like Manuj and Mentzer (2008), Sbaraini et al. (2011), Moe and Smite (2008), Dorairaj et al. (2012) have used in-depth interviews while conducting a grounded theory research. Semi-structure with open-ended questions are preferred in any qualitative type of research and used widely in grounded theory studies (Khan, 2014).

4.6.4 Draft of Basic Interview Questions

For this research study, a basic version of interview questions drafted was inquired from all the 25 participants. During the data analysis process, as per principles of theoretical sampling and constant comparison, some of the additional questions were asked against the categories as they evolved from the data. Sample of questions is shown in the APPENDIX-II. These questions helped to saturate the categories generated in Open and Axial coding phase. The initial interview questions were drafted with keeping all the considerations in mind. These considerations were mainly based on:

- Provide as much as opportunity to participants to contribute and express their feelings and experiences
- To get a broader perspective of the relevant issues and challenges, evolving risks, management practices and ground realities so that data should speak for itself rather enforcing the researcher's own opinions
- The interview questions should be related to substantive area so that focus should be maintained; though several noises could be expected during conversations

4.6.5 Selection of Participants and Reducing Bias

The selection of participants for this study was done on the criterion elaborated in the section 4.4.3. As purposeful and theoretical sampling both were used to locate target samples, it was presumed that the data would be collected from experienced project managers or project administrators who have been involved in Virtual-Agile IT Projects. In the beginning of the data collection, it was tentative that the researcher would across various boundaries and regions for the data collection but with respect to the number of interviews it was determined that collecting data from various organisations and diverse regions would help the researcher to gather more useful information.

Secondly, while selecting the sample there was no intention to get data from any specific region or country but the focus was to locate appropriate sample using researcher's own professional network. The focus was to ensure that the participant meet the defined criterion rather targeting any specific region or country. Experience of working in Multi-national or foreign-based organisations could be a positive step forward to collect relevant data. For example, while selecting the participant from Germany, one of the previous colleagues were consulted who recommend Participant#4 from the IT software department of his organization. Similarly, while selecting participants from Pakistan, it was determined in the pre-interview discussion about the pertinency of the participants. In all the interviews, one of the basic factors which was considered was that the participant should have experienced of managing Virtual projects together with working on Agile methodology. This helped to find appropriate samples from the target location.

Creswell (2007) suggests for avoiding biases in a qualitative research to achieve rigor and richness. However, Norris (1997) acknowledges on the other side that there is no definite solution or paradigm to avoid bias and errors in qualitative research. Norris (1997) further elaborates that biasness can be reduced to authenticate the research process by following methodological processes and procedures. Following are some of the strategies used by the researcher to avoid bias.

- i. **Acquiescence Bias**, also known as 'Yes-saying' or friendliness bias occurs when a respondent agrees with the point of views of the researcher as per situation, time, place and condition (Dodou and Winter, 2014). During the course of data collection, the researcher has tried to avoid acquiescence bias by asking several questions in between the interviews to ensure that respondent elaborates his thoughts with an honest and confined point of view. For example, using the '5 whys' technique helped to get deep insights of a problem or issue.

- ii. **Confirmation bias** is one of the persuasive forms of biases in research where a researcher develops a hypothesis or belief in his mind and uses respondents' information to authenticate that belief (Nickerson, 1998). Confirmation bias was avoided using constant comparison process where the responses of one participant was compared with the responses of next participant. Similarly, confirmation bias was avoided by peer reviewing where the findings of the research were shared with the colleagues and the supervisory team to get feedback on the results.
- iii. **Leading questions and working bias** was avoided by asking a variety of questions in between the conversations. Leading questions and working bias is a type of bias where a researcher when asking question to respondent puts some words in respondents' mouth which could lead to a conclusion which is different to respondents' belief and experience (Malhotra et al., 2004). During the research, leading questions and working bias is constantly avoided by the researcher. The researcher used to ask very simple and straightforward questions to his respondents. Where an explanation was needed, the researcher explained about the philosophy behind the question. For example, when asking few participants 'what type of virtual-agile project you have experienced', the researcher elaborated about the distributed projects, some explanation about distributed/virtual format and agile methodologies. The reason why the participants were not able to understand few terms was a difference in practical terminologies in relation to academic terminologies. For example, when asking to participant#8 about Virtual-Agile projects, he mentioned that few of his scrum teams are based in India and few in USA. Similarly, a hint or direction was provided to avoid noises in the data and help respondents contribute originally from their experiences.

4.7 Interview Details

The data collection for this research study occurred between September 2015 till August 2017. Total numbers of 25 interviews were conducted from the participants as mentioned in table 4.5. All the participants selected were having a role in management of the projects and thus fell under the defined criterion illustrated in Section 4.5. As previously mentioned, the interviews were conducted in different parts of the world; so, all the interviews were synchronous and real-time based. The interviews were recorded using a professional audio recorder. There were three types of techniques used for conducting interviews:

- **Face to Face conversations**
- **Telephonic conversations**
- **Video calls using computer-mediated communication**

The researcher believes that face to face interviews were generally easy to conduct and record and gave a proper impression of participants' body language and expressions. Face to face interviews were conducted for a total number of 10 participants: that included participants # 2, 5, 7, 8, 9, 10, 11, 12, 13 and 14. The researcher accepts that there were several advantages linked to face to face interviews. These advantages were mainly uninterrupted discussions, both the interviewer and participants adapt themselves to the conversational environment, and this would create discussion more imperative and lengthier. Similarly, few of the disadvantages which the researcher observed were several noises; the conversation sometimes went beyond the focus and then researcher had to inquire few pertinent questions to get the conversation back onto the track. The researcher provided maximum time to every participant to contribute according to their best of knowledge and experience. The researcher tried to ensure that the richness and productivity of data is maintained throughout the data collection process.

Interview with all the participants was overall a unique experience. After the pilot interviews, the researcher was still not able to identify and look for the relevant participants. In this regard, the researcher decided to meet his supervisory team, and discussed about the strategies to get access to the participants. It was decided by mutual consensus to consult other research colleagues, alumni or friends who can provide support to him. The researcher tried all the strategies to find out participants but couldn't bring any fruitful results. Then one of the members of the supervisory team referred a previous colleague of her, who was being working in a well-known organisation for the last 25 years and she was willing to discuss on the problem. The researcher was pleased to know about this and set up a date with the first participant. At that time, the researcher had also received the ethical approval from the committee and he was then ready to undergo meeting with his first participant.

The **first participant** was located at a different location in the United Kingdom, so means of conducting an interview with the consent of the participant was finalised as Microsoft Skype, a famous video conferencing tool. Before getting formally into the field, the researcher conducted a meeting with his supervisory team to discuss the strategies in relation to conduct qualitative interviews efficiently and the important points which should be kept in mind while inquiring questions. The guidance provided by supervisory team is highlighted as follows,

- Highlight the terms and conditions of the interviews at the start of the interviews
- Start with the consent of the participant; although a formal abstract, information sheet and consent form were already sent to participants before conducting interviews
- The interview place should not be influenced by noises or disruptions as this might divert the attention of both the participant and researcher
- Writing down the field notes during and after the interviews can provide much help in the development of a phenomenon

- All the interviews should be recorded or taped for the future evidence purpose

By keeping all these suggestions in mind, the first interview was conducted on 15th September 2015. A consent form and participant information sheet were already sent to fulfil the Ethics requirement and to ensure participant's willingness for the research. The entire ethics requirements were kept in mind. The interview started with the introduction of the researcher, his area of research and explanation of basic Terms and Conditions for the interview. The participant shared her career experiences and different circumstances under she had functioned in Virtual-Agile settings.

The researcher kept notes of most of the conversation and this helped him to understand the content of the discussion. During the 1st interview, one of the problems which the researcher faced was with recording/taping of the interview. The researcher used his mobile phone for the interview but found at the end of the interview that the recording has not been done properly; though he was able to get most of the data recorded through field notes during the interview. The first interview was having a total duration of 1 hour and 17 minutes.

After the interview, transcription was performed, sent to the participant for the check and the researcher was then able to analyse the data using grounded theory principles.

Summary of the 1st Interview

The key field notes which were the bases of conducting next interview were as follows

- The researcher came to know about the areas of implementation of Virtual-Agile methods. Like in the first interview, it was mentioned by the Participant that virtual projects can be of many types like new software development, information security, improvement of IT infrastructure etc. Also, the participant's view of implementing appropriate agile methods was dependent on organisational decisions, project needs and compatibility of the people working.

- From the participant's experience, it was also observed that Virtual-Agile projects are full of complications which give rise to many potential risks and therefore difficult to manage while being geographically dispersed.
- Risk Management for Virtual-Agile projects is generally based on general management and traditional risk management practices. Several tactics can be applied but still dependent on the organisational approach.
- Ignorance of formal risk management is common in the industry. When complications are faced, they just recognised them as daily routine affairs. It gives rise to more uncertainties later which usually leads to bad outcomes.

By writing the field-notes, the researcher got an initial picture of the area of research and phenomenon which helped him to design following strategies for the next interview.

- The next interview to be conducted with the participant who had been involved in settings having experience of dealing with multiple natures of projects like software development, information systems or security etc.
- Look for individuals who actually been involved in design or compliance of Risk Management

The **second interview** was conducted face-to-face in the United Kingdom and the participant was invited to the university premises to discuss the problem. The researcher acquired a silent space in the premises and interview went for more than 55 minutes. The interview started again with the introduction of the researcher and he mentioned the terms and conditions for participation to the respondent. The participant provided his contentment and then researcher requested the participant to briefly highlight his career experiences. The participant was really obliged and defined the circumstances and settings under which he has worked. As the questions were designed taking a rough idea relevant to the research topic and phenomena (Strauss and Corbin, 2008), the researcher observed that the questions were working well to get several insights of the problem. During the analysis of

2nd interview, field notes were generated, and the researcher noted down all the important minutes that guided him for the next interview which are briefly highlighted as below

- Virtual-Agile projects can work together efficiently but understanding the Agile paradigm in-depth is a critical factor
- Risk management in such projects is actually gaining an understanding of the process management
- It seemed from the interview that the participant was emphasizing on learning of some particular principals before entering practically into the projects
- It was also observed the participant was concerned that every organisation is using term '*agile*' for their own benefits and adaptability by mentioning that '***Nobody knows what agile is!*** Or '***People use agile for their own benefits***' which can be considered a major Risk.
- The concept of '*virtual*' and '*agile*' is most relevant to new product development in software development projects. In software development projects, Scrum methodology is the widely used for development in the distributed format.
- Look for the participants who have hands-on and experience of Scrum methodology and dealing with project virtually.

There were some of the highlights of from first 2 interviews. Consequently, the summary of all the next interviews are as follows:

Interview with Participant # 3:

Researcher considered the previous recommendations written down for the third interview. It took almost two months to find an appropriate person who has the experience of software development under Scrum methods and has been closely involved with the managerial practices pf Virtual-Agile projects. Theoretical sampling facilitated the researcher to locate the respondent having such type of experience. The interview again started with the

introduction of the researcher and requested the participant to highlight his experiences. The interview was conducted using computer-mediated tool i.e. Microsoft Skype. The participant was based at a different location in the United Kingdom and he himself preferred to undergo discussion through Skype. This participant was from the software development industry who was undertaking projects for the public-sector organisations in the UK. This interview provided an affirmation that the Scrum method of Agile is widely used in virtual projects. This was a presumption, but the researcher remained open-minded and kept notes of all the important arguments that helped to conduct future interviews.

Interview with Participant # 4:

The next interview was held by means of the phone conversation as the participant was based in Germany. He was an experienced project manager in one of the IT companies. The participant provided some of the unique concepts which enhanced the properties and dimensions of the previously developed categories. For example, the participant mentioned that he prefers to use a mix of Agile and traditional methodologies to manage risks but previously, the participants prefer to apply only one method to deal with risks. This contradiction in views was a good factor in terms of richness, rigour and diversity of practices of different organisations. The researcher after discussion with supervisory team assumed that diverse arguments and beliefs would help well to saturate the properties and dimensions of the categories and enrich the findings.

Interviews with Participants # 5, 6, and 7:

An interview with participant 5 was held face to face in university's premises. He was invited to discuss on the research problem. Interview#5 was one of the most expressive and rich interviews of the overall data collection, as the gentleman provided several insights of the managerial practices and highlighted various challenges and issues faced by the distributed team members. The participant was a free-lancer IT consultant and project manager in one of the institutions in the United Kingdom. He provided very useful feedback on the work

which the researcher was undertaking and gave suggestions that how the researcher could reach close to his research aim and find a solution to his problem. The participant had also been involved with Academia for many years.

Similarly, interview#6 was conducted through telephone where the researcher found out his participant with the help of previous colleague from post-graduate studies. He was from the same organisation as the participant#4 but was working in a different position and department. The 7th interview was again held face to face with the participant having experience of managing Virtual-Agile projects. The conversation was again quite exciting, rich in perspectives and provided several insights of the research phenomenon. At that time, the researcher was observing that few of the concepts have started getting repeated. As the researcher was getting used to the interview practice and field, he discussed with the supervisory team about the repetition of some codes and concepts, but they acknowledged the fact that now with the passage of the time as the concepts and codes are getting matured; you may observe more saturation in the data in later interviews. After conducting 7 interviews, the researcher decided to go to Pakistan which was his home country to conduct more interviews. All the 7 transcriptions were completed and analysed before moving to another region for conducting further interviews.

Interviews with Participants # 8-14:

Interviews # 8-13 were conducted in Pakistan using face-to-face means where the researcher approached all his participants through his personal and previous professional contacts. The basic questions were same as of the previous version but some of the questions were revised, eliminated and few other to facilitate the process of theoretical sampling. The researcher almost spent 45 days in Pakistan where he conducted 6 interviews. The transcriptions of the interviews 8-10 were performed as the researcher proceeded with the data collection for the analysis purpose. The field notes generated during the interviews helped him to conduct further interviews with participants 11 to 13

where he analysed the data and decided what to inquire in further interviews. The duration of all these interviews varied between 32 – 56 minutes. At that point, the researcher observed that the duration of the interview is getting less as the interview questions became more focused which further helped to mature the categories.

The next destination for conducting interviews was the United Arab Emirates. The researcher came to know that this is one of the favourable destinations where IT projects are undertaken. This insight was acquired from few of the colleagues who have been working in IT industry in UAE. Interview#14 was conducted with a project manager in software development industry under theoretical sampling. The researcher here at that point was observing more saturation in the categories, therefore, he looked for the participants working in the substantive area under Scrum method having vast experiences.

Interviews with Participants # 15 and 16:

A participant who was working in Kuwait in one of the financial institutions as a principal product manager had a vast experience of managerial practices under Scrum method. The interview was held by means of Skype as the researcher was not able to visit Kuwait for such a short duration. This interview was found to be more imperative as a researcher came to know some of the new insights about the phenomenon. These insights were mostly linked to how different organisations management evolving risks and their priorities to manage them. Consequently, the participant discussed the problems where he could not access his distributed team members during vacations or weekend which gives rise to several potential risks. The respondent also elaborated some strategies to overcome these challenges.

Similarly, interview#16 was held with one of the experienced project manager and IT consultant in the USA who had been working in a well-known automobile industry. This

interview was also conducted by means of Skype and lasted for 42 minutes. The researcher inquired all the main questions but asked additional questions to saturate the categories.

Here it is important to mention that while conducting the grounded theory study, the participants and questions may change, but the aim of the doing this activity is to attain diverse perspectives, experiences and beliefs about the problem under the principles of theoretical sampling. The researcher conducted all the interviews specifically to the guidelines of the grounded theorists such as Glaser and Strauss (1967), Strauss and Corbin (1990; 1998; 2008), and some specialist qualitative inquirers such as Creswell (2007; 2009), Denzin and Lincoln (2005), Lincoln and Guba (1985) and Crotty (1998). Though several noises and disruptions were faced in the research process, the researcher tried his best to avoid prejudices, focused on the principles to collect rich data and reflected rigour in the overall research process.

The researcher also wants to highlight that during all the previous interviews, some of the additional questions were asked to the participants in relation to the categories shown in Table 4.16. These questions were asked as there was a need to fill in the categories with more data. For example, the researcher asked participants about the *importance of knowledge sharing* and *relationship building process* in these projects. The researcher also asked about the role of leadership or project manager when managing such projects. These questions were added time to time when there was a requirement, where the researcher wanted to get more insights of the phenomenon.

Interviews with Participants # 17-25:

After conducting 16 interviews, the researcher was able to achieve quite a lot of saturation in the categories. This has been discussed in the detail later in open, axial and selective coding phase (Section 4.16 – 4.18). To attain more unique perceptions, the researcher conducted more interviews by asking some additional questions as discussed above. The

researcher was able to find more interviewees from the countries of Pakistan, Romania, and UAE under theoretical sampling. All the participants were well experienced and contributed to best of their knowledge. After the analysis of the 18 interviews, the researcher was not getting enough new concepts from the data and this was the time where he formulated his views, opinions, and beliefs into a model. The researcher after discussion with the supervisory team conducted 7 more interviews which were based on findings attained from the previous interviews. The discussion started normally as with the experiences of the participants, then some of the highlight of major issues or challenges and strategies to manage them. According to Strauss and Corbin (1998), this stage is data validation stage where the researcher inquires questions of the data to ensure saturation and maximise properties and dimensions of the categories. Similarly, when the discussion went around risk management procedures, the researcher inquired the questions of the core-category of 'Responsiveness' and other main categories i.e. technology, timeliness and communication (Table 4.16) to look for any new concepts or get deeper insights to help confirm the saturation of his findings. Though few new concepts emerged but most of the part of the discussion was repetitive (after analysis) and this was time where the researcher terminated his data collection process (discussed in Section 4.19.1) and worked on the development of conceptual framework.

4.7.1 Influence of Participants' contexts on Data Analysis

As the participants were from diverse backgrounds and regions, having different experiences of the situations and consequences, there were some similarities and differences observed in the practises of the participants which are discussed as follows:

- The UK and EU based participants, i.e. the interviews conducted from UK, Germany and Romania; it was observed that participants have similar sort of practises for managing their projects. The participants' practises depicted that the trend of remote/virtual working has been increased in Europe over the last decade and

participants are facing difficulties keeping hold of the developers/team members. It has been observed the Virtual-Agile projects in the region requires availability of high-end technology at all locations to create a strong network between all individuals. Similarly, the use of Enterprise Risk Management Tools is being promoted in the organisations and trainings are underway to control and reduce evolving uncertainties. The participants have emphasized on fulfilling the needs of the individuals and providing them with more space for completing their jobs. The participants who were having similar type of qualification and skills also emphasized the need of allocating appropriate job responsibilities to individuals according to the skills, so that they could be able to complete their works on time. Managing workload was specified a number of times by the participants to achieving the desired outcomes and reducing potential risks of failure.

- Pakistan-based participants were found to be more diverse in the sense that they were collaborating with clients, developers and product owners worldwide such as in Canada, Australia, USA, France, Germany etc. The practises mainly observed were diversification and flexibility in terms of adjusting their routines, working hours and collaborating with part-time workers. Project managers from Pakistan emphasized that though interacting with team members from various regions reduce labour costs and help developing innovative solutions but the issues were mainly keeping hold of the clients and product owners who play an important role in the development stages. The participants also highlighted that risks and uncertainties mainly take place due to less understanding of the project's objectives and therefore an efficient knowledge transfer process should be monitored continuously by the project managers to reduce the failures in the Sprint. The participants were mainly from the Software development industry and several similarities observed in their practises.

- The participants from Middle East region – UAE and Kuwait undergo multiple practises such as adjusting time, dealing with people from different background and knowledge becomes difficult as the project manager need to undergo proper training sessions for educating developers/team members. The participants specified that there is difference in understanding of the individuals working in the same project environment and they need to continuously monitor their progress for meeting the deadlines. The participants were mainly from the software development industry and IT sector which were undergoing several projects and program management respectively.

Consequently, as the participants were selected under specific criterion, there were no explicit differences observed between their participants' practises for the managing the Virtual-Agile project environments. The main reason the researcher understand is the interaction of participants with diverse contexts where they must adjust and adapt themselves according to the needs of that project environment and people and develop a consensus to meet the project objectives. Though, there were some cultural differences observed but as the motive was to record international-based practises, cultural differences were ruled-out in the context of this study to develop a conceptual framework which show commonalities of the practises and strategies.

4.8 Influence of using Multiple Mediums for Interviews

The researcher accepts that every method of collecting data has an impact on the ability to analyse and interpret the data. Conducting this research study has helped to identify some of the benefits and limitations involved in the research process. As previously mentioned, the data collection was undertaken using three strategies i.e. face-to-face, telephonic and using computer-mediated tools; every method has its own benefits or limitations which are briefly summarised as,

- Conducting face-to-face interviews provided the researcher and participants both an opportunity to get involved in the conversation and settings. The researcher well interpreted the expressions and outlook of the participant while analysing the data. This influenced researcher's perceptions during the open coding phase when he was allocating in-vivo codes to the data. For example, while categorising the potential risk factors, the researcher kept in view the expressions of the respondents and the significance they give to each risk factor. The significance could be in terms of how much are the chances of each particular type of risk that may occur in Virtual-Agile project environments. Similarly, the researcher believes that face-to-face interviews were more convenient to conduct without any disruptions where the researcher took take notes easily, inquire questions of the data and tried to get involve into a particular situation.
- There were only two telephonic interviews conducted for this research study. Both the interviews were conducted in Germany where the participants themselves preferred to undergo telephonic conversations rather using computer-mediated communication (Skype). According to Opdenakker (2006), telephonic interviews are less commonly practiced in the qualitative inquiry but are considered as a versatile data collection tool. Telephonic interviews allow the participants or respondents to be more comfortable and talk freely and reveal intimate information. Chapple (1999) argues that although telephonic interviews are a vivid, rich and high-quality method for collecting interviews, their benefits are fewer when compared with face-to-face interviews. They are normally preferred due to differences in geographical locations, fewer space requirements or may be due to safety or security reasons. It was overall a difficult task for the researcher to conduct telephonic interviews with respondents and to understand their opinion and responses, but nothing could be done in this regard as the participants themselves preferring to undergo discussion

by this mean. The 4th interview went around 1 hour and 15 minutes, and the researcher was able to get several new insights of the risk management practices as discussed above. Few of disadvantages linked with this interview was there was a bit of distortion in the telephone line, and then the call was disconnected in between the conversation. According to Chapple (1999), loss of nonverbal data may sometimes be misinterpreted during analysis. The researcher similarly was taking field notes which helped him to get involved into those particular settings even the distortions and disruptions were taking place. Similarly, the 6th interview was also undertaken through telephonic means but went smoother than the previous one as it wasn't having any line distortions, and the conversation was completed in one call. Though there were some limitations involved with the telephonic conversations, but the researcher prepared himself to be in the situation where he can just listen to the respondent and assumed that the situation is visible to him so that their responses could be interpreted more effectively. The researcher also observed that the environment has a lot of effects while discussion over telephones. At the participants' side, the environment seemed to be more relaxing and comfortable, where they contributed and express themselves more effectively. That was the reason that both the respondents preferred to undergo telephonic discussions; these assumptions were also noted down by the researcher when writing field notes.

- The third strategy for conducting interviews was using a software tool known as Microsoft Skype. Berg (2007) suggests that web-based in-depth interviews can take place in two settings:

- a. Synchronous environments

Synchronous environments consist of real-time chat rooms, instant messengers or real-time threaded communications provide a similar type of experiences as the real face-to-face interviews where the interviewer and

respondent can exchange their views and respond to each other's questions and answers.

b. Asynchronous environments

Similarly, asynchronous environments comprise of use of emails, message boards or privately hosted posting areas used by investigators when conducting a survey-based research.

Berg (2007) further suggests that while conducting the unstructured or semi-structured interviews over the internet, video conferencing are as identical face-to-face interviews and have some properties which are similar to face-to-face interviews where the researcher can record the participants' gestures and responses that may put an impact on his findings. Iacono et al. (2016) proposes that internet interactions sometimes allow the participants or respondents to better express their selves. This can be a reason of their familiarisation with the environments where they found themselves more comfortable and expressive. Iacono et al. (2016) further suggests that representation of the self-authentication and presentation of self-accuracy are both difficult to judge in face-to-face and internet interactions as the researcher cannot estimate whether the information provided by the respondent is a replication or fabrication of truths.

As discussed, video conferencing tool such as Skype was preferred to undergo interviews as it has similar in properties as compared to face-to-face interviews. There were also several tools available in e-market, but Skype being known as a consistent and one of the oldest video chat tools was preferred to conduct interviews. Due to time and financial constraints, it was difficult for the researcher to travel around the world and conduct interviews. Before approaching to the participants who were based in different locations, they were requested to lend or arrange a noiseless environment so that interview may go smoother without

disruptions. Similarly, the requirement of high-bandwidth internet was required to avoid interruption although the similar bandwidth was not guaranteed at all time. In this regard, the researcher wasn't able to do much but was prepared to use backup means in case the conversations got disrupted. The backup plan included shifting conversation to telephonic calls and arranging secondary devices for recording. Iacono et al. (2016) further suggests that internet connection can be an issue while undergoing internet interactions. Although technology has been improved over the years, but it was difficult to say that it would work flawlessly. He further advises the researchers to set up a backup plan in case communication gets interrupted or any breakdown occurs. Backup plan may include communication through alternative means like using telephonic calls, arranging backup recorders in case something gets wrong such as battery and storage issues, and ensure measures to check the devices through which the communication needs to occur.

A total number for 13 interviews were conducted via Skype for this study; these included interviews#1 and 3, and then from interview#15 – 25, mentioned as in table 4.5. During the very first interview which was conducted via Skype, the researcher faced the problem of recording/taping the interview as previously mentioned in section 4.7. The connectivity for all the other interviews except interviews#18, 22 and 24 was found satisfactory as there was a bit distortion and disruption in the line. During the interviews#18, 22 and 24 the call was dropped, recording was disrupted in between the conversation and the researcher had to reconnect again. The researcher feels that it might have affected the participants' flow of information in relation to the question inquired. For example, while undertaking the interview#22, the recording stopped when the participant was discussing about the role of stakeholders in risk management process. The researcher had to use the backup recorder, and then the conversation was again

initiated. The researcher observed that there was a little disruption in the information sharing from the participant side as he had to adapt himself into the environment again. The field notes which the researcher took at that time helped him to direct the conversation back on the track. The researcher also observed that while in the settings of taking interviews, it is quite normal that participants or interviewer get disrupted because of these breaks. The environment has an influence on both the researcher and interviewee's body language. Secondly, it affected the researcher mindset; as while taking down the notes, his concentration was lost and diverted to fix that issue. That certainly has negative impact on the ideas and inquiries that were to be included in the conversations. Similarly, in the interview#24, the researcher got a gut feeling that the recording was not taking place, so he disconnected the recording and switched it back on. It had an impact on the researcher mindset and researcher had to get involve into that particular settings again. The duration for this interview was more than 43 minutes at the end. These were some of the critical highlights of the interviews conducted for this research study.

4.9 Building of Rapport during Conversations

Building of rapport was a great concern for this research study. The researcher was well-aware of these issues before entering into the field. According to Bartkowiak (2012), good communication and interaction level between the researcher and participants' helps to collect data more effectively in qualitative studies. He further suggests that building of trust and understanding helps to disclose secret information. Without gaining the trust and understanding, the participants might produce fabrication and do not prefer to share the exact information which could be a great risk to the reliability of the data (Molden, 2011). Therefore, building of rapport with the participants was crucial to achieve as the interaction time and level between both interviewer and researcher was limited. According to Guillemin and Heggen (2009), the purpose of the building rapport is to reveal rich data while

maintaining a good level of relationship and respect between the researcher and participants. The participants' when felt secure will adapt into the conversational environment and reveal more sensitive information. For building of the rapport, the researcher undertook following measures

- One of the most important factors was attaining the trust of participants as anonymity between the researcher and participant could have created hurdles for revealing sensitive information. According to Churches and Terry (2007), trust is difficult to maintain in qualitative studies. Trust is mostly related to securing the information afterward the interview. The participants get a sense of worry that how the information or experiences would be used later on in the research. The researcher believed that for overcoming this challenge, the first step is to formally invite participants for contributing to the research study. The researcher for gaining trust of the participants undertook following strategies,
 - Sending an invitation to participants from university's student email account with the attachment of participant information sheet, consent form and abstract for the research. The researcher assumes that this would have created a factor of trust on the participant side. Similarly, few of the participants in response got back to the researcher and mentioned that they would require a hint of what would be inquired of them during the interviews; recognising if they are the appropriate persons or not. In this regard, the researcher discussed with the supervisory team and then suggestions were provided in the form of the basic interview theme line with the abstract of the study. For example, discussion of issues and challenges in Virtual-Agile project environments, how the organisations deal with risk management in such environments, what kind of techniques and methods they prefer. The

researcher observed that this enhanced participants' interest about involving in the research study and they felt more confident about their contribution.

- Similarly, respecting all the participants, being flexible, genuine and sincere helped to encourage rapport for this study. Keeping an environment of respectfulness was the first priority of the researcher as he thought that participants' may get affected by this element especially. The researcher tried to remain conscious during conversations and respectfully acknowledge the responses of participants. Agreeing on the right time for the interviews was a bit tough for the researcher as he had to chase his participants most of the time. In this regard, the researcher fully gave the authority to the participant to decide on a time of his/her choice and then get back to him when ready. If the participant was not able to get back, the researcher sent him/her a gentle reminder of the participation in the study.
- Similarly, during the interviews, the researcher tried to be an active listener and responded to the participants' viewpoint by giving verbal cues, such as yah, right, absolutely (Hull, 2007). Then keeping an eye contact also helped the researcher to boost rapport building process. Similarly, almost in all the interviews, the researcher warmly welcomed and provided gestures of gratification to his participants so that the discussion environment may become more useful.

The researcher believes that during the data collection phase he tried to neglect resistance to increase the rapport. This was done by showing gestures of thankfulness and respectfulness. Similarly, there were also few negative cases where the researcher didn't get access to the participants. This may be the reason of lack of understanding and trust which the researcher was not able to show to his respondents. One of the examples is the researcher tried to get in contact with an experienced participant who was based in the

United Kingdom. The researcher chased him for 2 years but couldn't get access to him. The participant always committed to participate in the research study but in reality he didn't fulfil his words. The researcher tried to get back to him overtimes by requesting him to allocate time, date and a location of his choice, but at the end it was of no usefulness. Similarly, another case was approaching the participants through LinkedIn which is a well-known professional networking forum; where different professionals can interact and look at each other's portfolios. The researcher was not able to get any response from that platform; he believes that may be due to lack of trust as no one wanted to share information. Similarly, one of another example can be the interviews in Germany, where the participants preferred to undergo discussion over phone rather Skype. The researcher believes that this might a reason of intercultural breaks where some cultures do not prefer to get fully involved with an anonymous person. But the outcome of both the interviews was found satisfactory as the researcher fulfilled rapport criterions due to which he observed that interviews were rich, lengthy in duration, where the participants contributed to the best of their experiences.

4.10 Process of Transcriptions

Transcriptions in qualitative research are considered to be a reflective process of the situation, non-verbal actions, talk, time and languages used (Bucholtz, 2000). Transcription is an interpretation or transformation of audio from recording to text (Duranti, 2007). Strauss and Corbin (1990) further suggest that transcription enhances the theoretical sensitivity of the researcher as he gets closer to the data. Transcribing interviews also helps to critique and locate negative elements occurred during the course of the interview. Interview-transcribing is one of the most time-consuming activities in a qualitative research where the researchers transform the recorded audio into word-to-word text for analysing. Few of the authors like Glaser (1992) and Dick (2005) encourages qualitative researchers to use field notes as an alternative to lengthy transcriptions for analysis. The field notes should

be drafted and checked against the recorded tape that may help to analyse the data in less time.

Transcriptions are generally characterised by three main types. Verbatim type of transcription includes the word-to-word transformation of audio/sound into text. This type of transcription also includes the mimic responses such as ahm, ahh, hmmm, I mean, you know etc. Similarly, intelligent transcription omits mimic types of responses and focus on actual content that needs to be transformed. The third type is the edited type, which omits certain responses and shortens the transcription by reducing a number of sentences without changing the meaning. According to Davidson (2009), verbatim transcriptions in qualitative study help to analyse the insights of the phenomenon which is under investigation by observing the responses of the participants. Further, they help the researcher to contextualise the data before giving them a representation in terms of codes or themes.

A total number of 25 verbatim transcriptions were done for this research study. All the transcriptions had been completed by the researcher himself which took most of his time during the research journey. While doing a grounded theory study, as the researcher had to constantly compare his findings with the previous findings, transcriptions was a difficult task especially when there was less time between the next scheduled interviews. Normally, an hour recording could take more than 3-4 days or even more of researcher's time to transcribe. It was dependent on researcher's temperament and motivation to finish his work promptly. Initially, the researcher was well-enthusiastic about transcribing the interviews but later after two interviews, it took him about 20 days to transcribe and analyse the data completely. For the first 4 interviews, the researcher did all the transcriptions one by one, analysed them and went into the field afterward. As this activity was time-consuming, it was mutually decided with the supervisory team to conduct interviews using the field notes which could certainly help the researcher to look for the participants and decide what should he inquired of them. Glaser (1992) and Dick (2005) have already acknowledged this strategy

above as it saves time and strength researcher's observations. To avoid influence and biases, the researcher in this regard compared the field notes generated during the course of interviews against the original recorded audio, which helped him to fulfil the gaps (missing information) and conduct further interviews. Similarly, from the 5th interview, all the transcriptions were performed in a set of 2, where the researcher conducted interviews, transcribed them and analysed them in detail with the previous findings to saturate the categories. A sample of the transcription from the interview#25 has been shown in the APPENDIX-III. This transcription doesn't include mimic responses or repeated words, like ahm, ahh, hmmm, I mean, you know etc. to allow readers to examine the content more constructively rather being disrupted.

4.11 Reflexivity and the Researcher

The researcher believes that it is relatively impossible in a research project to avoid prejudices completely. The process of reflexivity which is more about creating awareness within a research process has supported the researcher to prevent previous knowledge twisting the researcher's insight of the data. Reflexivity is considered as the researcher's attitude approaching analytically towards a knowledge building process or an impact of the researcher at each stage of the research process (Lincoln and Guba, 1985). The researcher presumes that the issue of reflexivity has been dealt by him very efficiently. According to Malterud (2001), researcher's philosophical position and assumptions affect what and how he desires to investigate about a phenomenon, the analytical methods estimated for the investigation, the findings considered utmost suitable, and then shaping and announcements of the results. The perceptions of the researcher help in conducting the research study both for qualitative or quantitative types.

In grounded theory study, reflexivity is attained by carrying out a conscious reflective process, in which the concepts should emerged from the data itself using constant

comparative method rather accomplished from preconceived ideas (McGhee et al., 2007). Charmaz (2006) suggest that reflexivity is a process considered in research which provides an accountability of researcher's experiences, philosophical positions, and interests that influenced the research. Corbin and Strauss (2008) believe that reflexivity is an essential part of the grounded theory process, where a researcher gives meaning to his investigation depending upon the philosophical orientations and professed a degree of relevance. Birks and Mills (2011) recommend that memo-writing process depicts researcher's self-awareness and makes personal assumptions more explicit. In other words, Birks and Mills (2011) state that reflexivity necessitates the analyst to generate vigilance, self-examination approach and eliminate biases in raw data. McGhee et al. (2007) mentioned that after conducting a research study Corbin identified in her self-reflection that when writing the memos, she was more influenced by the emotional responses of the data rather conceptualisation the responses of the participants. Corbin and Strauss (2008) further advocate that this process allows the researcher to analyse the data again and increase the truthfulness and trustworthiness of the results.

The understanding of reflexivity process has prevented the researcher from prejudices to a great extent and misrepresenting insights of the data which could be influenced by the preconceived concepts or ideas. The researcher tried to be self-aware throughout the research process and was able to consult literature without influencing it on the data. Reflexivity provided researcher an opportunity to appreciate and know about previous literature published in the relevant area, without supposing that the notions revealed in the initial review of literature can be the only clarification to his study problem. Similarly, in the critical evaluation phase (chapter 6), the literature helped to support the arguments from the results and then helped to highlight significances and weaknesses of the findings. The researcher philosophical believes helped him to interpret and analyse the data systematically and then represent them in the form of framework. Consequently, while writing up of the

thesis, the issues of reflexivity have been appreciated at every point, so the readers of the study could be able to identify the processes and phases involved in the research journey.

4.12 The Process of Data Analysis

This study uses Strauss and Corbin (1990; 1998; 2008) version of grounded theory methodology for generating the theory of Responsiveness. Glaser and Strauss (1967), Glaser (1992; 1998) and Charmaz (2006) guidelines have also been conceptually considered time to time during this study. Strauss and Corbin (1990; 1998; 2008) versions of grounded theory methodology consists of three main phases i.e. Open Coding, Axial Coding and Selective Coding. Under the guidelines of Strauss and Corbin (1990; 1998; 2008), the researcher has drafted the process of the grounded theory research for this study as shown in the following diagram. This diagram has been created by researcher himself that elaborates the steps and phases under which the paradigm of Responsiveness was developed.

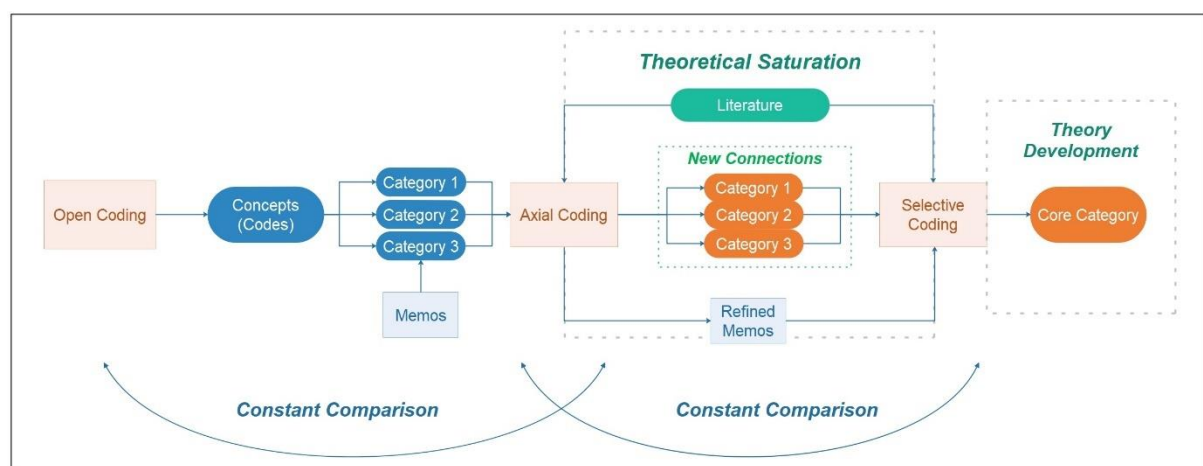


Figure 4.12: Process of Data Analysis

Explanation

The process of analysis initiated from the Open Coding phase. Open coding was the process of analysing the data by breaking down into codes and concepts, which were further developed into categories based on their properties and dimensions identified from the data.

According to Strauss and Corbin (1998), properties are the characteristics of the categories which gives them a meaning whereas dimensions comprise of a wide range of properties along which the categories vary, defining their specifications and criterion. The categories which emerged during the open coding analysis were further processed into axial coding phase. Axial coding was the phase which further refined the categories and developed a new relationship between categories from open coding phase based on the process of inductive and deductive thinking.

During the open and axial coding phase, and then axial and selective coding phase, the process of constant comparison was take placing to mature and saturate the categories. Constant comparison method helped to enhance the properties and dimensions of the categories and compare the data incidents one-by-one with the previously generated codes and concepts as they emerged. The process of memo-writing which was initiated during the open coding phase helped the researcher to compile his ideas and opinions against the generated categories. Memos were further refined in Axial Coding based on the new connections between developed categories. The categories developed were then refined and integrated into selective coding where a core-category was identified. During the Axial and Selective coding phase, the use of literature supported to understand and get deeper knowledge about the concepts identified from the data. Selective coding phase also included verification of the relationships and integration of categories and sub-categories with core-category. The core-category was a representation of the central phenomenon taking place to overcome risks and uncertainties in Virtual-Agile project environments. This was a theory development stage where the data was reviewed again and again and evaluated with literature to strengthen the results of this study. Table 4.16 shows the finalised coding for Open, Axial and Selective Coding stages.

4.13 Unit of Analysis

Defining the unit of analysis for a grounded theory study is crucial as the process of data collection and analysis occurs simultaneously. In qualitative research, Neuman (2011) considers the unit of analysis as the fundamentals, events, actions or communal life that are under consideration. They are the focal points to generating perceptions; experimentally determining or witnessing the observing concepts during data analysis. Humans or group of humans, organisations, events or actions could be the basis of the unit of analysis. The entire study of research is based on choosing the right unit of analysis (Cavana et al., 2001).

Creswell (2007) has specified that when using the grounded theory, the unit of analysis is the study of the entire process, actions or interactions involving multiple individuals. Due to difference in opinions and thoughts of various qualitative and grounded theory authors, the researcher assumed in the initial stages of the research that his unit of analysis is the process of risk management that lies somewhere within the substantive area of Virtual-Agile IT project environments, where actions, happening of events and interactions were taking place to resolve the problems and complications. This assumption was attained from the theoretical sensitivity which helped the researcher to start data collection at some point. Later, the unit of analysis was altered and the researcher focused on the actions and responses to resolving the risk and uncertainties. The reason why the Unit of Analysis is not fixed in the grounded theory methodology is the conceptualization of data (Strauss and Corbin, 1998). The actions, responses and interactions of each respondent that were analysed and compared were actually the unit of analysis for this study. Due to the presence of the phenomenon of constant comparison, incidents (actions, responses, interactions) were compared again and if they appear to resemble (saturation), the phenomenon became then recognisable.

4.14 Memo-writing and Field Notes

Memo-writing is an integral part of the grounded theory study (Glaser, 1978). Memo-writing is the process of writing down ideas and opinions about concepts and their associations with the categories. Memos also describe researcher's viewpoint or ideas about a particular situation or event in which the actions took place. Data is always there to be analysed in research, but ideas are fragile and when they hit the mind, they should be noted down straight away (Glaser, 1978). The memos are always modifiable as the more information is emerging from the data. The process of memo-writing was extensively used by the researcher during data collection and analysis process. The researcher preferred to write memos when coding was taking place as it helped to record researcher's feelings and beliefs about the phenomenon during analysis. According to Strauss and Corbin (1998), memos are not considered only as ideas, but the process helps the researcher to keep track of the all the categories, propositions, and multiplicative questions emerged during the analytical process. Memos generated for this study against each category or situation varies in length and nature according to the research situation and coding stages. The researcher generated the memos throughout this research study which helped him to formulate and strengthen his findings at the end.

In respect of the qualitative research, the researcher also recorded field notes during interview sessions with participants. Field notes is one of the techniques which is commonly applied by qualitative researchers to keep a record of ideas, notions and thoughts evolved during the course of interviews (Crotty, 1998). Field notes have also supported researcher while selecting the participants under theoretical sampling, where the researcher consulted those notes when approaching the participants. The process of memo-writing and field notes if omitted during the grounded theory study, a great deal of conceptual detail is lost or left undeveloped (Strauss and Corbin, 1990). The memos generated by the researcher are kept in record with dates and titles and are described with sections they belong to. The

memos helped to articulate the storyline in the selective coding phase where the relationships were refined and developed between different categories, and then memos contributed to elaborate the findings for the core-category of 'Responsiveness'. Examples of Memos are later shown in APPENDIX-IV.

4.15 Process of Constant Comparison

Constant comparison is considered as the mainstay of grounded theory study. Constant comparison method allows the researcher to look back and forth into the data which further helps to develop the categories and relate codes with their relevant concepts (Strauss and Corbin, 1990). The researcher started collecting data and then analysed it from one site and then after a set of sufficient collection and analysis, moved to another site that helped him to compare the data incidents systematically. Constant comparison method in grounded theory research is recognised as means of *validity* (Parry, 1998). Constant comparative method allowed the researcher to develop codes, then concepts while analysing the data concurrently. According to Conrad et al. (1993, p.180),

Constant comparison helps combine systematic data collection, coding and analysis with theoretical sampling in order to generate theory that is integrated, close to the data, and expressed in a form clear enough for further testing.

Glaser and Strauss (1967) suggested four phases for undertaking constant comparison

- Comparison of Incidents linked to each generated category
- Incorporation of categories and their properties (concepts)
- Establishing the theory
- Writing-up the theory

The researcher conducted the data collection and analysis process under these four phases, where he sorted the data, collected and analysed it, coded the information and strengthened his findings through theoretical sampling. The advantage of applying constant

comparative method was that when the data collection began for this study, the researcher was having raw data with several noises, over the time constant comparative method helped to allocate similar type of codes under each concept by comparing the incidents and keeping their properties and dimensions under consideration. The process thus helped to develop a substantive-level theory by looking at the relationship between categories for the phenomenon under investigation.

4.16 Types of Coding

4.16.1 Open Coding

According to Strauss and Corbin (1998), the process of open coding helps to identify the concepts from the data and further group them in the form of categories. Corbin and Strauss (2008) further suggest that the open coding is the first step in theory development which helps to conceptualise the data and label them as concepts. The concepts are a representation of the similar type of events or happenings undergoing in the phenomenon, they might be distinct but are grouped under the same heading as they share same properties. Constant comparison between newly and previously collected data assists the grouping of numerous codes into concepts leading to the development of categories.

Open Coding for this research began with word-by-word and line-by-line reading of the verbatim transcripts. A total number of 122 open codes emerged during the analysis of data. Many of the open codes were having the same description but had wide-ranging properties. All these types of codes were grouped together to represent the wide-ranging dimensions of a concept. While the grouping the codes, the questions which the researcher inquired to himself were like (Strauss and Corbin, 1998),

- ***'What makes this event or action similar to the preceding one?'***
- ***'What was the response of this participant in comparison to the previous participant for this particular event or action?'***

Being an interpretivist, the researcher was fully involved in the research process and gave meaning to the data according to the interpretations of the experiences and beliefs of the respondents. Similarly, where the connotation of the data was same, but the description of codes was different, the labels of those open codes were revised accordingly. The researcher performed this activity by looking each code and then going back to data to look for the similar data incidents, and then enhanced the properties and dimensions of a particular concept.

Table 4.16: Finalised Open, Axial and Selective Coding

Core-Category	Categories	Sub-Categories	Concepts	Codes
Responsiveness	Technology	Standardization of Tools	Conferencing Tools	Microsoft Skype
				Zoom
				Google Hangouts
				Facebook Calls
				IP Phones
				Instant Messaging Services
			Development Tools	Jira
				Rally
				Innotas
				Clarity
		Networking	Project Management Tools	SharePoint
				Enterprise Risk Management tools
				Magique
			Right communication channel	Contacting on time
				Avoiding Network traffic congestion
				Reduce call waiting times
			High Bandwidth connectivity	Reliable connection
				Need for Sharing/Uploading files
				VAP Requirement
			Need for Backup Sources	Communication failure
				Remote working
				Avoiding delays
	Timeliness	Timely Correspondence	Accessibility	Ensuring availability
				Contact beyond times

			Promptness in Response	Reducing misconceptions
				Delivering the projects on time
				Punctuality
				Providing Support
		Scheduling and Planning	Project/Time Plan	Task Allocation
				Project Deadlines
				Reaching Milestones
				Progress Check
			Self-organising	Restructuring schedule
				Prioritising tasks
				Managing workload
		Adaptation	Overlapping of Hours	Availability at multiple times
				Overcoming Time shifts
			Flexibility in Routine	Working beyond hours
				Change in working hours
				Willingness to work
				Providing Support
	Communication	Knowledge Transfer	Efficient Feedback Loops	Using Backlogs effectively globally
				Sharing alterations worldwide
				Error identification
				Sharing knowledge
			Information Sharing	Document sharing
				File uploads
				Sending emails on time
				Avoiding errors
			Progress Reporting	Feedback on work/progress
				Getting support
				Meeting deadlines
			Scope Management	Tracking
				Developing Consensus

				Workshops/Trainings
				Support Alterations
				Understanding Aims and Objectives
		Stakeholder Involvement	Active Participation	Avoiding uncertain situations
				Following timelines
				Meeting Client expectations
			Requirement for Extensive support	Need for experience
				Specifying Guidelines
				Providing Direction
		Leadership Function	Tracking and Monitoring	Following procedures
				Use of communication channels
				Checking progress
				Providing recommendations
			Risk Ownership	Responsibility
				Accountability
				Designing Response Strategy
				Facilitator
			Hiring of Skilful Individuals	Fulfilling projects needs
				Innovative solutions
				Learning abilities
				Managing constraints
			Need for Trainings	Mandatory requirement to work
				Learning and support
		Correlation	Building of Trust	Fulfilling commitments
				Avoiding conflicts
				Developing consensus
			Promoting Social Interaction	Social Gathering
				Developing relationship
				Openness
			Reducing Discrimination	Equity

				Respecting cultural norms
			Managing Work Load	Avoiding delays
				Handling multiple assignments
				Scheduling and structuring
			Previous Experience/Knowledge	Need for success
				Managing constraints
				Realising expectations
			Necessary Skills	Meeting specifications
				Understanding VAP environments
				Ability to sense situations
		Team Satisfaction	Motivation	Avoiding Isolation
				Better performance
				Better Co-ordination
			Consent to work	Willingness
				Realising ability
				Productivity
			Estimation of needs	Providing facilities at all locations
				Generalising the needs
				Fullfuling minimum requirements
	Active Risk Resolution	Risk Management Planning	Estimation of risks	Discussion in Meetings
				Brainstorming Sessions
				Expert Opinion
				Delphi Technique
				Gap Analysis
			Assessment of risks	Likelihood vs Impact Analysis
				Root Cause Analysis
				Using Digital PM Tools
				Expert Opinion
				Delphi Technique
			Keeping Records with Responses	Use of Product backlogs

		Risk Management Implementation		Risk Registers
				Recording Lesson learnt
				Managing uncertain situation
			Action	Contingency plan
			Review of action	Mitigation
				Managing and Control situation
				Meeting critical points
				Reducing Risk impacts

4.16.2 Axial Coding

Strauss and Corbin (1998, p.124) defines Axial coding as

The purpose of the axial coding is to begin the process of reassembling data that were fractured during open coding... In axial coding, categories are related to their sub-categories to form more precise and complete explanations about the phenomena

Axial coding was the next level coding in this study where the categories developed from open coding were further related to higher-level categories based on their properties and dimensions. This activity involved researcher's inductive and deductive thinking where he considered data incidents more precisely and developed affiliation or connections between categories from open coding. Thus, the categories from open coding were labelled as 'Sub-categories' as the new categories emerged during Axial Coding phase. Strauss and Corbin (1998, p.136) further suggests,

Whenever we conceptualize data or develop hypotheses, we are interpreting to some degree. To us, an interpretation is a form of deduction. We are deducing what is going on based on data but also based on our reading of that data along with our assumptions about the nature of life, the literature that we carry in our heads, and the discussions that we have with colleagues

The axial coding phase overlapped with the open coding phase where the researcher coded the data, recognised higher-level categories and inquired questions to the respondents to saturate the categories and concepts. The reason why this phase is called axial coding is,

Because coding occurs around the axis of a category, linking categories at the level of properties and dimensions (Strauss and Corbin, 1998, p.123).

During the Axial coding phase, the researcher following the principles of theoretical sampling inquired few questions of the data (against categories) to help saturate them. These questions were additionally asked to the respondents when required. For example, the researcher asked his participants about the significance of knowledge sharing, relationship building, and the tools used for communication between the team members. What is the role of stakeholder involvement in such projects and how frequently the it is necessary to correspond with other folks around the world? These types of questions helped to fill in the existing categories with more data and enhance its properties. During Axial coding phase, because of researcher's inductive and deductive thinking, higher-level categories were recognised which are discussed as below:

4.16.3 Selective Coding

According to Strauss and Corbin (1998), selective coding is the stage where the analyst integrates and refines his theory based on the findings of the axial coding phase. Strauss and Corbin (1998) highlighted following characteristics when choosing a core category:

- It should be central; all the major or minor categories can be linked to it
- It should occur regularly in the data; meaning that all the events or actions in the data should point towards that concept
- The description should emerge itself rather than forcing the concepts
- The name used to explain the core-category should represent a whole picture of it so that it can be used for further research in other substantive areas.

Selective coding began when the researcher observed saturation in the data. This was the point where the researcher started to refine and integrate all the concepts and categories together. After completion of axial coding where four main categories were identified, the researcher started analysing the categories from a broader perspective and tried to observe that what individuals have been doing to resolve the issues. Again, the researcher asked

the question to himself as in open coding and reviewed data incidents again and again. After conducting 18 interviews, the researcher was having quite a lot of saturation in categories and concepts. This was the time where he thought to temporarily pause the data collection process and draft his initial findings. The researcher took this decision due to following reasons:

- No new data or concept emerging from the data
- Properties and dimensions were matured and getting repetitive
- Timelines to follow

These were some of the initial pre-assumptions that the researcher made when entering into the selective coding phase. According to Strauss and Corbin (1998), selective coding is the point where the researcher can observe saturation in the categories. At this point, he could also identify the central phenomenon which could be related to already developed categories and sub-categories. The categories can then be connected and integrated to core-category based on the data incidents and researcher's interpretation. In accordance, some of the categories got eliminated and some new emerged pertinent to the research problem. This was the point where the researcher started assuming his emerging phenomenon and created links between the categories.

Decisions Undertaken for Termination of Data Collection

After the analysis of 18 interviews, the researcher was able to recognise the central phenomenon undergoing in the project environment. The researcher believed that the perception of Responsiveness could be well-related and integrated with the categories of Axial and Open Coding. This was an assumption which was acquired from the data after axial coding stage. The researcher after wide-ranging analysis of the 18 interviews went back into the field and asked few questions in the interviews around the central phenomenon and the axial categories, as suggested by Strauss and Corbin (1990) to confirm and validate the concepts previously identified. In accordance, a transcript sample

has been shown in the APPENDIX – III. In the sample, the researcher asked participant about the role of time factor in managing risks, the role of communication or interaction with stakeholders and the preferred communication methods to contact with external stakeholders etc. These questions helped to mature already developed categories in terms of their properties and dimensions, confirm saturation and then also confirm the existence of the core-category 'Responsiveness'. This activity was also performed to verify that,

- 1) Whether the researcher has reached the saturation,
- 2) Whether the properties had been matured enough to represent a phenomenon,
- 3) Whether the data incidents and responses are enough to compile them into the form of the conceptual model.

By undergoing this process, the researcher finalised his findings. According to Strauss and Corbin (1990; 1998), the data collection process in grounded theory study terminates when there is no new concept emerging from the data. This should be the time where the researcher needs to specify the criterion for terminating the data collection process. Similarly, the researcher with the consensus of supervisory team decided to terminate the data collection process. Some of the significant points of the discussion are summarised as follows:

- After analysis of 18 interviews, as the researcher was able to recognise various important characteristics for overcoming risks and uncertainties in Virtual-Agile projects; the next 7 interviews (19-25) has further confirmed and enriched the properties and dimensions of the already developed categories and concepts. The researcher can now finalise the core-category which is being highlighted in the data various times after the completion of the analysis of all the 25 interviews.
- The categories developed are wide-ranging in their properties and dimensions, and can depict rich practices for reducing risks and uncertainties

- As not enough new innovative concepts are emerging from the data so there becomes no need to conduct more interviews
- The data is getting repetitive in several interviews; therefore, these arguments can help with the termination of the process of data collection
- As the study is time-constrained and the researcher needed to complete his study under a planned time-duration to fulfil academic requirements; therefore, the data collection process can be potentially terminated, and the researcher should start working on the formalisation of the substantive-level theory.

4.17 Transformation of Data into Concepts and Categories

The process of coding began by fracturing down the data into various codes. These codes were a first step forward in the analysis process. According to Allan (2003),

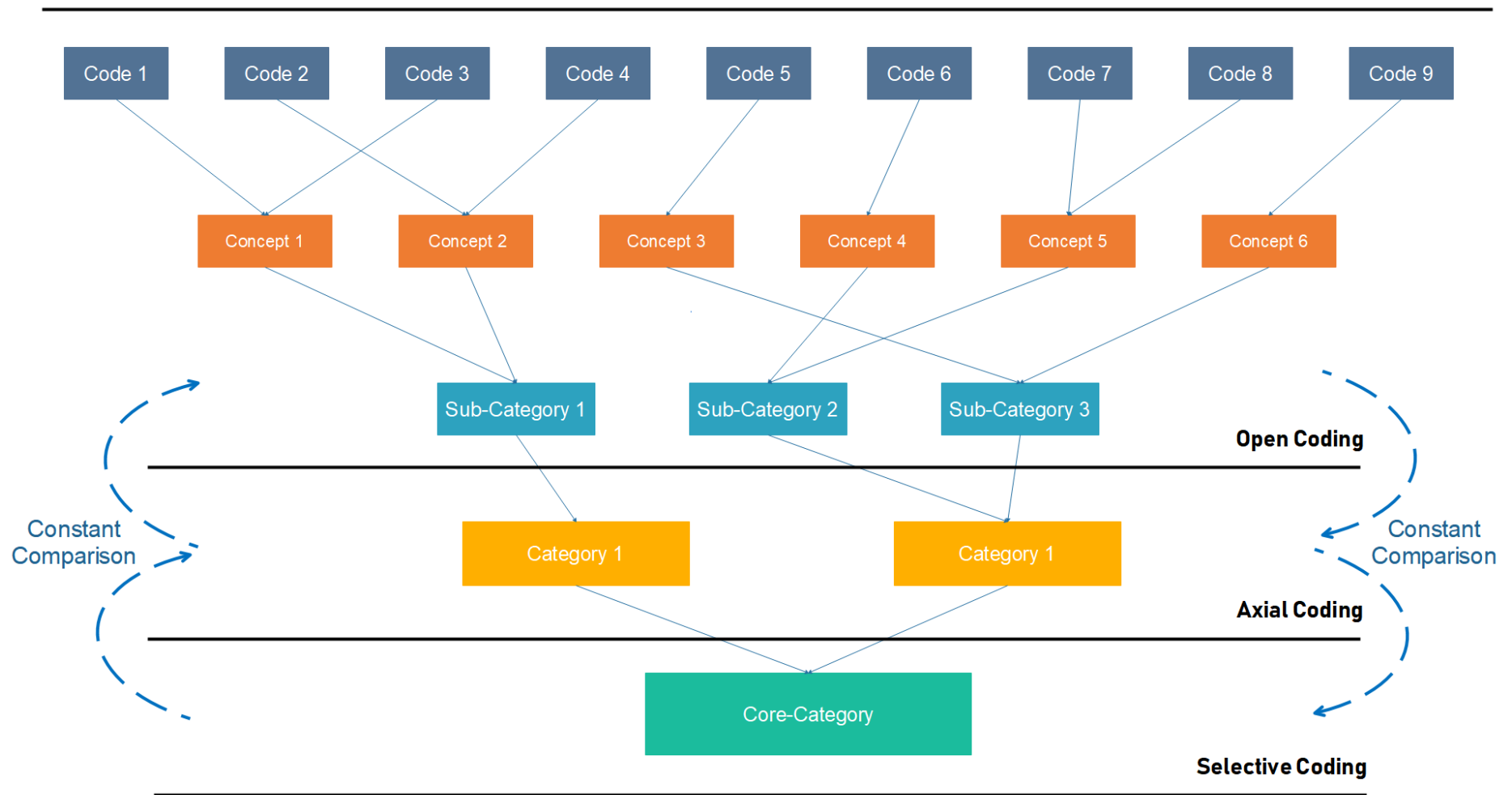
Codes	Collection of similar type of incidents (words or phrases) highlighting an issue or interest in the research
Concepts	Collection of similar codes that are grouped together based on their properties and dimensions
Categories	Higher level of similar concepts that are grouped to develop a theory

The data was transcribed and analysed as the researcher conducted interviews. Constant comparison method helped to compare the similar type of incidents and grouped similar codes into concepts based on their properties. Due to the high volume of data, the researcher has demonstrated some of the examples of how the open coding was performed and further grouped together into concepts. Additionally, some of the examples from the memo-database are also shown against some concepts in section 4.18 to help readers know about the ideas and opinions of the reader emerged during data analysis process.

The process of developing concepts began when the researcher started coding transcripts. There were two types of coding performed when doing analysis:

- **In Vivo Coding** – Words used by the participants
- **Descriptive Coding** – Summarizes an instance from the data in a word or phrase

According to Corbin and Strauss (2008), In Vivo and Descriptive both types of coding are suitable while conducting a grounded theory study. Following figure represents the stages and an overview of how the coding was performed.



4.17 An Overview of the Coding Stages

The above figure shows a depiction of how the coding was performed for this study under three main stages of Open, Axial and Selective. Open coding included reading of the transcripts and identifying instances or situations. In Open coding, initial coding was performed based on In Vivo and Descriptive type coding which led to the development of several concepts as shown in table 4.16. Similarly, further reading of the data helped identification of the sub-categories, main categories and then the core-category. Following are some of the examples taken from table 4.16 to show the detail process of coding.

Development of concept 'Conferencing Tools' (Open Coding)

The concept of Conferencing Tools emerged when the participants discussed the utilization of appropriate tools when communicating with the team members around the world. The respondents emphasized on the use of specific tools so that uncertainties can be reduced among virtual team members. Further, they also suggested ensuring the availability of the tools at every distributed location should be standardized so that a mutual consensus could be gained between the individuals for making contacts. It was observed during the analysis that people from different regions utilize various tools due to which ambiguities arise between team members. Therefore, the 'standardization of tools' a higher-level category as per table 4.16 was identified which seemed to be necessary at all locations to reduce potential risks between project stakeholders. The following screenshots are taken from MS Word; the primary tool used for In Vivo and Descriptive coding

Screenshot 1 (Transcript#3):

We rely mainly on virtual means of communications in collaborating and making sure our meetings and ceremonies as agile calls it. 70% of my communications have wireless means of communication and some of these are video conferencing and live meetings. We also have something called Skype. We also use another mean of communication like phone calls, emails, instant messaging and many more.

- HA Hassan Amar
Virtually communicate
- HA Hassan Amar
Microsoft Skype
- HA Hassan Amar
Phone Call
- HA Hassan Amar
Instant Messaging Services

Screenshot 2 (Transcript#11):

A computer developer or a PM who works for a computer firm or develops software should be well equipped with Google Hangouts or Skype or Facebook or any other social media or mediums to communicate with other employees or team members who are in other parts of the world

- HA Hassan Amar
Providing facilities at all locations
- HA Hassan Amar
Google hangouts
- HA Hassan Amar
Facebook Calls

Screenshot 3 (Transcript#25):

We do have virtual teams, currently, we have teams in Germany and USA, plus in Pakistan. So, we do collaborate you know virtually, or you know over the phones or skype is one of the medium we use and then we have Google hangouts we have Zoom. So, that's how we communicate in and between the teams

- HA Hassan Amar
Virtually communicate
- HA Hassan Amar
Google hangouts
- HA Hassan Amar
Zoom

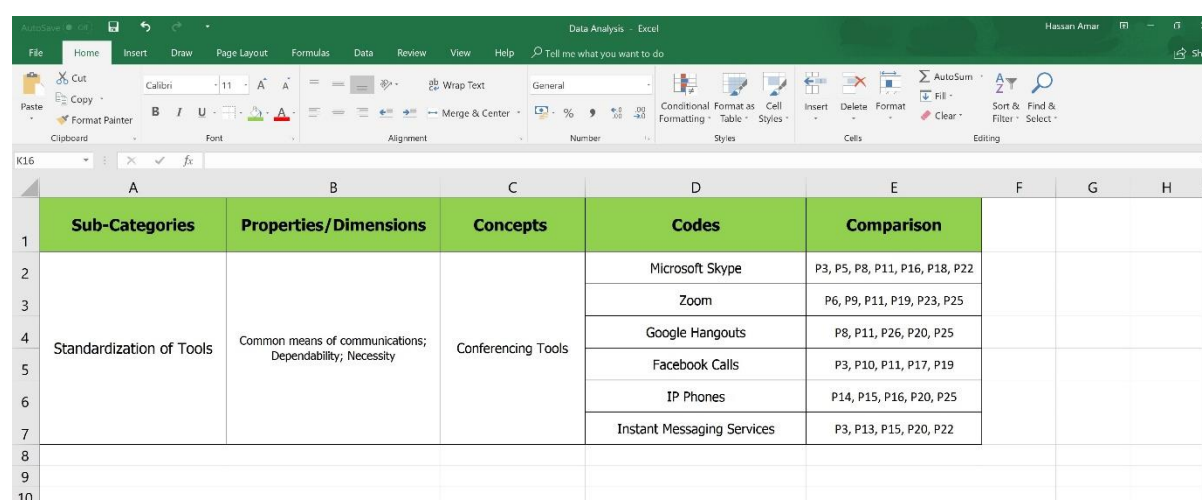
As it can be seen in screenshots 1, 2 and 3, codes are identified from the data. Some of the words which participants mentioned such as google hangouts, zoom, skype etc were directly considered as codes (In Vivo codes). These codes further helped to develop a concept 'conferencing tools'. It can also be seen in the screenshot 1, 2 and 3 that some of the other descriptive codes such as 'virtually communicate' (under concept of high bandwidth

connectivity, table 4.16) and 'providing facilities at all locations' (under concept of estimation of needs, table 4.16) were found.

Development of Sub-category 'Standardisation of Tools' (Open Coding)

Identification of the higher-level categories was done in Microsoft Excel. Following is a screenshot from MS Excel which shows evidence of coding. The 'comparison' column in the screenshot represents how many times a participant has discussed about a particular code which further helped to develop a concept. For example, if Microsoft Skype a code which emerged from the participant#3 was compared in the following interviews. Participant 5, 8, 11, 16, 18 and 22 discussed specifically about this conferencing tool. All the data incidents were also compared with each other and then properties/dimensions were determined which are shown in the following screenshot.

Screenshot:



	A	B	C	D	E	F	G	H
	Sub-Categories	Properties/Dimensions	Concepts	Codes	Comparison			
1				Microsoft Skype	P3, P5, P8, P11, P16, P18, P22			
2				Zoom	P6, P9, P11, P19, P23, P25			
3				Google Hangouts	P8, P11, P26, P20, P25			
4	Standardization of Tools	Common means of communications; Dependability; Necessity	Conferencing Tools	Facebook Calls	P3, P10, P11, P17, P19			
5				IP Phones	P14, P15, P16, P20, P25			
6				Instant Messaging Services	P3, P13, P15, P20, P22			
7								
8								
9								
10								

The screenshot shows how the codes were arranged and grouped to form sub-categories and then main categories (table 4.16). The sub-categories were identified by reading the transcripts again and going back to the data instances. The properties and dimensions identified from the data in terms of 'Conferencing tools' that further helped to recognise the higher-level category of 'Standardisation of Tools' (as per table 4.16) were 'Need for common means of communication', 'Dependability', and 'Necessity'. These properties and

dimensions which to identify that standardisation of the tools should be done at all the virtual locations to reduce risks.

Development of Category 'Technology' (Axial Coding)

During the process of axial coding, 'Effective use of Technology' emerged when the researcher reviewed and compared the data incidents and identified the need of utilization of technology efficiently in Virtual-Agile project environments. Few data incidents from where the researcher recognise the need for technology were,

"The risk involved is that, if any of these facility fails to work like we are in the middle of a meeting and one fails to work then we have to switch to the other one without any delay ... My organisation has done a lot by investing in the technology"[P3].

The participant discussed about the need of Backup Sources which is a concept of the sub-category of 'Networking' (table 4.16). Similarly, another participant mentioned,

"A computer developer or a PM who works for a computer firm or develops software should be well equipped with the Google hangouts or Skype or Facebook or any other social medias or mediums to communicate with other employees or team members who are in other parts of the world"[P11]

After reviewing such data instances again and again, it was assumed that the requirement of the technology for the Virtual-Agile project environments is necessary, but its effective usage is more important. Consequently, all those data incidents were reviewed and interpreted to recognise the relationship of technological needs with the previously developed codes, concepts and sub-categories from Open Coding phase.

Development of the concept 'Project/Time Plan' (Open Coding)

For the development of the concept (table 4.16), coding was performed using MS Word as per following screenshots.

Screenshot 1 (Transcript#3):

You have to spend more time on the things that are happening more normal in non-virtual projects but in virtual projects you have to spent let say just 5mins or you can figure the communication in your free time or in your break. So, there you need a strict tool for meeting touch point or schedule than in local based project.

- HA Hassan Amar
Progress Check
- HA Hassan Amar
Restructuring Schedule
- HA Hassan Amar
Meeting Project Deadlines

Screenshot 2 (Transcript#14):

Without having a plan, I think that success in distributed projects is very difficult. The reason why the teams fail is they do not plan and therefore are unable to meet deadlines... Less documentation in agile doesn't suggest you ignore project planning. This has a considerable position always and especially in virtual projects, where developers can bring a shared plan to meet deadlines.

- HA Hassan Amar
Project/Time Plan
- HA Hassan Amar
Meeting Project Deadlines

Screenshot 3 (Transcript#25):

I mean everything is time-based. Everything is bounded if we have some deadline left; let's say we have to deliver project on 31st August so we cannot exceed that.

- HA Hassan Amar
Reaching milestones
- HA Hassan Amar
Meeting project deadlines

As it can be seen in screenshots 1, 2 and 3, descriptive codes have been identified from the data as shown in table 4.16, such as reaching milestones, meeting project deadlines, progress check and task allocation. These codes further helped to develop a concept 'project/time plan'. There are several other instances available from the data which confirm the emerged codes with respect to the number of interviews conducted. The three examples

shown above provides a highlight from database maintained for this study. It can also be seen in the screenshot 1, 2 and 3 that some of the other descriptive codes such as 'restructuring schedule' (under concept of 'self-organising', table 4.16) was also discovered.

Development of sub-category 'Scheduling and Planning' (Open Coding)

As mentioned previously, further analysis was performed in MS Excel after initial coding. Following is a screenshot from MS Excel which shows evidence of coding, arrangement of codes/concept under sub-category. The 'comparison' column in the screenshot represents how many times a participant has discussed about that particular code which further helped to develop a concept. For example, 'meeting project deadlines' a code which emerged from the participant#3 was compared in the following interviews. Participant 6, 7, 8, 10, 14, 17, 23 and 25 discussed something related to the meeting project deadlines which was labelled using descriptive type coding. All the data incidents were also compared with each other and then properties/dimensions were determined which are shown in the following screenshot.

Screenshot:

	A	B	C	D	E	F	G
	Sub-Categories	Properties/Dimensions	Codes	Concepts	Comparison		
1							
2				Task Allocation	P1, P2, P5, P9, P10, P14, P19, P23, P24		
3	Scheduling and Planning	Necessary for achieving targets; Source for achieving stakeholder satisfaction; Helps tracking the project work; develops a mutual agreement	Project/Time Plan	Meeting Project Deadlines	P3, P6, P7, P8, P10, P14, P17, P23, P25		
4				Reaching Milestones	P4, P5, P13, P16, P18, P21, P25		
5				Progress Check	P1, P3, P4, P6, P8, P13, P14, P15, P18, P22		
6							
7							
8							
9							

The properties and dimensions identified from the transcripts which further helped to recognise the category of 'Scheduling and Planning' were 'Necessary for achieving targets',

'Source for achieving stakeholder satisfaction', 'helps tracking the project work' and 'Develops a mutual agreement'.

Development of the Category 'Timeliness' (Axial Coding)

The category of 'Timeliness' emerged during the analysis in axial coding phase. The reasons why category of timeliness is significant for Virtual-Agile projects are few of the assumptions of the participants that were interpreted by the researcher. During the inductive and deductive thinking process, the researcher interpreted that reduction of risks and uncertainties has a strong relationship with time. Time is a crucial factor which plays an important role while making decisions, planning and responding to uncertain situations. Some of the examples in relation to emergence of 'Timeliness' are,

"So definitely need some time adjustment from our side in particular, like we used to work in night shift in my previous organization where time zone overlaps"[P8]

Here the data incident discussed about that Overlapping of hours (a concept) of the category 'Adaptation' as per table 4.16, that supports in adjustment according to the requirements of project environments. Similarly, another participant highlighted,

"Time management is the most difficult part in these virtual projects. You have to plan your work, plan your routine, allocate time to everyone, you can say you have to manage yourself fully"[P13]

The participant in the quotation mentioned about several concepts, but one of the most prominent concept he points towards is Project/Time plan, and then Self-Organising and Accessibility which links back to the categories of Timely correspondence, and Scheduling and Planning. Consequently, all such data incidents were reviewed in the data to identify the higher-level category and create its relationship with sub-categories.

Development of the concept 'Scope Management'

For the concept 'Scope Management' from Table 4.16, following codes were identified from the data,

Screenshot 1 (Transcript#7):

Ensure the communication between the team members discusses the key milestones, aims, and objective.

HA

Hassan Amar
Understanding Aims and Objectives

Screenshot 2 (Transcript#12):

We normally convey the alterations or any changes in sprint meetings. Developers have different understanding, so to reduce sprint failures we discuss the work from beginning.

HA

Hassan Amar
Support Alterations

HA

Hassan Amar
Developing Consensus

Screenshot 3 (Transcript#14):

We start, we kick off the project, we collect the scope, we sign the scope, we do the design, we do the development, we do the quality assurance if needed, we fix the concerns, we deliver the project. If at any point in time, there is some kind of scope creep happening we do not do it. We take it as a new project all together overall project.

HA

Hassan Amar
Providing trainings/workshops

HA

Hassan Amar
Developing Consensus

As it can be seen in screenshots 1, 2 and 3, some descriptive codes have been identified from the data as per table 4.16, such as understanding aims and objectives, support alterations, developing consensus and providing trainings/workshops. These codes further helped to develop a concept 'project/time plan. There are several other instances available in the database which confirm the emerged codes with respect to the number of interviews conducted. The three examples shown above provides a highlight from database to help readers understand how the coding was done.

Development of the sub-category 'Knowledge Transfer' (Open Coding)

Further analysis was performed in MS Excel after the initial coding. Following is a screenshot from MS Excel which shows evidence of coding and arrangement of codes/concept under sub-category. The 'comparison' column in the screenshot represents how many times a participant has discussed about that particular code which further helped to develop a concept. For example, 'developing consensus' a code which emerged from the participant#3 was compared to the data in the following interviews. Participant 6, 9, 14, 15, 19, 22, 23 and 24 discussed same things related to the code 'developing consensus' which was developed previously. All the data incidents were also compared with each other and then properties/dimensions were determined which are shown in the following screenshot.

Screenshot:

Sub-Categories	Properties/Dimensions	Concepts	Codes	Comparison
Knowledge Transfer	Need for Reducing Failures; Help understanding stakeholder requirements; Helps to bring all the distributed team members on the same; need for mutual understanding	Scope Management	Developing Consensus	P3, P6, P9, P14, P15, P19, P22, P23, P24
			Providing workshops/trainings	P6, P9, P14, P17, P18, P19, P21, P22
			Support Alterations	P1, P2, P7, P8, P10, P12, P14, P18
			Understanding Aims and Objectives	P3, P7, P9, P11, P12, P16, P17, P18, P20, P21, P22, P24, P25

The properties and dimensions identified from the data which further helped to recognise the category of 'knowledge transfer' were 'Need for Reducing failures', 'Help understanding stakeholder requirements', 'Helps to bring all the distributed team members on the same page' and 'Need for a mutual understanding'.

Development of the category 'Communication' (Axial Coding)

During the Axial coding phase, the category of 'Communication' as per table 4.16 emerged when several participants discussed their opinions in importance and relevance to Virtual-Agile project environments. Communication in Virtual-Agile projects have different dynamics, it's not only the way of communicating or interacting but it's the way of responding and contributing to several processes of Virtual-Agile projects. All the beliefs and experiences of the participants were analysed and compared with categories from open coding phase to find a new relationship. For example, a participant while highlighting the significance of 'communication' mentioned,

"We are relying on communication and we also consider that the people working in the virtual teams are really good at social aspect"[P12]

The quotation suggests that communication has a deep affiliation with development of strong relationships (Correlation) through social interaction. It could be observed that social interaction is a concept that links back to the category of 'Correlation'. Similarly, another participant while acknowledging the characteristics of communication mentioned, "

"The key thing is communication because you know when your team is virtually sitting, virtual apart from you, you cannot see them, you cannot meet them, might be sometimes when you are working with the team you have never seen your life you know, yet you build up a relationship with them, so motivating them"[P14]

The participant has acknowledged several dimensions of communication; firstly, she mentioned about that the significance of 'Correlation' with communication and then highlights the importance of 'Motivation' which is a concept of Team Satisfaction (from table 4.16). Consequently, by reviewing and analysing the data again and again, properties and

dimensions of each category were understood which became the basis for emergence of new categories in Axial Coding phase.

Development of the concept 'Estimation of Risks' (Open Coding)

For the concept 'Estimation of Risks' under the higher-level category of 'Risk Management Planning' (Table 4.16), following codes were identified from the data,

Screenshot 1 (Transcript#3):

The way we identify and manage risk is during the scrum meeting where any potential risk is flashed out and dealt with straight away.

HA Hassan Amar
Discussion in Meetings

Screenshot 2 (Transcript#18):

One of the main things that a project manager should do before starting a new project in present or future is that there should be a proper gap analysis to identify the potential risks.

HA Hassan Amar
Risk Identifier/Estimator

HA Hassan Amar
Gap analysis

Screenshot 3 (Transcript#22):

We use the brainstorming, Delphi technique, root cause analysis and expert opinion like this sort of stuff.

HA Hassan Amar
Brainstorming

HA Hassan Amar
Delphi Technique

HA Hassan Amar
Root Cause Analysis

HA Hassan Amar
Expert Opinion

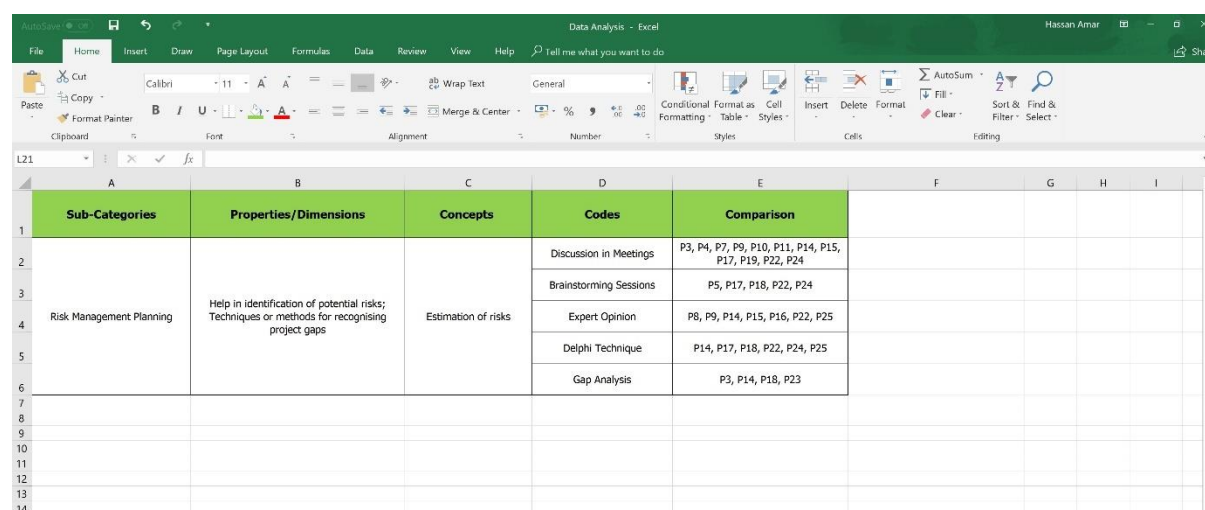
As it can be seen in screenshots 1, 2 and 3, codes are identified from the data. Some of the words which participants mentioned such as gap analysis, brainstorming, Delphi technique, root cause analysis and expert opinion were directly considered as codes (In Vivo codes). These codes further helped to develop a concept 'risk management planning'. It can also be

seen in the screenshot 1, 2 and 3 that some of the other descriptive codes such as 'discussion in meetings' and 'risk identifier/estimator' emerged as shown in table 4.16.

Development of the sub-category 'Risk Management Planning' (Open Coding)

Further analysis was performed in MS Excel after the initial coding. Following is a screenshot from MS Excel which shows evidence of coding and arrangement of codes/concept under sub-category. The 'comparison' column in the screenshot represents how many times a participant has discussed about that particular code which further helped to develop a concept. For example, 'expert opinion' an In Vivo code emerged from the interview#8 which was then compared to the data in the following interviews. Participants 9, 14, 14, 16, 22 and 25 also discussed about having 'expert opinion' when estimating risks. All the data incidents were compared with each other and then properties/dimensions were determined which are shown in the following screenshot.

Screenshot:



Sub-Categories	Properties/Dimensions	Concepts	Codes	Comparison
Risk Management Planning	Help in identification of potential risks; Techniques or methods for recognising project gaps	Estimation of risks	Discussion in Meetings	P3, P4, P7, P9, P10, P11, P14, P15, P17, P19, P22, P24
			Brainstorming Sessions	P5, P17, P18, P22, P24
			Expert Opinion	P8, P9, P14, P15, P16, P22, P25
			Delphi Technique	P14, P17, P18, P22, P24, P25
			Gap Analysis	P3, P14, P18, P23

The properties and dimensions identified from the data which further helped to recognise the category of 'Risk Management Planning' were 'Help in identification of potential risks', and 'Techniques or methods for recognising project gaps'.

Development of the category 'Active Risk Resolution' (Axial Coding)

Active Risk Resolution emerged when the researcher asked the respondents about the risk management practices which they undertake during the projects. It was found that the risk management process is undertaken into two main stages i.e. Risk Management Planning and Risk Management Implementation as shown in table 4.16. Planning includes holding meetings with project stakeholders or specialists and discuss the possibilities of upcoming or potential risks. One of the participants while discussing the usefulness of the planning phase mentioned,

"When the project is so complex then we use such kind of things to identify the detail the risk associated to it and other things you can say what we do is that we have pre-audit meetings with the clients"[P18]

Similarly, another participant mentioned,

"If I came to know about any risk in what then I communicate that to my PM or in my daily scrum meeting I can do that thing. So, I can send email or call them on IP phone so anytime I feel that the risk then I can just contact to my PM"
[P20]

The reason why the active risk resolution emerged as a higher-level category was due to the participants viewpoints and body language. It seemed that for resolving risks or complications, there should be an active way of managing situations and contacting each other. The project teams might not follow proper procedures to undergo risk management; thus, the risk management should be dealt with priority and must not be taken as a routine affair. Consequently, it was determined that an active risk resolution process can support

reducing risks to a great extent with the help of appropriate competency, knowledge and understanding.

Emergence of the core-category 'Responsiveness' (Selective Coding)

The core-category or central phenomenon of '**Responsiveness**' was identified in the selective coding phase from the data as shown in table 4.16. The core-component of Responsiveness was identified from the actions, behaviours, and events occurring in the project environments where people were working together to control and eliminate uncertain situations. The team members and individuals while expressing their experiences and beliefs about overcoming risks and challenges pointed towards being responsive to the situations. Being responsive and receptive to uncertain events, and situations and happenings in a complex project environment is the core of reduction of evolving risks and uncertainties in Virtual-Agile IT projects. Some of the respondents' experiences have been compiled in the view of Responsiveness,

"Being responsive is very important. As in Virtual-Agile teams the communication, as I told you is not it's not facing to face communication or we are not physically present with each other; so, being responsive and productive plays a very role"
[P23]

"That's the major {being responsive} of each person, that varies from individual to individual. While I am doing the weekly meeting with all my stakeholders. Many guys will record, ok they are facing this issue but if I ask them had they done the root cause analysis of the problem why that are facing this issue? Have they tried to reach the person who is core responsible for that? Have they done

that? Most of the time around 80 to 90 percent, their response is low means, so they have not done the initial basics.”[P24]

4.18 Memo Database

During the Open and Axial coding phase, against all the higher-level categories and sub-categories, the researcher generated memos which outlined his thoughts and opinions in relation to the concepts and sub-categories, and then sub-categories and the higher-level categories. The memos generated reflect researcher's own interpretation of the data incidents. Memo-generation process was also influenced by researcher's theoretical sensitivity which was enhanced during discussion with the participants and reading of the transcripts. In accordance, a memo database has been maintained throughout this research study. APPENDIX-IV shows two examples of memos for each concept in relation to its sub-category and one example of memo for each sub-category against its higher-level category. These memos further helped to develop a conceptual model shown in Section 6.6.

4.19 Summary

This chapter has provided readers a detail overview of the major decisions undertaken for data collection. The chapter has also elaborated the criterion under which the participants were selected together with the details of each of the participants interviewed for this study. A detail section has been provided to show how the raw data was converted into various codes and concepts to take the form of conceptual model in the chapter 6. Samples of transcriptions and coding have been shown to elaborate the process under which the paradigm of Responsiveness has emerged. Memo-Database has been shown from APPENDIX-IV to provide readers an overview of the thoughts and opinions which were recorded/noted down by the researcher when undergoing data analysis. Thus, the chapter

has helped to understand the process of data collection and analysis in detail undertaken for this study.

CHAPTER 5: FINDINGS AND RESULTS

5.0 Introduction

This chapter is a continuation of Chapter 4 where the researcher has discussed the emergence of all the categories and concepts in detail. The chapter also depicts an initial relationship of 'Responsiveness' with all the other categories of 'Technology, Timeliness, Communication and Active Risk Resolution'. This chapter also serves as the basis of the model development, further on which the discussion and evaluation has been carried out in Chapter 6. Consequently, some of the additional discoveries of this research such as risks, and risk resolution strategies have also been elaborated based on empirical evidence. The chapter will provide an opportunity for the readers to know about the respondents' thoughts and beliefs in detail to manage risks and complications in their Virtual-Agile projects. Chapter 5 has been structured as,

Section 5.1: Effective Use of Technology for Responsiveness

Section 5.2: The Implication of Timeliness in Responsiveness

Section 5.3: The Dimensions of Communication in Responsiveness

Section 5.4: Responsiveness for Active Risk Resolution

Section 5.5: Discovery of Risks and Risk Resolution Strategies

Responsiveness has a unique relationship with all the main categories as emerged from the data. These categories are 'Effective use of Technology', 'Timeliness', 'Communication' and 'Active Risk Resolution'. This unique relationship with each of the category was identified during review of the data where respondents have emphasized on the application of these characteristics. Primarily, it has been determined that 'Responsiveness' depends upon three components. These components facilitate developing a robust collaboration between the entities, further supporting in effective decision-making, project planning and risks management practices; thus, reducing the overall uncertainties in Virtual-Agile projects.

5.1 Effective Use of Technology for Responsiveness

Effective use of Technology is recognised as the basic requirement of the Virtual-Agile projects. Technology not only helps to undergo project work, but it plays an important role in maintaining high collaboration level between the distributed project stakeholders. The use of technology varies in software development industry with respect to the project settings and requirements. Some of the participants highlighting the significance of Technology mentioned,

Category	Data Incidents
Technology	<i>"Technology can help things {provide support for} like enterprise tools, knowledge sharing, so I think it is all the good practices you would expect to do in an ordinary project just get part to into a sharp relief."</i> [P5]
	<i>"My organisation took this issue {having technology infrastructure} very seriously and done their bit by making sure whatever the medium and facility that would help the collaborative teams bring together who are scattered all around the country. My organisation has done a lot by investing in the technology."</i> [P3]
	<i>"The tools are progressing so that you can have integrated tools to allow you to have many people working on the same project."</i>

The participant#5 who was an IT consultant mentioned that the issue of technology has a special noticeable position in Virtual-Agile projects. Though technology supports knowledge sharing and use of enterprise tools in conventional projects, but it has a strong weightage in distributed projects as the teams and stakeholders are dispersed, and depend upon on each other via technical resources. Utilizing technology effectively aids to overcome challenges to a great extent as the teams can have a high collaboration and communication level.

Consequently, Participant#7 acknowledged that nowadays due to progression in computer-mediated technologies, the organisations should focus to upgrade themselves with respect to the time. Similarly, as diverse entities are a part of Virtual-Agile project environments, there is a need to promote innovation within individuals so that they could be able to maintain a strong integration. As the teams are distributed, and working along various multiplicities and boundaries, technology plays a dynamic role in keeping them integrated and collaborated. The data suggests that organisations should improve their technological infrastructure before undertaking the projects. Especially the product owner, clients/sponsors and off-shore teams should be accessible through multiple platforms, supporting the frequent flow of communication. Technology, therefore is the only critical component which brings the virtual stakeholders together.

Effective use of Technology has been further categorized into two major areas as per Table 4.16. Firstly, the need for Standardization of Tools at all the locations and then using technology effectively to create a strong Networking overtimes with the dispersed stakeholders. If the distributed stakeholders are good at the utilization of the technology, a certain amount of uncertainties can be overcome, thus reducing the chances of disruptions in work and threats of dirty codes and enhancing opportunities for the organisations. Technology includes two main components: **Standardization of Tools** and **Networking**.

5.1.1 Standardization of Tools

The foremost characteristic of technology in Virtual-Agile project environments is the Standardization of Tools. The participants emphasized the need that individuals, teams, and stakeholders should be provided with relevant communication, management, and development tools which could help them to work more effectively, further helping in improving processes, and thus enhancing competitive advantages. Although there is no alternative to face-to-face communication, but using technology effectively can reduce distances between distributed stakeholders. The vigorous practices of communication tools benefits teams to interact and participate in daily meetings where diverse entities can discuss the latest situations and circumstances of the projects. Nowadays, there are numerous communication tools available in the market. The most common tools which have been emerged from the data are Microsoft Skype for business, Google Hangouts, Zoom, Instant Messaging services, IP Phones and social media platform such as Facebook. The participants have preferred these as a secure and reliable means of communication. Secondly, these tools are available easily over the internet for download, so everyone could easily download them according to their own needs. Few participants while highlighting the applicability of various tools mentioned,

Concept	Data Incidents
Conferencing Tools	<i>"We rely mainly on virtual means of communications in collaborating and making sure our meetings and ceremonies as agile calls it. 70% of my communications have wireless means of communication and some of these are video conferencing and live meetings. We also have something called Skype. We also use another mean of communication like phone calls, emails, instant messaging and many more."</i> [P3]
	<i>"A computer developer or a PM who works for a computer firm or develops software should be well equipped with Google Hangouts or Skype or Facebook or any other social media or mediums to</i>

	<i>communicate with other employees or team members who are in other parts of the world.”[P11]</i>
--	--

Likewise, the need for appropriate software development tools such as Jira, Innotas, and Clarity have been acknowledged by various participants. Developers or Programmers can use such tools to find out bugs and resolve issues within the developed source code. Participants have acknowledged the need to ensure availability of the tools to the teams or individuals at all locations. They also help distributed team members to share their work and schedules and help in the development of source codes for effectively. The practice of these tools varies from organisation to organisation; it depends on how the organisations promote and facilitate teams, and stakeholders with such tools. As every team member must demonstrate a planned amount of progress on daily basis, the tools can thus also help project managers or scrum masters to account each member for their progress of work. Few of the participants in this regard mentioned,

Concept	Data Incidents
Development Tools	<i>"And dealing and communicating with our global teams, using Agile tools that includes your organisational tools and tools your video chats that include whether that's you use Jira or Rally or whatever tools.”[P16]</i>
	<i>"We use Innotas and Clarity for Agile development together with Jira. These are some of the common tools used in software development.”[P17]</i>

The use of tools is not only limited in terms of conferencing and development, but it expands its boundaries to the application of Project and Risk Management Tools. A participant#14 who was a project manager in one of the software development organisations in UAE endorsed the use of Microsoft SharePoint Project Management tool for performing project and risk management. The tool includes built-in templates for storing risk records which can be shared with the all the dispersed stakeholders. Consequently,

organisations prefer using enterprise risk management tools where people can connect with each other and submit their remarks and strategies to counter risks. A participant#5 who was an IT consultant mentioned that he was working (in 2016) on the integration of an Enterprise risk management tool called 'Magique' within his organisation, so that it could help teams identify and assess the potential risks, and further help in planning responses within no time. By doing that, the participant proposed that the use of spreadsheets will be reduced, and every distributed team member can input his comments in regard to a particular problem or identified risk. Use of enterprise risk management tool can help record the risk promptly and can replace the manual use of risk registers/logs. Some of the related quotations found from the data have been compiled in the following table,

Concept	Data Incidents
Project Management Tools	<i>"We use SharePoint project management tool and we have everything define, we have various templates for risk management, risk registers, risk templates, ownership, we create triggers, we send emails. Everything is automated so, basically if we are able to define the time duration when this risk will occur. We have automatic emails going because sometimes our project last for a long period one year or two years."</i> [P14]
	<i>"One of my little projects is I am doing at the moment is to put New Enterprise Risk Management tool in place so instead of doing the stuff by spreadsheets or annual process, we now have a single source. We have an enterprise risk management tool which will record all the risks, it will have threats, vulnerabilities, impact, probabilities, and etc and all the good kind of stuff you would have."</i> [P5]

5.1.2 Networking

The utilization of technical resources effectively aids to develop a strong network and integration between the dispersed stakeholders, which further aids to develop

Responsiveness in Virtual-Agile project environments. The data suggests that if the teams and project stakeholders have a strong integration, they would be able to undergo project work more effectively which then reduces evolving risks, and the teams become more vibrant about their responsibilities. Determination of appropriate communication channel reduces ambiguities and confusions and help to recognize the way and means to contact others. Some of the participants' quotes in context are mentioned as follows,

Concept	Data Incidents
Right Communication Channel	<i>"You need to understand the communication channel, you need to understand how to collaborate with folks and everything you know this is something which we are learning."</i> [P8]
	<i>"We have an IP phone with such IP phone most of the time it's on Skype but since the sometimes traffic and lot of other congestions we use the phone directly."</i> [P15]

The participant#8 who was working as a Quality Assurance Lead in his organisation highlighted that he and his team has been learning to use the best means of communication. The participant was based in Pakistan and his responsibilities were to look at the development code for testing, pairing and integration of various resultants of the sprints before handing over formally to the client. According to Lalsing et al. (2012), Sprint is an incremental development process in Scrum method of Agile and represents as one development cycle. The participant's one of the teams was based in Pakistan and other the teams were in USA and India. They all were jointly working on the same project. The participant mentioned that it is difficult to rely on one communication channel while interacting with the teams throughout the world. Using multiple platforms for communication and then determining the right channel benefits; and then aids in determining the most convenient ways of contacting the distributed teams. The participant wasn't seemed to be sure about the communication channels that were being used by the teams in India and USA. He, therefore, tried to acknowledge that you might have to utilize

other tools if you believe that one communication channel is not reliable or working. Therefore, in regard, he and his team are still learning to collaborate effectively using best communication channels.

The requirement of high bandwidth connectivity is one of an important aspect which aids in the development of a strong networking. As the teams share interrelated tasks, the organisations should ensure measures for the availability of high-speed intranet/internet, LAN (local area network), WAN (Wide area network) and reliable connections at multiple locations. Highlighting the importance of high bandwidth connectivity, some of the participants mentioned,

Concept	Data Incidents
High Bandwidth Connectivity	<i>"Normally the connection breakdown during meetings which creates a lot of problems. We have to postpone our meetings sometime which is a disaster to progress."</i> [P21]
	<i>"Definitely, reliable and fast connection helps to share big files or documents over internet more conveniently."</i> [P22]

Consequently, sorting out the backup sources helps to ensure continuous integration between the distributed teams and stakeholders. In case of failure in the primary communication channel, the teams can then communicate other folks using secondary sources, thus, ensuring the availability through multiple platforms. Few participants acknowledged the use of backup sources as per following quotations,

Concept	Data Incidents
Need for Backup Sources	<i>"If any of these facility fails to work like we are in the middle of a meeting and one fails to work then we have to switch to the other one without any delay because I mentioned we all have busy schedules."</i> [P3]
	<i>"In case of an internet failure, we all can be using our the internet devices that we have. We know we have been given from the</i>

	<i>office. So, you know things like these we do have a plan and we do sort of do things on runtime basis.”[P25]</i>
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5.2 The Implication of Timeliness in Responsiveness

Timeliness in Virtual-Agile project environments has emerged as another aspect of Responsiveness that helps in reduction of uncertainties and complete project tasks on time. As known, Virtual-Agile project environments comprise of entities who are geographically dispersed and depend upon the technological means for interaction; therefore, **timely correspondence, scheduling and planning**, and **adaptation to project environment** support frequent and well-organized flow of information, decision-making and fulfilling timelines. Elaborating the significance of Timeliness in Virtual-Agile project environments, some of the participants’ viewpoints are compiled as under,

Category	Data Incidents
Timeliness	<i>"Time shifts creates a lot of challenges. Product delivery, meetings, communication, everything requires proper time management.” [P20]</i>
	<i>"I would say completing work on time, getting reports on time, meeting everyone on video link on time is very difficult.” [P6]</i>
	<i>"Time management is the most difficult part of these virtual projects. You have to plan your work, you have to plan your routine, allocate time to everyone, you can say you have to manage yourself around the clock.” [P13]</i>

Timeliness includes three components that needs attention from an organisational perspective when undergoing distributed software development. These components as emerged from the data are discussed as below.

5.2.1 Timely correspondence

Timely correspondence within the Virtual-Agile project environments is found to be a common problem due to the time shifts. The reasons are mainly the differences in

geographical locations which limits the team members and clients/customers to correspond to each other. Timely correspondence can help control several uncertain situations where team members could interact and exchange their views about the project processes, complete their work on time and get help from their distributed folks. In context, accessibility to individual project stakeholder should be acknowledged, so that correspondence could be managed timely. Accessibility, as emerged from the data, is the need to ensure that the required team member or concerned stakeholder could be contacted or available to respond to the queries of the individuals when required. Discussing the significance of accessibility in Virtual-Agile project environments, few participants mentioned,

Concept	Data Incidents
Accessibility	<i>"Let's say in the one-time zone which is the earlier one, someone supposed to deliver something and people in the later time zone are waiting for that, if they don't, the whole day is going to get wasted. You see time management there is a real issue and it requires a lot of punctuality and professionalism to be able to manage that."</i> [P10]
	<i>"So, we do have limitations then there is nobody in the US office that can cover those things {help in problem-solving} and then strange ends you know on a very fixed day {delays are expected}. So, we normally have sprint failures in these cases where things are not delivered on time and then we do discuss those things in retrospectives."</i> [P25]

Participant#10 was a Project Manager in a software development organisation in Pakistan and was concerned about the availability of his team members. He mentioned that if the correspondence is not performed timely, it delays several project processes. The team members who are based in other time zones are difficult to get hold of. They are not available to attend meetings, not able to respond to emails or calls and this certainly impacts

the project work. Consequently, the participant#25 who was based in Pakistan had several issues when dealing with his product owner in the USA office. He mentioned that if the product owner is not accessible within a time frame, this can even lead to failures in the sprint and that's a big risk. For example, for integration purposed if the team is not able to get in contact with the product owner to get some feedback on the source code, then this would waste their whole day and affect the progress. As sprint development cycles are for limited time-frame, a certain amount of consensus is needed on the project work from both sides. The participant acknowledged that during the Virtual-Agile projects, he normally faces such issues where he cannot get in correspondence with the product owner or client when they are in different time zones. This is a matter of concern for which he is being a scrum master usually takes up this matter in sprint retrospective meetings and develop several strategies for the future sprints accordingly. According to Verner et al. (2014), sprint retrospective meetings are governed by the scrum master, which includes attendance of the product owner and team members to discuss about the work completed in a sprint, and help develop strategies for future sprints for improving productivity. Consequently, the data suggest for using multiple channels to get in contact with the project manager or appropriate persons when responding to such situations.

With getting accessibility to stakeholders at different times, the data also emphasize on the promptness for undergoing project work and responding to uncertain situations. Team members should be able to inform their fellow colleagues about the challenges they face. It is the responsibility of all the stakeholders to respond promptly to the queries or observations of each other. The participant#24 in the following quotation acknowledged that in case of a risk event, he prefers to mitigate the risk as soon as he comes to know. He gave an example by saying that if his team comes to know about any risk, they would prefer to mitigate it within next fifteen days. If he is unsuccessful in handling such situation, further consequences may develop and affect the project processes. Such situation could be

like, if the product owner or client doesn't respond to the query on time, this is a developing risk where the project team has to wait for a response which delays the overall project activities.

Concept	Data Incidents
Promptness in Response	<i>"We have to immediately respond to those risks that in next fifteen days. If this activity will not close, this will be the risk {consequence} and this will be the impact of that risk and this should have the mitigation plan."</i> [P24]
	<i>"We communicate with our other team members on daily basis and we stand up and we try to assess who, what are the blockers for them and try to mitigate all those blockers so that they are happy in their work environment and there are no flight risks."</i> [P9]

The participant#9 who was based in Pakistan mentioned that the format of Virtual-Agile projects requires multiple stakeholders to have a discussion on daily basis looking to resolve complications. Timely correspondence aids to define strategies to meet the timelines and avoid delays. One of the central things which the researcher analysed during this quotation is the frequency and promptness of interaction. The researcher believes that rapidness and swiftness are required for resolving the uprising issues. Meetings on daily basis can help project team members to know about the ambiguities and complexities; and thus correspondence in time helps a lot to reduce future risks.

5.2.2 Scheduling and Planning

Timeliness also depends upon proper scheduling and planning of the project work. To meet the deadlines, the data suggests that if any of the team is based in a different time zone, time management for any other fellow becomes very difficult. In this regard, self-organising the tasks and responsibilities can help overcome challenges and reduce potential risks. The teams who are allocated interdependent tasks needs to have an efficient plan among

themselves so that they could be able to complete shared tasks on time. They should have the strength and experience of managing their routines and work according to a defined plan. This helps reducing uncertainties for each of the individual involved in a project. Some participants in this regard mentioned,

Concept	Data Incidents
Self-Organising	<i>"The difficulty in restructuring and prioritising my time for individual projects was an issue. I was 70% on my current project and 30% was spilt between the other two projects. Time is the most important resource which was difficult to handle in such circumstances. Sometimes our schedules got in our way, so we had to postpone our rituals and ceremony."</i> [P3]
	<i>"You have to spend more time on the things that are happening more normal in non-virtual projects but in virtual projects you have to spent let say just 5mins or you can figure the communication in your free time or in your break. So, there you need a strict tool for meeting or touch point or schedule than in local based project."</i> [P4]

The participant#3 mentioned that he used to face several difficulties in planning and organising his work. As in Virtual-Agile project environments, individuals are a part of multiple projects, therefore, they have to allocate a definite time to each of the projects. Self-organising their selves and drafting a proper plan help to contribute their effort efficiently to each of the project. This can help completion of the software product more skilfully and purposely. The participant#4 mentioned that Virtual-Agile project environments require dynamic interaction. For meeting this criticality, the participant being a project manager gives more time to meet up the targets. He mentioned that he prefers to take out five minutes daily out of his busy schedule to get interact with the distributed team members in India. He may use his leisure or free time, but he self-organises his activities to meet the objectives. The participant who was based at Germany tried to get in touch with

his project team in India where he could check the status and progress of the work regularly so that he should be well-known about the project progresses and complications. The researcher here can assume that planning and scheduling not only helps to self-organise but can also provide support to monitor and control the project activities. For example, if the project manager cannot get in touch with his teams during the daily scrum meetings, he won't be able to know about the latest situations of the project. Therefore, for active participation, self-organising schedule, and getting in touch with the stakeholders must be carried out on frequent basis

Similarly, planning and scheduling also help to formulate a project time plans. The reason why self-organising and time plan is found to be two different elements required for Responsiveness, is that of dimensions of Agile methodology; as it is a people-focused approach, entities working should be able to organise themselves rather depending upon others. Time plan is linked to an overall plan of the project which is provided to individuals from a higher authority such as project manager, the board of directors etc for completion of the project. The entities involved in the projects use this project plan to develop their own time plans. Few participants while expressing their thoughts mentioned,

Concept	Data Incidents
Project/Time Plan	<i>"Without having a plan, I think that success in distributed projects is very difficult. The reason why the teams fail is they do not plan and therefore are unable to meet deadlines... Less documentation in Agile doesn't suggest you ignore project planning. This has a considerable position always and especially in virtual projects, where developers work on a shared plan to meet deadlines."</i> [P13]
	<i>"I mean everything is time-based. Everything is bounded if we have some deadline left; let's say we have to deliver project on 31st august {for example}, so we cannot exceed that."</i> [P25]

The participant#13 mentioned that bringing down a proper plan and schedule is a collective effort which is required to be undertaken on time especially during the sprint planning phase where the developers, scrum master, and product owner decide upon the tasks to be completed in the sprint. The participant acknowledged putting time limits on each of the tasks so that it helps meet deadlines more efficiently. Similarly, the participant acknowledged that without planning it is utmost difficult to meet the deadlines. For meeting deadlines, the project team should mutually plan and work according to it. For example, if any of the participants is not able to work due to any personal or unexpected reasons, the interrelated work between the team can be affected. Everyone should be clear about his work and position in the project. Therefore, proper project and time planning in Virtual-Agile projects can only be the best help to meet the deadlines.

Likewise, the participant#25 highlighted that in sprints they cannot exceed their timelines. They must give the product delivery to the clients on time. If they wouldn't be able to produce the development or source code, the client becomes unsatisfied and this ultimately affects their business and integrity which could affect their future growth. Similarly, the participant has also emphasized the need for planning and scheduling in terms of meeting deadlines. He mentioned that being a project manager, he cannot give additional time to his teams to get the job done. When he has a commitment with the customer, he takes up certain procedures to fulfil that commitment. The researcher can assume from the participant's body language that the procedures and practices should be defined for the designing of the project plan, and then ensuring that everyone adheres to the proceedings of that plan.

5.2.3 Adaptation to Project Environment

The difference in time-zones can bring several complications in the project environments. The participant suggested that this issue can be overcome by adapting yourself in

accordance with the requirement of the project environment. This applies to both the project team and product owner/client so that they could facilitate an effective communication process. Team members and clients who are not based at one location can help each other by overlapping their working hours so that they could interact timely. Few of the participants in this regard mentioned,

Concept	Data Incidents
Overlapping of Hours	<i>"Difference in the time zone is the challenge ok, you have to work on that, you have to fix that. There has to be at least, if not a complete partial overlap in a day. That you as team is online and product owner is online for at least two hours."</i> [P17]
	<i>"Firstly, when folks are working in different locations, the challenge is the time zone especially for the folks working in US and Pakistan, so definitely there is a time zone difference and with Indian folks it is pretty much ok because there is a half hour difference but with the US folks varies from 9 hours to 12 hours so definitely we had to come up with the mechanism of overlapping."</i> [P8]

Participant#17 who was based with his team in Pakistan was having trouble contacting his Product Owner in France. He mentioned that this issue can be fixed by using the overlapping strategy. He used to set up his working hours in such a way that they overlapped with the product owner working hours in France. He mentioned this challenge could be fixed up by consensus and working upon it. Likewise, a participant#8 who was based in Pakistan was having complications due to differences in time zones. The participant was dealing with the teams in India and USA. He was based in Pakistan and had a time difference of about 9-12 hours with his team members in the USA. He mentioned that overlapping hours reduce several complications related to time, and we can then contact out folks on daily basis. Overlapping of working hours helps to reduce uncertainties while developing a software as we can converse and take feedback on the work being done on our end and vice versa promptly.

Managing time is imperious and the project manager has to come up with some mechanism of changing the working hours of the people. This certainly reduces the challenges as the dispersed team members can interact, collaborate and share their work on time. Similarly, having a flexibility in routine helps to reach any individual whenever he is needed beyond the working hours or schedule. Some of the participants' quotations are combined as follows,

Concept	Data Incidents
Flexibility	<i>"One problem is the weekends are different the time zone problems ok, that's one major reason so basically like if you say Sunday we are working here in Kuwait, there is nobody{working} in India. It's a weekend for them. Another problem is they come early to the office and I may not be available for another one and a half or two hours because of the time zone. We tried to compromise by making them start late and we start a little bit early so to reduce the time thing. But once that happens {if any problem or risk happens} on the weekends are the major concerns because if there is something urgent and he is not there and then I need to call him when {he is} in his residence and stuff like that."</i> [P15]
	<i>"If you need to communicate something you need from your product owner, so for you to work with him, you have to work when he is online as well, and you are online as well. You cannot expect everything to happen smoothly you know, if he is in different time zone."</i> [P17]

The participant#15 who was based in Kuwait was developing a project with his team fellows in India. He mentioned that time difference is a problem, but he is flexible in his schedule and has changed it accordingly so that he could start working a bit early as compared to his team in India. He wanted to acknowledge that although the time difference causes several complications, but a project manager should be wise enough to deal with such issues. Because of time differences, if any risk or uncertain event happens where he needs to get in

touch with the relevant person in India, he prefers to call him even when the person is at his residence. The researcher assumes from his concern that the team members or stakeholders should be flexible enough to take time out of their busy routines, and personal life to provide a support to their folks if required.

The participant#17 who was coordinating with his product owner in France mentioned that when your development team is based at other location with respect to your product owner/client, it's not an easy process to communicate. Product Owner is equally involved in the development process as the developer, scrum master, and tester. Being flexible in various approaches, especially time adjustment, helps to get a strong hold on the project progress. If you are not flexible in the time schedule and do not interact with your product owner timely, you cannot expect things to happen in a smoother way, and thus, give a way to expected failures to be a part of the project.

5.3 The Dimensions of Communication in Responsiveness

Communication in Responsiveness varies in dimensions and supports developing effective collaboration, engage entities' and support various project processes. Maintaining a high level of communication has an imperious position in enduring day-to-day project affairs, thus, aiding in the reduction of evolving uncertainties and potential risks. Few participants while acknowledging the significance of communication in for Responsiveness mentioned,

Category	Data Incidents
Communication	<i>"The one thing you must always keep in mind so whenever you are dealing with the global teams your communication needs to be crystal clear."</i> [P16]
	<i>"The key thing is communication because you know when your team is virtually sitting, virtual apart from you, you cannot see them, you cannot meet them, might be sometimes when you are working with the team you have never seen your life you know,</i>

	<i>yet you build up a relationship with them.”[P14]</i>
	<i>“I mean that there is pretty much change in everything from day to day structure that how you organise communication, how do you organise spend over, and especially when you are going from design to implementation or execution phase.”[P6]</i>

The entities who are distributed cannot interact physically; to overcome such challenges, the project managers, and decision-makers should focus building up a strong communication structure between the project team, product owners and clients. Specifically, in the context of distributed software development, the findings suggest that communication has various magnitudes and includes distinct factors required to ensure effective project processes. These factors are:

5.3.1 Frequency of Knowledge Transfer

The process of knowledge transfer in Virtual-Agile projects is difficult to comprehend and stimulate. The explanations are mainly the differences in mindsets, level of knowledge and understanding between the project stakeholders. Knowledge transfer in Virtual-Agile projects differs to the context of traditional projects in several ways. The required frequency of knowledge is high and variates along project settings and requirements; thus, creating more difficulties to adapt the ideas, notions, and concepts. If the teams’ or entities would have an understanding about their work, they would be in a better situation to communicate the problems or control risks. During the early stages of development particularly in sprint planning, high frequency of knowledge transfer aids to understanding the requirements for a particular sprint. Scrum master or development team leads can be the central entities who deal with product owner/clients, and then transfer the knowledge to other team members; thus, reducing the level of ambiguities related to work. The data suggest for keeping an extensive feedback loop to facilitate the knowledge transfer process. The feedback loop in Virtual-Agile projects create better understanding among clients and project team, and they

can come to know about the gaps in their work. Signifying the importance of feedback, some of the participants mentioned,

Concept	Data Incidents
Efficient Feedback Loops	<i>"Based on the backlogs or user stories we develop sprint reviews and bring in the customer whether they are happy or not. In this way, they have the opportunity to have their say {feedback} ... Any feedback in terms of changes will be thrown in backlog and would be sent back to the circle."</i> [P3]
	<i>"We use some methodology of Agile like the way we use for scrum then we show early alternations to the client and we get early feedback."</i> [P12]

Likewise, appropriate information sharing in Virtual-Agile projects is of great significance in the knowledge transfer process. Information sharing can be in the form of documentation and emails, or sharing of the ideas, concepts or viewpoints related to work or resolution of a problem. Information sharing is about how well the person is able to communicate the issues or convey appropriate information among the distributed team members. Though Agile doesn't support extensive documentation the data suggest for keeping records or minutes in the form of documents to create mutual understanding among the dispersed stakeholders. Some of the participants in this regard mentioned,

Concept	Data Incidents
Information Sharing	<i>"The general forms of virtual approach have made it easier for us to share documents and access it in an easier and convenient manner."</i> [P3]
	<i>"The way {virtual} agile works is different to non-virtual projects. Documentation is less but in virtual projects, I prefer to keep record of conversations and meetings and share with team members in other parts of the world, so it helps them to understand the important issues if they cannot understand through live meetings."</i> [P9]

The participants mentioned that information sharing in Virtual-Agile projects variates in several dimensions. Documentation helps to understand the work and share the information formally with other team members or the clients based at other location. Information sharing can also be in the form of keeping a record of meetings and sharing them with the people around the globe. Document sharing helps the people from different backgrounds to understand the discussion and conversations from daily meetings if their primary language is different from the one spoken during meeting sessions. The participants have acknowledged the use of documentation in the Virtual-Agile format as it helps to reduce ambiguities about the project related work.

Consequently, progress reporting on time helps to contribute to keeping a high frequency of knowledge transfer in Virtual-Agile projects. Progress reporting and meetings with high officials help to know about the status of the work undergoing in different locations. For example, if an application is not running or has been crashed during the testing phase, the project manager and scrum master can communicate these issues to the higher officials and get assistance on such issues. Teams and project manager being distributed can share their sprint progresses with the board of directors or sponsors. Progress reporting also helps to communicate the issues to higher management which are not in control of the project team. Few of the participants while acknowledging its importance highlighted,

Concept	Data Incidents
Progress Reporting	<i>"We have meeting once in a while with big board members and share our projects and experiences."</i> [P4]
	<i>"You track their progress and you give some status reports to your central management."</i> [P16]

Participant#4 was based in Germany and dealing with his team members in India. He mentioned that he used to take up issues in higher board meetings so that assistance could be attained on the major decisions and disputes. These meetings were usually performed

via face-to-face interaction. Any concerned member who needs to be a part of such meetings can join from India via video link, and discuss their issues and reservations as well. One of another aspect of knowledge transfer process is scope management. As Agile allows alterations and flexibility, participants have shown concerns over the mutual understanding of the aims and objectives between the distributed entities. Scope management becomes an issue when the understanding of individuals differs in relation to the project work. In accordance, participants have suggested ensuring extensive communication to develop a mutual consensus. Few participants in regard mentioned,

Concept	Data Incidents
Scope Management	<i>"Ensure the communication between the team members discusses the key milestones, aims, and objective."</i> [P7]
	<i>"This {scope understanding} is a potential problem which if the person capturing the requirements does not know how to communicate with both sides; that's a big risk But that person cannot communicate to the technical team and then brings non-sense back to you because the requirements are getting lost."</i> [P10]

Participant#7 being a project manager has encouraged team members to discuss the scope, objectives, and design of the product before proceeding with the project work. As the tasks are interdependent, it is highlight recommended that the team members should have clear notions about the product to be developed. This activity can help to know about the actual project deliverables and scope. The reason why the participants mentioned this characteristic could be when the teams are located at different regions, they have diverse sort of mindsets and working practices, so the participant believed that scope understanding should be specific and shared so that it helps to undergo the development process effectively.

5.3.2 Stakeholder Involvement in Projects

As Virtual-Agile projects operate on the principles of Agile, they demand high interaction and support from every stakeholder during each stage of the project. These stakeholders may include the distributed teams, project leaders, scrum master, product owner or clients. Whether related to project work or support to overcome in uncertain situations, project stakeholders' active involvement is imperative and thus helps to meet the targets. Especially whenever the project team faces issues or challenges, communication with product owner helps to develop an understanding on the project deliverables. According to Laanti (2013), Product owner in Scrum method is a key stakeholder who conveys vision and messages to the scrum team on behalf of the customer to meet the project requirements. Some of the related quotes for active participation of the stakeholders are compiled as under,

Concept	Data Incidents
Active Participation	<i>"If things are definitely falling out of hand; it's better to know the clients if it is better to know the product owner about the things and then let them know of the situation."</i> [P25]
	<i>"So, I guess it goes down to the delivery. So, if the risks are managed and sorted out, and are communicated to the client, the expectations can be aligned, and we can avoid disasters at the end; but the if the risks are not managed then we have to do firefighting to make the product successful. Try to identify the risk from start and throw them to the client. He or she knows that what risks are involved in Agile and then they provide solutions on that. Rather than not knowing what the risks are then blaming each other at the end."</i> [P23]

The participant#25 who was a project manager in Pakistan, was dealing with the clients in USA and Germany. He acknowledged that during difficult times in the project he prefers to communicate extensively with his product owner or client. If the situation is getting out of his hand, he prefers to communicate to product owner in time so that appropriate level of

support could be attained. The issues that he highlighted separately were mainly related to handling alterations, exceeding budget or time limits, or any other evolving aspect which is impacting the delivery. The participant#23 highlighted that he prefers to involve his product owner or client at each level of the project; whether it's a beginning or end stage, he chooses to communicate everything to his product owner and client. The reason for such communication is to know where the project progress stands. To avoid blame games in case of future failures, he must communicate the real circumstances of the project at all times. He also mentioned that if he doesn't interact with stakeholder actively, he would have to undertake additional measures to eliminate or mitigate the issues. The risk or issue occurred could affect the overall project performance, therefore involving stakeholders time to time reduces uncertainty and help to resolve the issue sooner.

Likewise, the participants' have acknowledged having strong support during difficult times. The participant acknowledged that in case of risks event, the level of interaction should be pre-decided so that it helps to understand that what level of help the stakeholder is willing to provide. It is important to estimate how often and in what circumstance the stakeholder should interact (frequency of meetings) or what should be the procedure to get in contact with required stakeholder for getting the support (communication means). While expressing the thoughts in terms of having a strong support, few participants mentioned,

Concept	Data Incidents
Requirement of Extensive Support	<i>"You know so you have to keep in touch all the time {with stakeholder} so if a risk could be if you don't have an information security person on board and that to prepare to take on the new way of working then you could end up having an expensive project."</i> [P2]
	<i>"The communication things, we use risk register to list down and communicate that to the team and the client..... when the project is so complex then we use such kind of things to identify the</i>

	<i>detailed risk associated to it and other things. What we do is that we have pre-audit meetings with the clients.”[P18]</i>
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5.3.3 Development of Correlation

Strong relationship between the distributed teams’ support in mitigating or acting upon uncertain situations proactively. As Virtual-Agile project environments comprise of diverse people from different geographical locations, they vary in culture, language and working practices. Strong relationships between teams help in maintaining high communication level. It also supports the frequent flow of information between distributed teams, so that everyone could share their experiences and problems openly. Strong correlations between entities can reduce conflicts and supports team formation. The building of trust between a diverse group of people helps to build team formation. Few participants while acknowledging the importance of trust in such project environments mentioned,

Concept	Data Incidents
Building of Trust	<i>"Its {trust} very important when you are working offshore, and your team is placed in another country.... It takes time to build {trust} when you fulfil your commitments.”[P17]</i>
	<i>"I think the most important thing should be building trust among teams, so since the team is not in communication or face to face communication, and you are not in the sitting in the same area; so, as I said since there are geographical cultural differences; so, the team should have trust in each other so building the trust is the most important thing and then enhancing the communication.” [P12]</i>

Participant#17 was based in Pakistan and looking after the operations of the software development projects. His one of the teams was operating from the same location as he was and few individuals from another location. The customer and the product owner were based in France. He mentioned that product owner or client cannot easily develop trust onto the

development teams when he is operating from a different location. Firstly, it becomes difficult for them to share the requirements of the projects due to linguistic issues, and then the product owner/client cannot trust the project team until the team shows them with some evidence of progress. The participant mentioned that the trust-building process is crucial but can be achieved when you fulfil your commitments and deliver the process on time.

Consequently, some of the people involved in Virtual-Agile projects may have previous affiliations or relationships due to which the product owner or individuals may have some unusual feelings of being discriminated. The researcher believes that the project leaders or organisations should keep this issue into consideration and maintain a balance rapport while dealing with a diverse group of people. If the people are not being treated with equity, this can lead to the development of isolation, thus affecting the communication badly. The teams and stakeholders need to maintain a steady relationship, so that project performance could be achieved. Correspondingly, some of the participants mentioned,

Concept	Data Incidents
Reducing Discrimination	<i>"Affiliations or relationships can sometimes produce bad or harmful impact on the distributed teams."</i> [P11]
	<i>"Work with equality regardless of skills, ethnicity or qualification."</i> [P1]

One of another aspect of building correlation is to promote and offer opportunities to have social interaction. Nowadays, multiple social platforms help team members to communicate through different channels, thus supporting to build a strong relationship. Similarly, social interaction can be promoted when inviting distributed team members to another location to give them a chance for having face to face meetings with their folks at different stages of the project. Considering this viewpoint, some of the participants mentioned,

Concept	Data Incidents
Promoting Social Interaction	<i>"Obviously, we had cultural issues because we had developers in India as opposed to the UK. However, the company was very good in actually getting some of the Indian developers to come over to London, so they would spend time with us and sometimes they are colocated and sometimes they would obviously remember where they lived, it would be great because you have that personal relationship with them."</i> [P5]
	<i>"We do call some of our developers from other locations to meet with the management and people in our organization, so that it helps building relationship."</i> [P9]

5.3.4 Required Competency

The requirement of competency has evolved as another component which contributes to maintaining a high level of communication. Either the project manager or scrum master, a technical team lead or a team member, his performance is judged from his competency level. The analysis suggests that the individuals involved in Virtual-Agile projects may belong to other organisations or work on a part-time basis, therefore they are unable to manage their workload, and this ultimately affects the project progress, and possesses several risks. It has been revealed from the data that team members are usually busy on other assignments or projects because of which they cannot attend meetings and share their work on time. Managing workload of other assignments have been found crucial to meet the targets. Some of the participants' viewpoints are compiled as follows,

Concept	Data Incidents
Managing Work Load	<i>"We do have proper schedules, but it is very difficult to gather people around face to face {through video conferencing} and have meeting because people are already exhausted working on other projects."</i> [P3]

	<i>"Individuals may be busy on other assignments or projects. It's up to their ability how they manage work routines and deliver their work on time."</i> [P19]
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The participant#3 was a Business Analyst in UK Public sector organisation, where he was looking after several software development projects. He mentioned that due to the burden of other projects, his colleagues don't prefer to undergo video conferencing as they are exhausted from doing other jobs. The researcher believes that this situation possesses a risk and may affect the progress and communication process; therefore, the project manager may need to find out the involvement of individuals on other projects.

Consequently, the experience and knowledge of working in Virtual-Agile project environments help to cope uncertainties where entities feel more confident about their jobs. They know their patterns of working and therefore are able to undertake pressure. By having the knowledge of Virtual-Agile formats, work can be more effectively managed. Virtual-Agile projects comprise of several ambiguities which need a serious attention from a management point of view. Virtual-Agile projects which are mainly based on the principles of Agile methodology, achieving them in distributed format become difficult where the team members cannot interact physically, and depend upon computer-mediated technologies for communication. People shifting from the traditional format of working (co-location) are not able to change their mindset which affects the project environment and performance. Traditional project environments are based on conventional working models where the interaction and collaboration level are low, thus, the need for teams and clients to the network is less until and unless the product is fully developed for testing. Few participants while acknowledging this issue highlighted,

Concept	Data Incidents
Previous Knowledge/	<i>"It is fair to say that if you don't have experienced people in those positions you will have more risks that are detected and</i>

Experience	<i>more likely that the project will not succeed.”[P7]</i>
	<i>"To give you an example what we did in our case, when we joined it was clearly waterfall kind of methodology, even if we say having Agile and scrum it was just you know, so not being connected properly. Agile scrum was not followed in a true way. It was kind of a mix what we called as an Agile. That must be avoided. The first step is you have to make sure that you follow one methodology or the other, ok. You cannot just have a blend of both at the same time and expect miracles to happen.”[P17]</i>

The participant#17 was an operation manager and leading several software development projects where he preferred to use one method for undergoing the product development. As waterfall is purely recognised as a traditional model and requires less interaction, the participant mentioned that agile methods for software development are particularly based on scrum method so when he joined the organisation, the culture of using a hybrid approach was common in his organisation. The participant mentioned that it is big risk when the organisation is using a blend of two approaches because the individuals working in the project environments couldn't know how to respond to clients' changes, how to integrate the alterations within a sprint cycle, as traditional methodology does not allow changes before completion of a project cycle. Therefore, it is the need to understand the methodologies and the working format so that risks could be avoided in such project environments.

Consequently, as identified being responsive is the core of managing risks and uncertainties, the project stakeholders should identify and analyse the problems they face and utilize their natural tendency or ability to understand about the things and events taking place in Virtual-Agile project environments. The reason this concept is significant because the teams are not able to identify the problems or complications occurring the projects. When asked from the following participants about the role of being responsive to managing risks, they mentioned,

Concept	Data Incidents
Necessary Skills	<i>"While I am doing the weekly meeting with all my stakeholders. Many guys will record ok they are facing this issue but if I ask them had they done the root cause analysis of the problem why that are facing this issue? Have they tried to reach the person who is core responsible for that? Have they done that? Most of the time around 80 to 90 percent, their response is low means they have not done the initial basics."</i> [P24]
	<i>"They don't know why it's happening, but they can see the alarms only and say ok I have not completed my activity; so, what should I say to them now? but I must report some risk. They will not think deep down why it's happening. This is varied person to person."</i> [P21]

The participant#24 above has highlighted that while undertaking the meeting with stakeholders, he wants to see the abilities in individuals where they could identify and analyse the problems they face. The participant may also have wanted to point out towards the required level of skills from each individual which help them to understand the things and events taking place in Virtual-Agile project environments. The participant wanted to highlight that sometimes the teams couldn't identify the problems because of lack of knowledge and experience about a problem. The participant#24 was a program manager in one of the IT companies in UAE where he seemed to be concerned about the amateurish attitude of the individuals. He mentioned that whenever the team members face alarms/issues during the projects, they do not pay attention towards them, and do not know how to counter them. This issue when comes to him (being a project manager), he becomes proactive and reports the risks to the product owner or client. The team members do not think that their one late response will affect the whole development process. He also mentioned that it depends on the situation and settings of the projects but still varies from person to person how he handles the problems or complications. Not all the individuals have

the same capacity to estimate or judge the situation, rather it varies from individual to individual that how he takes up the problem into consideration.

5.3.5 Team Satisfaction

Achieving team satisfaction in Virtual-Agile project environments is crucial as the teams are dispersed, where no physical interaction exists. As per data, team satisfaction issues are expected to occur in such project environments very commonly which tends to affect the team efficiency. The participants suggested that by motivating the team members, uncertainties and risks in overall project environments can be reduced and controlled. Similarly, when the teams are not contented, they could not perform their jobs more actively. Team satisfaction helps to respond to risks and challenges more prominently as team members are confident about their work. The better the motivation level is, the better the communication and better the tendency to manage project uncertainties. Few of the participants in this regard mentioned,

Concept	Data Incidents
Motivation	<i>"The team needs little bit motivation and then I realise my team is having conflicts and things like that where I feel there is kind of the team is going to depart."</i> [P14]
	<i>"You have to motivate them because most of the time maybe he has certain issues that those are not related to project but he is not in that mood today and that may impact your project as well."</i> [P24]

Teams who are scattered may not agree to undertake the work happily, and this leads to disruption in project processes. The data also suggest that before giving jobs or tasks to team members across the globe, the responsible person such as project manager, scrum master or technical team lead should be able to get a consent from individuals. They should discover that whether the individuals know about the work they are undertaking or are they skilful enough to take the work? Do the individuals know about the job they are

undertaking? Correspondingly, by getting their willingness and consent, they can be more productive, and this will help to encounter dynamic challenges in the environment. While acknowledging the willingness of teams, few participants mentioned,

Concept	Data Incidents
Consent to work	<i>"Today I might not be feeling that happy, so I need to adjust myself and that is where agile I think is not flexible because it does expect you to work in the same capacity again and again."</i> [P8]
	<i>"Before giving tasks to individuals, it's always good to know about their willingness."</i> [P18]

One another factor which contributes to achieving team satisfaction is to provide appropriate facilitates to the distributed teams around the globe. The management or the parent organisation should undertake sufficient measures to ensure establishment and consumption of facilities at all the locations. Few participants in this regard mentioned,

Concept	Data Incidents
Estimation of Needs	<i>"What my responsibility is to make sure that my whole development team is you know ready and equipped for the latest strengths."</i> [P17]
	<i>"More generalise {not visible; difficult to comprehend} in virtual projects to know the needs of the people."</i> [P4]

The above participant highlighted that provision of the latest technology and strength helps to attain team satisfaction. Participant#17 was based with one of his teams in Pakistan and dealing with his client in France when he emphasized to fulfil the needs of individuals. The needs can be in terms of providing the right tools for development, ensuring the team is properly trained or providing the teams with licensed software for development or conferencing. Similarly, when the teams are located off-shore or dispersed, providing them

with standardised tools and equipment helps to sustain a stability in a project environment; thus, reducing uncertainties and achieve balance rapport.

5.3.6 Leadership and its role in communication

Leadership role in the development of extensive communication is imperative as he is the overall responsible person. A leader is responsible for managing overall project environments where the events are uncertain and evolving. The main reason for this uncertainty is invisibility of events at different locations which makes difficult for the leadership to track and monitor the team members' and project progress. A leadership as being accountable for the whole project environment is also responsible for overcoming the risk events. He is the actual risk owner and the responsible person for undertaking decisions, and to ensure that the project environments are harmonised. He has to deal with all the uprising issues and then ensure precise measures to control them. The reason why the leadership is found an aspect of the communication is his domineering role in project environments which directly or indirectly links to the dimensions of communication. Few participants while describing the role of leadership in communication mentioned,

Concept	Data Incidents
Risk Ownership	<i>"What else the manager does suppose to do except risk management, I don't find anything else."</i> [P16]
	<i>"For the sprint, there is something that a project manager is looking at on daily basis. He discusses the status or is we on time? So, there is how unless you have identified that {risks} you will not be able to mitigate that right."</i> [P11].

Participant#16 who was a project manager and an IT consultant in a USA based organisation mentioned that leadership's role in Virtual-Agile projects is difficult in contrast to conventional projects, as he has to deal with multiple issues and stakeholders. He is the actual risk owner and the only responsible person who has to communicate with several

entities around the world. It becomes more challenging for the leadership to maintain a good level of communication with all the distributed stakeholders. Leader's responsibility varies in terms of training, hiring skilled individuals, tracking, monitoring and control of the project aspects, and ensuring an active functionality of risk management process.

Leadership role varies with respect to the position he is working in Virtual-Agile project environments. A leader can be a project manager who is responsible for the whole project, a leader can be a scrum master who is looking after scrum team or a leader can be a technical team lead who have a certain number of individuals to manage within his team. A leader knows the requirement and his main concern is to ensure that everyone should be acknowledged about the latest events taking place in the project environment. One of the main apprehension of leaders is to ensure an effective process of communication lie within the teams and client, so that it helps completion of the project on time, within budget and according to required scope. He, being responsive and communicative must know about the events taking place in dynamic project environments. On one side the leadership tracks the progress and status of the projects, and on the other, he is also concerned to know about any risks or uncertainties expected to take place. Leadership on daily basis needs to get a record of changes made in scope, a record of the risks identified, and then prepare a mitigation or contingency plan to deal with those risks. Similarly, two project managers while expressing their thoughts about tracking of the team members mentioned,

Concept	Data Incidents
Tracking and Monitoring	<i>"It's not easy to track in a virtual project" ... If I am running like a project lead, stuff like that I have a strict tracking method. I made sure there are proper communication channels and am informed of the situation of the projects so as if there is any delay in projects I will know it beforehand. Internet and data processor is used as a whiteboard where people communicate about the progress of their projects and give suggestions for</i>

	<i>improvement. We welcome any suggestions and respect the decisions made.”[P4]</i>
	<i>"You have to keep record and of all the things you are tracking changes.”[P16]</i>

Being dispersed, the above project managers seem to have low control over their team members as things are not clear and visible in Virtual-Agile projects. Participant#4 was based in Germany and dealing with his team in India who seems to have less control over the team members due to the difference in physical location. He expressed that leadership must adopt certain strategies to ensure proper monitoring and control of the team members in terms of their progress. If he doesn't, the project progress could be affected, thus leading to delays, penalties and cost overruns.

Similarly, the leadership should ensure training of concerned stakeholders, especially project team and product owner in the project environment. The training can be in terms of agile, utilization of conferencing tools or letting the client/product owner know about the format and standard of working of the project teams. The training issue is of importance and therefore some of the participants expressed their thoughts as following,

Concept	Data Incidents
Training	<i>"Agile specialist teaches the company all the way down to designers to understand what agile is about.”[P2]</i>
	<i>"The way of training is done just to let them know what we are doing and how we are doing and stuff like that.”[P8]</i>

Consequently, another obligation of the leadership is to ensure availability of skilled individuals in the Virtual-Agile project environments. Leadership should ensure that the individuals which are hired for the projects should have the relevant skills to perform the duties. The selection of individuals should be based on merit and their portfolio so that they

could be able to take up dynamic challenges. In accordance with hiring of skilled individuals, some participants mentioned,

Concept	Data Incidents
Hiring of Skilled Individuals	<i>"Hiring of younger people because they will almost insist on the new Technologies that are available and hiring of skilled individuals with agile knowledge."</i> [P2]
	<i>"When we were hiring the new resources yes that is something we talk about because hiring the skilled resources help us in adjusting to the virtual environment."</i> [P8]

Thus, the results above show multiple dimensions of communication for developing Responsiveness within the Virtual-Agile project environments. The characteristics discussed above play a significant role in achieving project performance and overcoming risks and uncertainties. Thus, being responsive to all these factors, the project environment can be harmonised offering several opportunities and minimising the level of threats.

5.4 Responsiveness for Active Risk Resolution

It has been found from the data that Responsiveness influences the process of Active Risk Resolution which is undertaken into two main stages i.e., Risk management planning and Implementation Phases. The findings suggest that Responsiveness facilitates both risk management planning and implementation phases at every stage of the project with having alertness and awareness about the procedures. Application of the project risk management tools and techniques varies from organisation to organisation. Some project managers promote traditional tools and techniques whereas some organisations prefer management of risks according to their own experience and understanding of the project affairs.

The relationship of Responsiveness with both the risk management planning and implementation phases was observed when analysing the respondents' experiences; where the respondents' have described that how effectively using technology they communicate in

time to respond to an uncertain situation. The participants' beliefs have depicted that for doing an active risk management planning and implementing risk responses, the teams and the stakeholders need to aware of the situations and the proceedings of the Virtual-Agile project environments. Consequently, they have also shown concern that the reasons for failures in the projects can be linked with the inefficiency of the entities involved in the projects. The reasons can be the differences in working practices and mindsets due to which they cannot or do not prefer to interact with each other more often. Following quotations shows the influence of Responsiveness in Risk management planning and implementation phases,

Category	Data Incidents
Active Risk Resolution	<i>"For managing risks, everyone should be active. Where and when problem occurs, how well you observe and communicate the problem in time to developers and client or PM.... Time and means of communication obviously matters a lot when mitigating risks"</i> [P12]
	<i>"If I came to know about any risk, what then I do just communicate that to my PM or in my daily scrum meeting I can do that thing. So, I can send email or call them on IP phone so anytime I feel that the risk then I can just contact to my PM."</i> [P20]
	<i>"How we should resolve this risk? Is this previously occurred risk, it's frequently occurring? How should we mitigate it now? What is the root cause of that? Are we owning this risk, or we want to completely resolve that risk ...? You always have to trust your team members; otherwise your project will not work."</i> [P24]

Risk management planning is performed when the project manager, team members and stakeholders interact and plan responses to the identified potential risks. The process of risk management planning goes throughout the sprint development cycle. After the completion of a sprint cycle, in retrospectives, the stakeholders get into contact for undertaking the risk

management planning using lessons learnt from previous sprints. The activity is typically performed at a decision-making level involving the project managers, scrum masters, concerned team leads and the product owner; and is then communicated to teams around the globe. From the data, it has also been identified that team members around the globe can also play an imperative role during the risk management planning phase. When a sprint initiates, risk management planning is undertaken during daily scrum meetings where the project managers or teams analyse the forthcoming uncertainties and plan actions to deal when they occur. When occurrence of any risk happens, Responsiveness enforces the teams or individuals get in contact and use the decided responses/actions which helps to control an uncertain situation. At this point, the project stakeholders are implementation phase where they get support from the product backlogs or risk registers, already maintained with a planned response for meeting uncertain circumstances. The teams, product owner/client and other stakeholders get into contact and start working for resolving the risk events. If any unexpected or surprising risk occurs, Responsiveness enforces the project stakeholders to analyse the situation proactively and decide upon mitigation strategies or contingency plans to control risks. Further, Responsiveness supports reviewing the actions undertaken from time to time, to ensure maximum control over the project processes.

5.4.1 Risk Management Planning Phase

According to data sources, the risk management planning phase is undertaken in three main stages i.e., estimation, assessment, and deciding the responses for the potential risk factors. Planning phase also helps to determine the possibilities of occurrence of potential risks in terms of their likelihood of occurrence and influence on the project activities. The data suggest that Responsiveness among project stakeholders helps to determine the upcoming risks and challenges in Virtual-Agile projects. Whether during the project planning phase or even when the project has been initiated, Responsiveness helps to proactively forecast the

risk events. As mainly dependent upon technological means, timeliness and communication, the stakeholders facilitate the planning phase as following,

Estimation

Identification of risks is performed with brainstorming sessions where teams and project stakeholder discuss and identify potential problems and challenges that may arise during the sprint cycle. Identification of potential risk factors is performed in,

- Sprint Planning meetings
- Daily Scrum meetings
- Sprint retrospective meetings

Sprint Planning is a collaborative task session that is attended by the Scrum master, product owner and development teams to plan the work for the upcoming sprints. Here the collaborative stakeholders select the tasks from the Product Backlogs which needs to be completed in the upcoming sprints. Risk management planning is undertaken during these meetings where the stakeholders discuss every possibility of the potential risk factors. Consequently, when a spring initiates, Scrum meetings occurs on daily basis where the team members, project manager and product owner contact, and discuss about upcoming ambiguities whereas sprint retrospective meetings occur after the completion of one sprint (iteration), where the project stakeholders review the accomplished tasks and decide upon the future strategies based on the lessons learnt from previous sprints. For the identification of the risks, different stakeholders use different techniques. Some depends upon conventional methodologies whereas some prefers doing it in their own style. Few participants in this regard mentioned,

"The way we identify and manage risk is during the scrum meeting where any potential risk is flashed out and dealt with straight away."[P3]

"We normally do not have any formalised risk management techniques, but we do while we are doing the grooming and climbing meeting specifically, we do discuss all these things."[P25]

Grooming and climbing meetings in Virtual-Agile format occurs during every sprint. The grooming and climbing meetings are undertaken in projects to update the product backlog of the projects (Paasivaara et al., 2009). In those meetings, risks are always treated as risks even if they have been mitigated or managed. The participant mentioned that throughout the sprint life cycle, risks are identified, and the project team and stakeholders work to mitigate those risks. Similarly, another participant while expressing his thought about the estimation of risks mentioned,

"One of the main things that a project manager should do before starting a new project in present or future is that there should be a proper gap analysis to identify the potential risks"[P18]

The participant#18 who was a Project Manager in Pakistan preferred to undertake gap analysis to help compare the actual performance with the desired performance. Gap analysis helps to identify the objectives, analyse the present situations and help designing future strategies for the completing projects. The participant mentioned that there can be differences in understanding the project scope and objectives due to which several ambiguities can arise. Therefore, a proper gap analysis helps to identify the scope issues. Gap analysis also helps to point out the risks which can arise due to lack of understanding and knowledge about the project work between dispersed stakeholders. Consequently, the participant preferred to depend upon interactions and meetings for the identification of the risks.

Assessment

Assessment phase of the risk management planning also occurs in the same meetings where the project team or concerned stakeholders apply different strategies to analyse and assess the effect of identified risks. During the assessment phase, it is dependent upon organisational approach how they estimate or analyse the identified risk factors. Some of the methods or approaches that are identified from the data for assessment of identified risks are,

- Use of various standards as Prince2, PMBOK, CMMI, ISO etc
- Use of Delphi Technique
- Root Cause Analysis
- Expert Opinion or Judgement
- Likelihood vs Impact Analysis, and
- Digital Project management or Risk management tools

The well-known standard such as PRINCE2, PMBOK and CMMI models are widely applied methodologies of project management which improves processes and provide systematic guidelines to manage projects. PRINCE2 is a process-based method used for effective project management whereas PMBOK provides guidelines, best practices and terminologies to manage projects more efficiently. CMMI standard is nowadays extensively used in software development industry which offers different levels of process improvement training and appraisal programs. All these standards are applied randomly as per requirement and understanding. These methods are most commonly applied by decision makers, project planners and managers when analysing the risk factors. Agile methodology does not particularly provide specific guidelines for managing risks and suggest for maintaining high interaction and collaboration with its stakeholders where the solutions can evolve. The data suggest for multiple practices in Industry where some project managers, scrum masters and decision makers apply conventional standard for risk management planning whereas some

accept a risk event and act accordingly. The viewpoints of the participants can be assessed from following quotes,

"In practice, I do a mix, so I use in front more the assessment form of PMI methods as there is no strict plan in Agile stuff how to use it I really use risk assessment and risk recovery in the beginning of the project. And typically related to more PMI methodology {risk assessment and risk recovery are some of the methods from PMBOK}, I plan a budget and time impact in also Agile projects."[P4]

"I would say as such no formal theory but informally we do in the form of meetings, gradually and evaluating in different meetings. The risk is evaluated for in would be sprint meeting, I would say but no such formal method used for risk analysis."[P12]

Participant#4 was a project manager in Germany and dealing with teams in India. He preferred to apply traditional methodologies of PMI. PMI which is an acronym from Project Management Institute, is a U.S based standard which elaborates its guidelines in the form of PMBOK (Project Management Body of Knowledge) (PMBOK, 2004). He further proposes that Agile do not provide any specific guidelines to manage projects, therefore he prefers to refer conventional PMI techniques. The participant also mentioned that using the conventional approaches of PMI does not only support in the risk analysis and generate risk recovery plans, but also helps him to prepare a budget and time plan for projects. There can be several sub-tools, which can be the part of risk analysis and risk recovery plan. Risk analysis can be performed using quantitative or qualitative approaches whereas risk recovery planning is the next step after assessment where the participant#4 seems to plan responses to all identified risks.

Likewise, participant#12 who was a project manager in software development industry in Pakistan discussed that Agile doesn't have any formal guidelines for management of risks, so he prefers to do the risk management planning while interacting with the teams and individuals in daily scrum meetings where he discusses several dimensions of the risks and get feedback from the individuals and stakeholders for responding to an uncertain event in future. Similarly, another participant while describing his experience referred to the application of CMMI (Capability Maturity Model Integration) in this organisation,

"We are going for CMMI level three that has a complete process area of risk management ok so, it comes under the same basic principles in which you have to basically define the threats and probabilities then you have implement controls accordingly. So, it's all the basic assessments and the management, so you have to keep a constant eye on the contingency or the mitigation."[P17]

Participant#17 being a part of senior decision-making team refers to adopt CMMI level three, which works in a more conventional way for managing risks. Although his organisation is following Agile methodologies, he believes that there is a lack of guidance available for dealing with risks and challenges in Agile. Consequently, while acknowledging the use of certain tools and methods, some of the participants highlighted,

"There are certain things that we do over here in our organisation, we find the triggers for this issue, we define their impacts, we define their probability and we also define the cost. In case, these issues become risks and if they actually occur then what is the probability of their occurrence, what would be their impact of their occurrence, what will be the cost impact, because at no point an issue becomes a risk and it occurs and if the cost is more than the cost of the project it's pointless."[P14]

"In case some risk has very deep effect on project we then go for the root cause analysis sometimes to identify what went wrong and what can be done to correct it in the future."[P18]

"We use the brainstorming, Delphi technique, root cause analysis and expert opinion like this sort of stuff."[P22]

The tools and approaches proposed in above quotations by the participants are dependent upon their preferences and experience. The researcher can assume that if a project manager is from more a practitioner level background, he relies on the application of such tools and techniques. Participant#18 and 22 both were having PMP certifications. PMP certification (Project Management Professional) is an accreditation from PMI for managing the projects soundly and efficiently. While discussing the significance of risk assessment, a participant proposed to include a third dimension into the impact vs probability analysis tool, so that the organisation would come to know at which stage the risk is expected to happen,

"The standard risk methodologies that are used are the impact and the probability. I would like to see a third dimension added which is proximity because if you look at a risk and that risk is a year on your radar or program is one thing, but you will be best to focus your activities on your nearest proximities of risk to ensure that those elements are given your full attention rather diluting the focus to items that are a year or two years away."[P7]

The participant mentioned that he would probably prefer to get an estimate of the time period of risks that can be the part of the projects. For example, if a project has 4-6 sprints and the risks identified initially might expect to occur during 5th or 6th sprint, then introducing the proximity level in the probability vs impact tool should inform him about the estimated time of the risk. Similarly, risk management is also performed using the

customised digital tools where the project managers or teams can get information from one platform while being dispersed,

"One of my little projects is I am doing at the moment is to put New Enterprise Risk Management tool in place so instead of doing the stuff by spreadsheets or annual process, we now have a single source. We have an enterprise risk management tool which will record all the risks, it will have threats, vulnerabilities, impact, probabilities, and etc. and all the good kind of stuff you would have So, we have customised it for what we wanted to do." [P5]

Use of Product backlogs and Risk Registers

Use of Product backlogs and risk registers has been found a common practice for storing the record of risks with proposed mitigation strategies in Virtual-Agile project environments. Project managers, teams, and stakeholders when going through the estimation and assessment phases propose a contingency or mitigation plan in order to deal with the future risk events. The proposed actions or strategies are stored in product backlogs and risk registers. Product backlog in the Agile scrum is a list of product specifications in a short descriptive form. The product backlog features a list of tasks that should be undertaken according to priorities and contain a description of the required functionalities in a product (Cockburn and Highsmith, 2001). Similarly, risk registers are well-known tools from traditional project management such as PMBoK and PRINCE2. They are used to keep the record of identified and analysed risks with a suitable strategy which can be applied during the implementation phase. The use of maintaining logs varies from organisations to organisations. Some of the participants' experiences are mentioned as follows,

"We basically use risk register to identify earlier that all the risks are first entered in a system, registered and then we work on that plan, then the plan is

developed and then we have always the risk mitigation plan on each and every of the risk identified risk.”[P12]

"My core responsibility is to maintain that risk register and each functional wing to what we have, and they carry out the into their work patterns and then report it to risk manager.”[P22]

"You should always make sure that you always take a risk register for the lessons learned to ensure that you look at the mistakes that were made and you ensure that those mistakes and the possibilities of those mistakes happening are minimised.”[P7]

Some of the teams and project managers use risk registers to keep the record and responses of potential risks whereas some participants acknowledged the use of backlogs for storing risk responses. Keeping the record can also help them storing the lessons learned from previous sprints. Risk registers are then communicated and shared among all the team members and project stakeholders so that they could come to know to respond in case of risk events. Likewise, the utilization of product backlog list varies from organisation to organisation. While describing the use of product backlog, some participants suggested that as backlog helps to know about the prioritised work, in the same way, it also helps to maintain a record of each recognised risk. An indicator is put in front of each task which helps to recognise the risk response in case of an uncertain situation. Similarly, Product backlog list is shared with all the project team members so that they could come to know what the alarming points when undergoing the development. While acknowledging the use of product backlogs, a participant mentioned,

"We don't really keep risk registers; what we keep is the product backlog list, most of the things what we identify as risk, are rather thrown into it as user

storage. We deal with it when it comes to the necessary strength, that's it, so I would say that is how the product backlog list is actually used.”[P3]

5.4.2 Risk Management Implementation Phase

The implementation phase of risk management gets in place when any predicted or unexpected risk occurs where the Virtual-Agile teams or stakeholders proactively get in contact and respond to risks and evolving challenges. The implementation phase is generally commenced based on risk management planning stored in the form of risk registers or product backlogs, which help to know about the responses or actions that need to be undertaken. Responsiveness supports implementation phase for getting in contact, respond timely and eliminate the effects of the risks. Risk management implementation phase has following phases,

Action and then Review

The action stage in implementation phase occurs when the project teams and stakeholders get in contact and decide to respond to an uncertain situation or risk event. Risk management planning phase supports implementation phase, where the risks which were already estimated, assessed and stored in the form of risk registers and backlogs come into consideration for responding to risk events. Similarly, wherever the situation is very critical, and the project stakeholders are not able to get any help from the risk management planning phase, Responsiveness facilitates project stakeholders to decide upon the strategies or activities that are needed to be undertaken in short time. Responsiveness being dependent upon communication, timelines and technology help them to decide what to do or how to react based on the background context of the risk; timeliness supports responding to risk event timely and proactively and technology as a facilitator is always present there to maintain a web and integration between team members. A participant in this context mentioned,

"Like having a mitigation plan or having a risk recovery plan and then at the end you observe that the risk is coming or it's pretty the same. Then you have to manage if it's rising or not, so perhaps you can reduce it in the traditional way like having the right people in place. At the end, something is really changing them which you have to manage in the project."[P4]

The participant discussed that if you have a mitigation plan, you can respond to risky situations very promptly. If the risk is not having any negative impacts on the project or if it's having some, you need to place right people or individuals in order to minimise the effect of risks which he recognised as a more conventional style of managing risks. Similarly, another participant mentioned,

"Our mitigation for the risk is based on our daily meetings where everyone put his opinion and strategies to meet critical points."[P6]

The participant expressed his viewpoint that he is being a project manager mitigate risks during daily scrum meetings. During the meetings, the team members and project manager collaborates and discuss their viewpoints on the problems and then mitigate those risks. They can express their reservations or opinions to encounter the risks. Likewise, some other participants while acknowledging the significance of planning and implementation phases highlighted,

"Without any risk plan we don't move forward with any of the project. Each and every risk with each and every stakeholder is identified. That is the main strategy that we use to handle the risk."[P13]

"You have to go back during your review meetings to discuss those risks again and again."[P17]

The participants acknowledged that they prefer circulating the risk plan among all stakeholders. They do not move forward in the projects until and unless they have a proper resolution plan. Similarly, after the risks have been mitigated or controlled, they prefer to discuss those risks in the next meetings so that their status could better be known. Here the participants have elaborated the importance of Review phase where the action strategy when has been implemented, the stakeholders review the results to further analyse situations; whether the effect of those risks have been controlled or not, or how much the occurred risk has caused disasters to the project. Similarly, another participant while acknowledging the importance of implementation phase mentioned,

"I mean to say with the virtual agile projects it is something like if we encounter risk situation or it becomes a hazard you know it won't be just impacting one location or one team or something it might be impacting all the locations and then all the projects."[P8]

The participant believed that occurrence of risks not only affect one location, but it impacts all the locations from where the teams are operating. The participant acknowledged that risks should be dealt straight away using proper knowledge and communication. He further proposed that risks can affect the project progress due to which distributed teams at all locations may suffer. Consequently, another participant mentioned that even after the completion of one sprint, especially during the sprint retrospective meetings, they prefer to discuss all the risks that were the part of completed sprints and have been already mitigate (Review phase). This helps them to consider several actions and strategies applied for mitigation so that they could get aware for the future sprints. They record their actions in the form of lessons learnt which then help them to reduce or minimise the occurrence of risks in future. Few participants when highlighting their perspectives mentioned,




"We do planning on the first day of sprint and we have retrospectives after the sprint, so we discuss about risks which we faced. How can we reduce them or minimise them, so and these are the events {actions that can be undertaken for future sprints} we can do?"[P18]

"But then still they are identified as the risks through daily scrum meetings {even after the mitigation}; we have sprint review meetings, we have retrospective meetings, as a part of that, and all these meetings if anything identified as the risk, is dealt with straight away."[P3]

5.5 Risks and Risk Resolution Strategies

During analysis of the data, the researcher also discovered 8 types of risk factors that can be considered as potential risk factors in the Virtual-Agile project environments. These 8 main types include further 23 risks which can be seen in the following table 5.5. Based on the results of section 5.1, 5.2 and 5.3, the researcher has further elaborated resolution strategies shown later in figure 5.5. The description of table 5.5 is suggested as below,

- *'Type' represents the higher-level categories of risks factors*
- *'Participants (p1, p2, p3, ... p25)' shows that how many participants have raised this risk*
- *'No. of cases' shows how many times a risk has been identified during the data analysis.*
- *'Risk possibility' is the likelihood of occurrence of individual risk factor that has been calculated by diving 'No. of times' by 'Total number of participants=25'. For example, in the table, a risk factor such as 'lack of understanding scope' has been identified by 12 participants where its probability of occurrence is 48% (% of cases). The colour range has been shown below,*

- a. Green Colour  shows probability < 30% which means that the risk is less likely to happen
- b. Amber Colour  shows probability > 30% and < 59% which means that risk is more likely to happen during projects
- c. Red Colour  shows probability > 60 % which means these types of risks are extremely likely to occur in the Virtual-Agile projects

Please Note:

The above ranges have been defined by the researcher himself according to perspectives of the participants. The probability of risks may change according to the project settings and organisational preferences; these values cannot be considered as fixed as they vary in projects types and environment.

5.5 Calculation of Risk Likelihoods in Virtual-Agile Projects

Risk Factors	Type	Risk Factors	Participants (p1, p2, p3 p25)																									No. of cases	Risk Possibility Percent of Cases (%)
			P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25		
Risk Factors	Project Risks	Lack of understanding scope				√						√	√			√	√	√			√	√		√	√	√	√	12	48
		Lack of knowledge of working		√	√		√			√	√	√		√	√			√	√		√			√	√	√	√	15	60
		Change in Scope							√	√		√	√	√		√	√		√	√	√	√	√	√	√	√	√	16	64
	Human Risks	Lack of Skilled individuals	√	√				√			√			√	√				√	√	√					√	√	11	44
		Lack of training			√			√				√					√	√	√	√				√		√		9	36
		Cultural Differences				√	√	√		√	√		√	√								√						8	32
		Linguistic Differences		√							√		√			√			√						√			6	24
	Collaboration Risks	Lack of face-to-face communication	√	√	√							√	√	√		√	√	√	√	√	√	√	√		√	√	√	17	68
		Insufficient knowledge sharing				√						√		√	√					√	√	√	√		√	√		10	40
		Unavailability of individuals									√			√							√			√		√	√	6	24
		Lack of stakeholder interaction			√		√	√				√			√			√	√		√			√			√	10	40
	Technological Risks	Unavailability of tools/equipment			√	√	√				√	√		√				√		√	√						√	9	36
		Failure of communication channel								√		√		√		√						√	√	√	√		√	10	40
		Disruption in connectivity		√			√			√						√	√					√	√		√		√	9	36
	Time relate risks	Difference in time zones			√	√				√	√		√	√			√	√	√		√	√	√	√	√		√	15	60
		Delay in meetings			√																√			√		√		4	16
		Unable to meet deadlines	√							√	√		√	√	√		√	√		√	√	√	√	√	√	√	√	17	68
	Financial Risks	Salaries not paid on time																								√		1	4
		Exceeding budget				√	√		√	√	√		√			√			√	√			√			√		11	44
	Quality Risks	Unable to meet scope						√					√					√	√	√	√	√	√		√	√		10	40
		Dissatisfaction of stakeholder			√			√								√		√			√							5	20
	Process-Related Risks	Transition to Virtual-Agile format		√	√						√	√					√	√	√					√		√		9	36
		Lack of Risk Management practices			√		√	√				√	√								√					√	√	8	32

5.5.1 Project Risks and Resolution

Project risks are 'More and Extremely likely' to occur in the Virtual-Agile project environments. Project risks comprises of the risk factors which are generally related to projects aspects. For example, when can be a lack of understanding scope between the project team and client, it may affect the timelines and quality of the project. The proposed resolutions for these risks have been adapted using the practices from Section 5.3.1 and 5.3.2. Knowledge transfer can help reduce the probability of project risks and its influence on the project environment. The reasons how knowledge transfer can reduce the project risks is by getting feedback on the work performed, getting feedback on the development codes and ensuring that the scope of that work has been understood by both the teams and client. Similarly, stakeholder involvement may also help to reduce the project risks where they can provide useful suggestions and ensure strong support in difficult times

5.5.2 Human Risks and Resolution

In the format of Virtual-Agile projects, human risks are 'less and more' likely to happen during the projects. Human-related risks which mainly consist of 'cultural and linguistic' differences, lack of skilful individuals and lack of training are expected to disrupt the project progress. Cultural differences are more expected to happen when team members and clients are from different geographical locations. They would have different languages, working practices and preferences while undertaking their work. Similarly, the data suggests that project managers face difficulties in finding skilled individuals and this ultimately becomes a risk when the team members are not able to understand the work specification or give required progress respectively. Due to the work burden, team members are not able to handle their work routine properly and this may affect the timelines and contractual terms and conditions. The researcher suggests that these risks can be overcome by adopting the practices from Section 5.3.3, 5.3.4 and 5.3.6. Development of correlation (Section 5.3.3) can help them to socially interact through various channels or help building of trust. Similarly,

the team satisfaction (Section 5.3.4) can help fulfilling their needs by motivating them, knowing their consent about the work and providing them with appropriate facilities. Consequently, Leadership role under Section 5.3.5 also helps to find skilled individuals and ensure training of each project stakeholder.

5.5.3 Collaboration Risks and Resolution

Collaboration risks within the Virtual-Agile project environments are 'Extremely likely' to occur as identified from the data. Most of the participants have a consensus that lack of face-to-face communication is big risk factor in distributed agile projects as the stakeholders are dispersed and there is very less opportunity to interact with them physically. Collaboration risks result in insufficient knowledge transfer between the teams, lack of stakeholder involvement and unavailability of the individuals for the undergoing the project work. The researcher proposes that there is no alternative of face-to-face communication, but the consequences developed with respect to this risk can be overcome by effective use of technology (Section 5.1.1 and 5.1.2) where the stakeholders using appropriate tools can create strong web between them. Similarly, the risks of insufficient knowledge can be overcome by keeping high frequency of knowledge (Section 5.3.1) where people in the project environment can help each other on various issues. Similarly, by timely correspondence and proper scheduling and planning (Section 5.2.1 and 5.2.2), project stakeholder can undergo daily meetings to allow frequent flow of communication.

5.5.4 Technological Risks and Resolution

As the web between the dispersed entities rely on technology, it has been identified from the data that technology-related risks are 'More likely' to occur during the Virtual-Agile software development. People rely on each other via technology, so to ensure a strong infrastructure, leadership has to play an important role for the elimination of such risks. Leaders from their experience can better estimate the needs and provide facilities to

individuals in terms of technology (Section 5.3.6). For example, if the project development team and product owner are operating virtually, then the project manager needs to ensure a strong technology infrastructure within the premises of development house. Similarly, if the leadership is based at a different location with respect to the team members, he needs to assure that the individuals or team members operating from other location have sufficient bandwidth for connectivity, have all the required tools available: tools for developments (licensed) and tools for secure communication (Section 5.1.1 and 5.1.2). Similarly, as the distributed teams have interdependency upon each other for the completing the tasks, they should be able to have backup sources. If the person is a freelancer or working from his home, he must assure that he fulfils the basic requirement of technology before undergoing the work. By utilization of technology effectively and leadership role, technological risks can be eliminated to a greater extent.

5.5.5 Time-related Risks and Resolution

According to participants, Time-related risks are 'Extreme likely' to occur in Virtual-Agile project environments. Difference in time zone is considered one of the biggest challenge and risk factor that have a certain influence on every project. Difference in time zone can further give rise to several other challenges which need to be managed by teams and leadership very efficiently. Delays in daily scrum meetings are more likely to happen. This can be due to unavailability of individuals or lack of efficiency towards managing time shifts. Similarly, the data also suggest that the risk of not meeting the timelines is extremely common in software development projects. This can be due to alterations constantly taking place in scope, unavailability of individuals or dissatisfaction of stakeholder over the product results. The researcher believes that if the development team is not able to meet the deadline, this risk can be overcome by scheduling and planning, corresponding timely and adjusting the working hours of everyone so that they may have an opportunity to communicate as much as possible (Section 5.2.1, 5.2.2 and 5.2.3). They can schedule and plan, and then adjust

their routines according to the requirement of the project. In regard, competency (Section 5.3.4) also plays an imperative role in managing the tasks and workload. The difference in time zone is a big risk factor which reduces communication between the teams and the client. The data indicate that such issues can be resolved when teams and stakeholder agree to work beyond times and overlap their schedule according to the project requirement. Self-organising themselves to ensure availability in case of any uncertain event can reduce risk factors in terms of time.

5.5.6 Financial Risks and Resolution

Financial risks which include exceeding budget is 'More likely' to happen in the Virtual-Agile project environments. There can be several reasons such as not being able to complete the project on time, objectives not being met or lack of planning towards managing a budget. The researcher believes that this issue can be overcome by leadership involvement (Section 5.3.6) and proper scheduling (Section 5.2.2) so that every team member should know about the deadlines and submit their tasks on time. Similarly, leadership should play an important role in managing the budget, monitor and control the project progress and ensure that project meet the times. In case of salaries being delayed, leadership should play his role and satisfy team member of this issues by motivating them so that their progress couldn't be affected.

5.5.7 Quality Issues and Resolution

Quality issues can better be solved by stakeholder interaction (Section 5.3.2) and ensuring a proper loop of knowledge transfer process (Section 5.3.1) so that every team member should know about the work to be done. It has been discovered from the data that the Virtual-Agile projects fail as they don't meet the scope and specification. This type of risk is more likely to happen in distributed formats. The reason can be mainly the dispersion of

teams and lack of understanding, due to which the individuals couldn't understand the required product or work to be undertaken.

5.5.8 Process-Related Risks and Resolution

From the data, it has also been discovered that the Virtual-Agile teams don't undergo proper risk management strategies due to which dynamic risks are more often expected to happen. As agile doesn't focus on any strict risk management methodology, the data suggest that the organisations are undertaking the risk management according to as per their competency and preferences. Similarly, Project leadership (Section 5.3.6) being risk owner is wholly responsible for the risk management; he needs to provide training and give understanding to the project team about the procedures and methods. If the risk management process is undertaken from top to bottom level, the risks within the project environment can be reduced. Consequently, the data indicates that people in the Virtual-Agile project environments are not able to understand the format working, therefore they lack to compete with the dynamics of the project environment. This creates a lot of ambiguities and can be overcome by competency (Section 5.3.4) where the person can understand the requirements according to his tendency and understanding.

5.6 Summary

This chapter has provided readers a detailed overview of the codes, concepts and categories emerged from the data. Against each code and concept, original data incidents were shown from the interview transcripts to provide readers an understanding of how a category or concept was evolved. This chapter helped readers to realise the needs that helps organisations to counter the challenges and complexities. This chapter also elaborated the types of risk factors evolved from the data which can disrupt the project processes and progresses. The risk factors elaborated in the table shows even how many times a risk has been discussed in by the participants. The chapter helped readers to review the emergence

of various concepts and categories which later took the form of a conceptual model in chapter 6.

CHAPTER 6: POST LITERATURE REVIEW, PARADIGM DEVELOPMENT AND EVALUATION

6.0 Introduction

This chapter includes a post-review of literature in accordance with the findings and results of Chapter 5. The literature review conducted is focused as per the guidance provided by Strauss and Corbin (1990; 1998; 2008). Conventional project management approaches are reviewed with their application and practicalities in different industries. Consequently, some of the available approaches for software risk management have also been reviewed. The chapter demonstrates a conceptual model which became the basis of development of the paradigm of Responsiveness. Accordingly, evaluation has been performed to highlight strengths and weaknesses of the findings. Likewise, the relevance of the paradigm has been discussed to help readers understand where the that fits, and which of the Agile sub-methods it addresses. Consequently, the researcher has discussed the actions which were undertaken to ensure trustworthiness in qualitative research. The chapter has been structured as follows:

Section 6.1: Inclusion and Exclusion Criteria

Section 6.2: Conventional Project Risk Management Approaches

Section 6.3: Software Risk Management

Section 6.4: Risk Management and Collaboration

Section 6.5: Technological Perspective – Diffusion of Innovation

Section 6.6: Responsiveness in Virtual-Agile Projects – Critical Evaluation

Section 6.7: Relevance of Paradigm of Responsiveness in Virtual-Agile Project Environments

Section 6.8: Actions for Ensuring Trustworthiness in Research

6.1 Inclusion and Exclusion Criteria

Regarding the second stage literature review, Strauss and Corbin (1998, p.52) suggested that

When the investigator has finished his or her data collection and analysis and is in the writing stage, the literature can be used to confirm findings and, just the reverse, findings can be used to illustrate where the literature is incorrect, is overly simplistic, or only partially explains phenomena. Bringing the literature into writing not only demonstrates scholarliness but also allows for extending, validating, and refining knowledge in the field. What the researcher should avoid is being insecure about his or her discoveries. Running to the published literature to validate or negate everything that is one finding hinders progress and stifles creativity.

Considering the recommendations of Strauss and Corbin (1998), the researcher decided to review the literature using inclusion and exclusion criteria. Inclusion and exclusion criteria are generally used for undertaking a systematic literature review (Creswell, 2009). For defining the inclusion and exclusion criteria, the researcher referred to his main research question, i.e.,

"How to overcome the risks and uncertainties in Virtual-Agile projects?"

From the scope of the research question, the author with the support of his supervisory team finalised the inclusion and exclusion criteria. The purpose of using inclusion and exclusion criteria was to select relevant literature against the findings which could help paradigm development. Inclusion and exclusion criteria supported looking for appropriate models, theories and literature which then helped to critically evaluate the findings. Further, using the inclusion and exclusion criteria the researcher matured his findings using the

previous concepts in the critical evaluation stage (section 6.6). Inclusion and exclusion criteria are being described as follows:

1) Inclusion Criteria

- Refer to literature in terms of Organisational Management related to reduction of risks, uncertainties or ambiguities.
- Refer to organisational background or Virtual-Agile literature for maintaining high collaboration or communication between strangers or new individuals mutually brought together to achieve one goal.
- Literature in relation to technology and time management support for controlling risks and uncertainties, and managing projects successfully.
- Refer to well-established risk management standards, theories and models for managing risks and projects.
- For critical evaluation, use of indexed terms such as “virtual” or “distributed” or “agile” or “complex” or “software development” projects was used.

2) Exclusion Criteria

- literature was not consulted which did not link to the final findings (Chapter 5) such as theories, models that do not propose to reduce risks, uncertainties or challenges.
- Literature which did not discuss maintaining high collaboration or communication or the need for using technology and time effectively.
- Literature which was not relevant to the context of Virtual-Agile or software development projects.

6.2 Conventional Project Risk Management Approaches

In the literature of project risk management, the most commonly applied standards are PMBOK (Project Management Body of Knowledge) and PRINCE2 (PRojects IN Controlled

Environments). The approaches and procedures to manage risks provided by PMBOK and PRINCE2 are similar in nature for projects in general. Both the standards seem to be lacking in providing guidelines for managing risks and challenges for Virtual-Agile projects especially. The researcher believes that the body of knowledge is practitioner-derived which is more suitable for the persons who have been qualified to work using such procedures. Consequently, Shenhar (2001) suggests that managing projects successfully is much more than only applying risk management procedures. Risk management can be a part of effective project management but as some of the product development projects are derived from system complexity, therefore traditional risk management practices are not sufficient to manage risks and uncertainties and can only be applied to general projects.

6.2.1 Project Management Body of Knowledge (PMBOK)

PMBOK (2004) defines project risk management as a systematic process of recognising, examining and planning a response, and monitoring and control of the uncertain event. It also aims to reduce the probability of negative risks and maximise the probability of positive risks which could bring benefits to the organisations. PMBOK (2004) risk management comprises of six main steps, i.e. risk management planning, identification, qualitative analysis, quantitative risk analysis, response planning, and monitoring and control.

Boehm (1991) proposed that some researchers reduce the number of stages while implementing the PMBOK risk management procedures in software development projects. Similarly, some of the researchers propose more steps or stages while implementing the PMBOK procedures (Chapman and Ward, 2002). The need for the tools and methods varies according to the understanding of the individuals involved in the risk management process. Figure 6.2.1 shows the risk management process of PMBOK (2004, p.254).

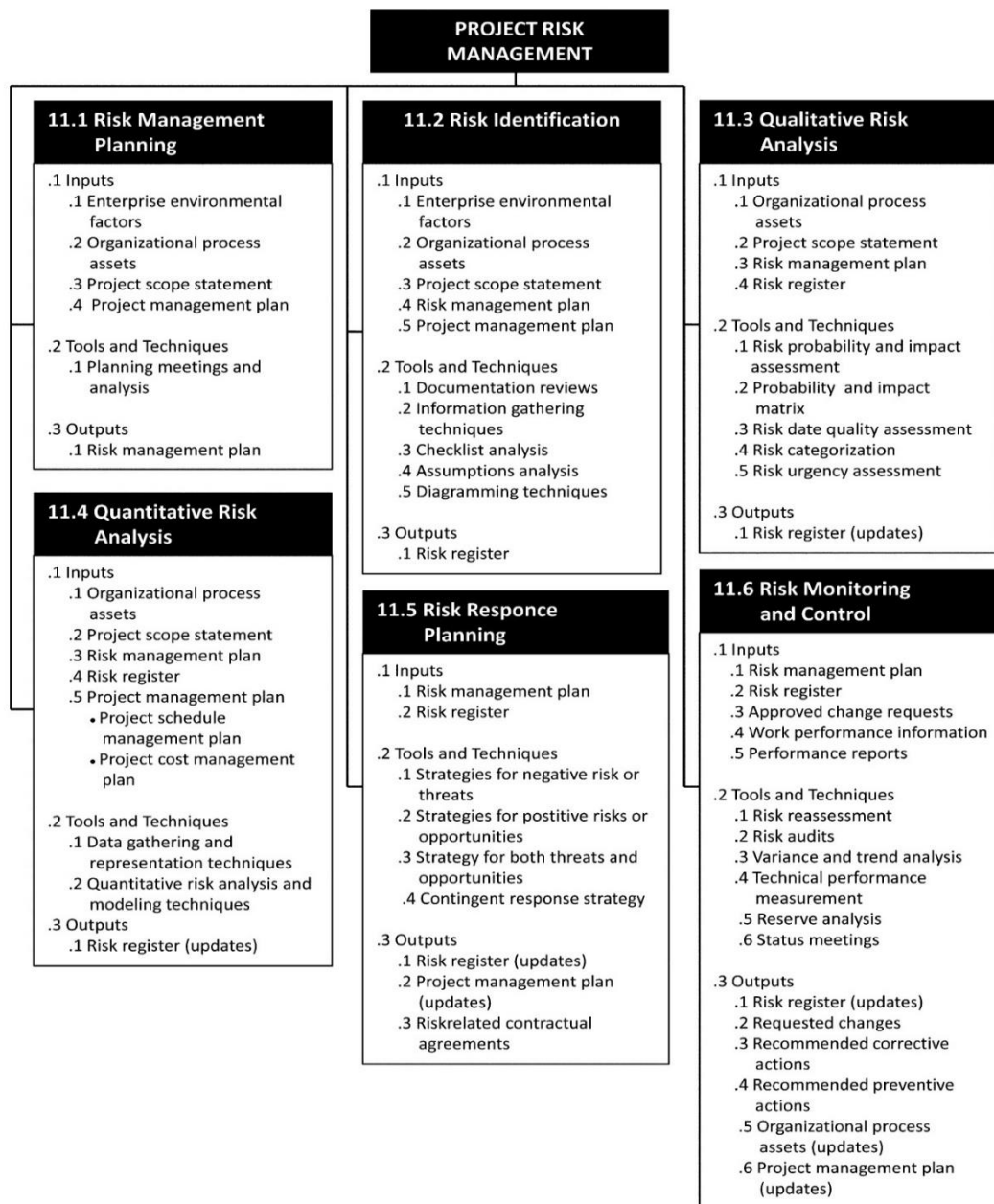


Figure 6.2.1: PMBOK (2004) Project Risk Management

6.2.2 PRINCE2 (PRojects IN Controlled Environments)

According to OGC (2017), PRINCE2 is a systematic method of managing projects, comprising of seven principles, seven themes and seven processes. In terms of risk management, PRINCE2 proposes a five-stage operation: identification, assessment, planning, implementation and communication, as shown in figure 6.2.2.

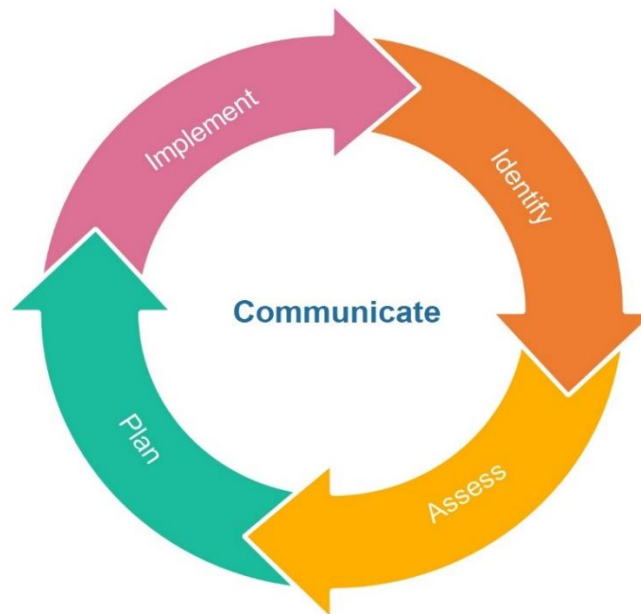


Figure 6.2.2: PRINCE2 Risk Management Process adapted from OGC (2017)

- 1) *Identification phase* includes identification of all types of risks (threats and opportunities). For this phase, assistance from the previous risk registers is undertaken which hold the record of risks from previous projects.
- 2) *Assessment phase* includes an examination of identified risks in terms of their probability of occurrence and impact on the project objectives.
- 3) *Planning phase* suggests specific responses in accordance with identified and assessed risks. Responses are designed for both threats and opportunities as shown in table 6.2.2.
- 4) *Implementation phase* is an action stage where the planned responses from stage 3 are implemented.
- 5) *Communication phase*: After carrying out the risk management steps, communicate them to all the stakeholders in the form of the checkpoint, highlight, end-stage, end projects and lessons learned report.

Table 6.2.2: PRINCE2 Responses for Threats and Opportunities (OGC, 2017)

Threats Responses	Opportunities Responses
Avoid	Exploit
Reduce (probability and/or impact) Fall-back (reduce impact only) Transfer (reduce impact only, and often only the financial impact)	Enhance
Share	
Accept	Reject

6.2.3. PRAM (Project Risk Analysis and Management) by APM

Project Risk Analysis and Management (PRAM) is a risk management process proposed by Association of Project Management (APM) (APM, 2010). APM is a well-known chartered body of knowledge in United Kingdom, committed to developing and promoting project and programme management through its five dimensions of professionalism. The five dimensions of professionalism provide a framework that helps developing a career. These dimensions are:

- Breadth
- Depth
- Achievement
- Commitment
- Accountability

(APM, 2012)

Association of Project Management (APM) has further published PRAM in 2010, in which a risk management process comprising of number of phases. According to APM (2010), risk management process consists of five phases, together with a 'Manage Process' activity. The risk management process is iterative in nature, meaning that the output from each phase might requires a previous phase to be revisited. The following figure has been adapted from APM (2010) which shows a risk management process. The thick solid lines indicate main iterative loop, the thin solid lines indicate possible links to earlier phases and the dotted lines show requirement to manage the process at all stages. APM (2010) further suggest that the risk management process must be repetitive throughout the project life cycle.

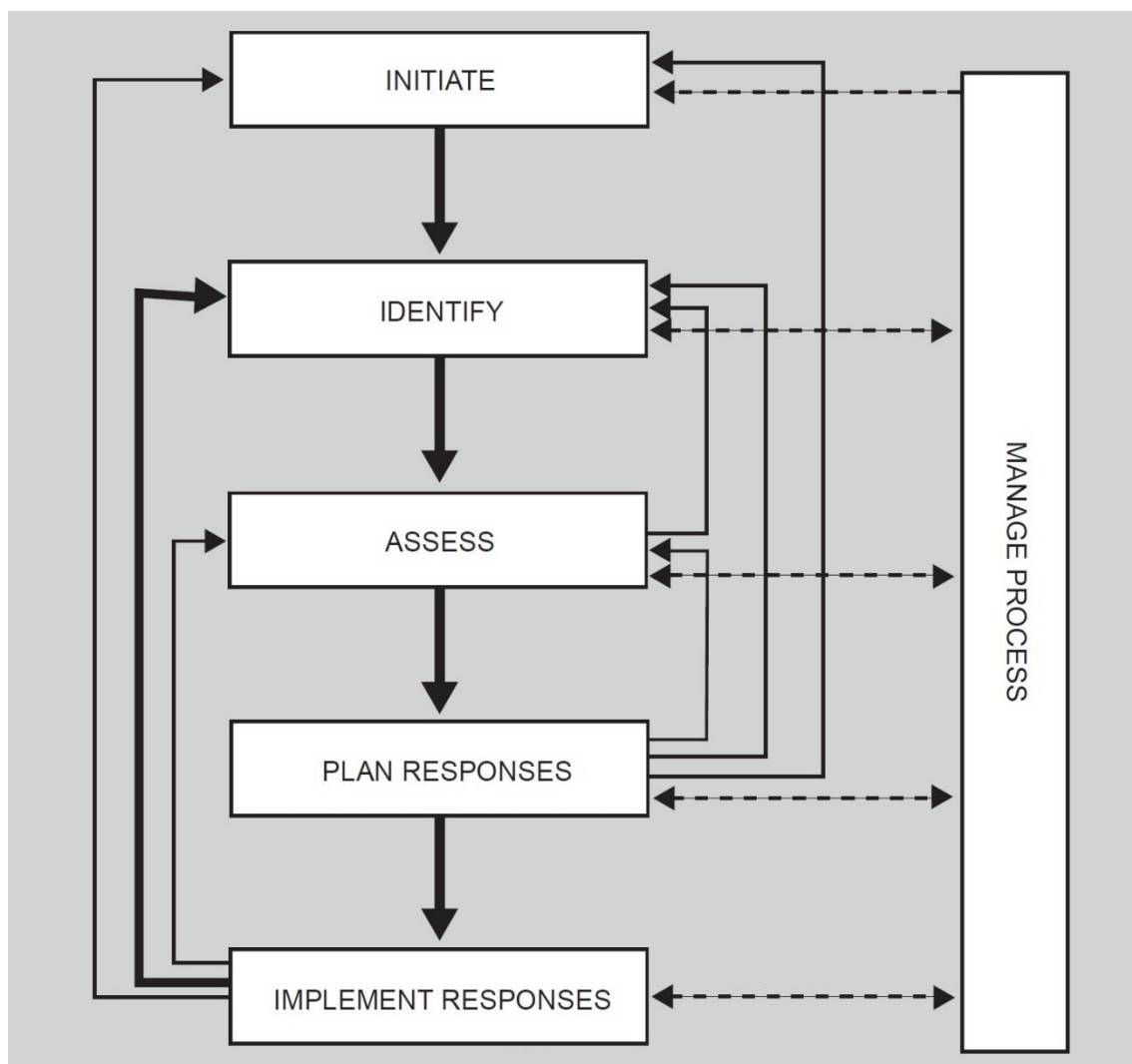


Figure 6.2.3: APM's Risk Management Process adapted from APM (2010)

APM (2010) suggests that risk management process should be networked with other project management processes. They further recommended that the information from the risk management must be used to guide the other parts of the project, such as, project planning and estimating, resource planning, change and quality management and then the stakeholder and communication management.

As per the shown figure 6.2.3, *Initiate phase* helps to establish the scope, objectives and motive behind having a risk management process. Initiation has mainly two sub-phases:

- Define Project – helps to share the purpose and ensure common understanding of the project objectives
- Focus Risk Management Process – helps matching the risk management process according to the requirements of the project

Identification phase helps to estimate the risk events appropriate to the scope of the project having potential and possibility of occurrence. Risk events can be determined from the lessons learned from the previous projects relevant to the scope of the project. Here, the stakeholders should also be consulted for the practical opinions. The aim of the Identification phase is to inform the parties involved in the project processes about the relevant risk events which can practically influence project procedures.

Assess phase helps to develop an understanding of the identified risks between project stakeholders for which the effective planning can be done. At this level, overall combined project risks are also assessed. The assessment of the individual risk events as well as combined project risks can be undertaken using qualitative/or a quantitative approach. Here the nature of the risks can be suggested, such a positive or negative depending upon the potential effects of the risk events. Probabilities and impacts of each risk event are determined together preliminary risk responses to be undertaken at the time of risk occurrence.

Plan responses phase helps to determine appropriate responses to individual risk events identified from identification and assessment phase. The motive behind the plan responses phase is to address two main aims: Plan risk event responses and plan combined project risk responses. APM (2010) further suggests that risk response owners should receive specific information on the risk events so that the action can be undertaken. *Manage Process* in PRAM helps to ensure that the risk management process remains effective in addressing the identified risk events and project risks. Management process gets input/feedback from each previous phase, as well as for the process. Manage process can be undertaken through formal and regular risk management process reviews or can be undertaken informally throughout the project. The efficiency of the process depends upon how well it is executed between different levels and iterations in the project environment.

6.3 Software Risk Management

According to Yong et al. (2006), a software development project comprises of dynamic and complex risks. Islam (2009) describes that most software projects fail in delivering under the constraints of time, cost, quality and budget due to the evolving nature of risks and weak management practices. The reason can be insufficient understanding of the project scope and lack of efficiency to manage projects (Bannerman, 2008). The traditional practices of project risk management lack elaboration of the best risk management practices in such dynamic environments (Islam, 2009; Bannerman, 2008). Various definitions exist in relation to software risk management, but one of the most well-known and widely used definitions is provided by Boehm (1989, p.1):

Software Risk Management is a discipline whose objectives are to identify, address, and eliminate risk items before they become either threats to successful software operation or major sources of software rework.

6.3.1 Boehm's Risk Management Model

In the literature of software risk management, several models and techniques have been proposed by different authors and researchers. All the existing models or techniques have the same purpose of eliminating the risks. Some of the models or frameworks use the same concept for risk management and some have unique features. Accordingly, Boehm (1991) proposed a software risk management which occurs under two main phases, i.e. Risk Assessment and Control. Risk assessment further includes three sub-stages of risk identification, risk analysis and risk prioritization. Boehm (1991) suggested that the purpose of risk assessment is to recognise the potential risk factors, calculate their probability of occurrence and generate a risk priority document for further action. Similarly, the risk control phase consists of three sub-stages: risk management planning, risk resolution and risk monitoring. The risk control phase helps to plan risk resolution responses against the identified risks and monitor the situations in case of a risk event. Boehm's (1991) risk management model is shown in figure 6.3.1.

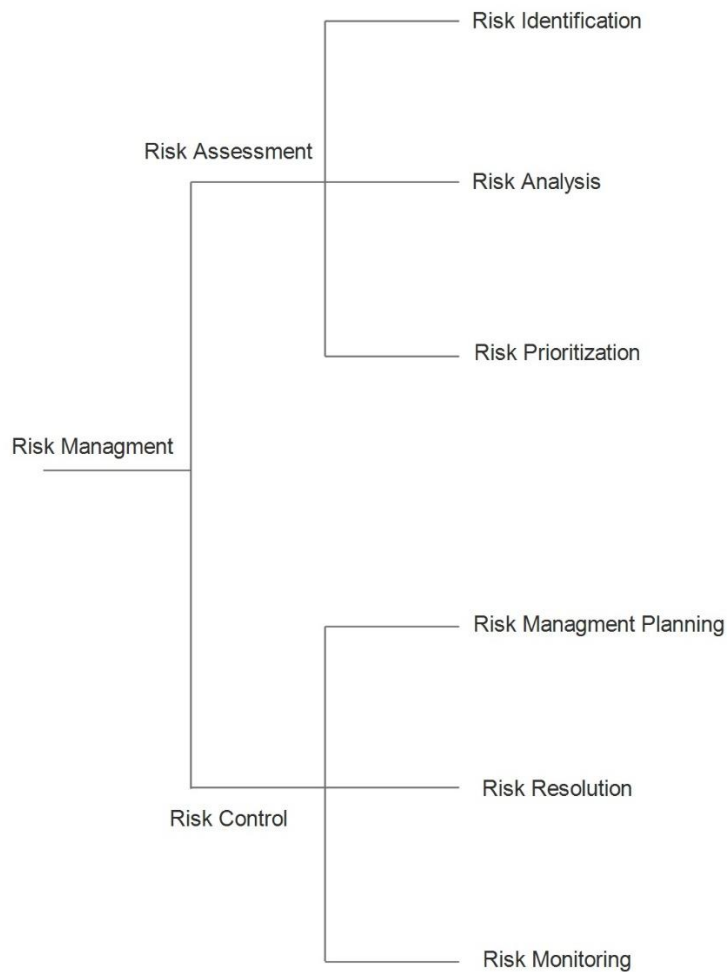


Figure 6.3.1 Boehm's (1991) Risk Management Process

6.3.2 CMMI-Risk Management

Capability Maturity Model Integration (CMMI) was introduced by the Software Engineering Institute (SEI) and is a process improvement approach (CMMI Product Team, 2010). CMMI comprises of 22 information areas, one of which is risk management (CMMI-RSKM). According to Williams (2006), the objectives of the CMMI-RSKM are:

- Make preparation for risk management by discovering risk source, define risk dimensions and create a risk management strategy
- Recognition and Assessment: Identity, assess and prioritize risks
- Mitigation: Prepare plan for risk mitigation and then implementation of the plan.

CMMI-RSKM has a support from risk repository and emphasizes the training of practitioners and instructors. It focuses on the general types of risks but does not consider risks specific to Virtual-Agile software development. CMMI-RSKM focuses on three major perspectives, i.e., project, product and process, but does not seem to deal with risks related to people. CMMI-RSKM also supports risk management communication and risk management evaluation but does not consider potential risks for Virtual-Agile projects.

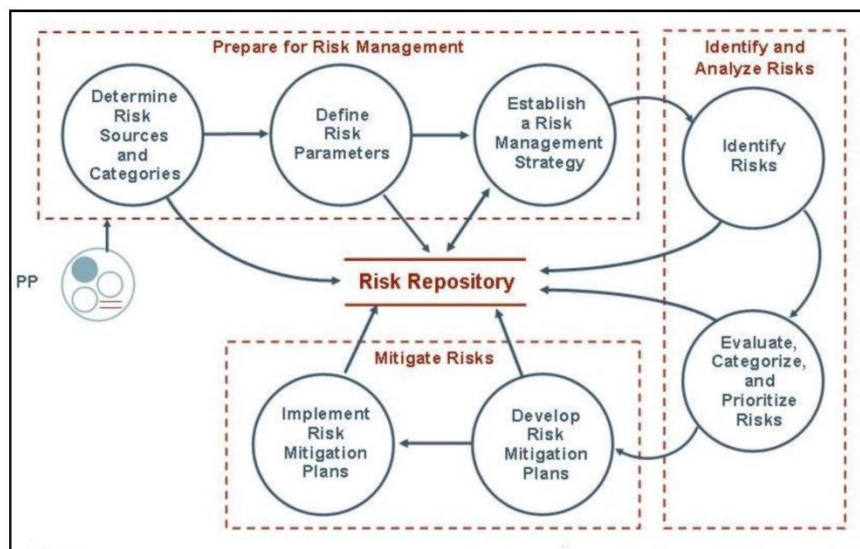


Figure 6.3.2: CMMI-Risk Management Model by Williams (2006)

6.4 Risk Management and Collaboration

Risk management in complex collaborative systems is difficult due to the involvement of multiplicities having diverse intentions and mindsets. Complex systems require increased specialization due to which collaboration becomes crucial as more knowledge is required than any individual possesses. The appropriate information to resolve such complex systems needs to be communicated to key persons and stakeholders involved (Engelbart, 1995). Complex systems necessitate the authorities to bring innovative ideas and share them with key project stakeholders. The need for collaboration between individuals and stakeholders is crucial for accomplishing mutual goals. Podean and Benta (2012, p.115) describes collaboration as

A very dynamic process that combines functionality and supports communication, management and involves content handling.

Collaboration can be referred to numerous concepts of working such as cooperation and communication. Camarinha and Afsarmanesh (2008) recognized collaboration as a process where individuals share knowledge, and jointly plan, implement and work together to attain common project perspectives. The authors (2008) acknowledge that the term 'collaboration' is often mixed with 'cooperation' as most people are not able to differentiate between these. Fuks et al. (2008) proposed a 3C collaboration model consisting of three main stages:

- Communication
- Coordination
- Cooperation.

Communication is regarded as an initial process in the collaborative process. It is an integral part which supports in understanding or developing an agreement on different perspectives between people. Coordination is the management of the resource, activities and people involved in a system. Coordination supports team members to interact and resolve conflicts using effective communication. It also helps to enhance resource utilization efficiency and the aptitude to meet the goals. The third element of the 3C collaboration model is cooperation between people to develop, deploy and organise information, or create and refine cooperation objects such as documents, worksheets etc. Cooperation necessitates a mutual workplace that should be able to provide the relevant tools, control and permission to manage these artefacts. Fuks et al.'s (2008) 3C model is shown in figure 6.4(a).

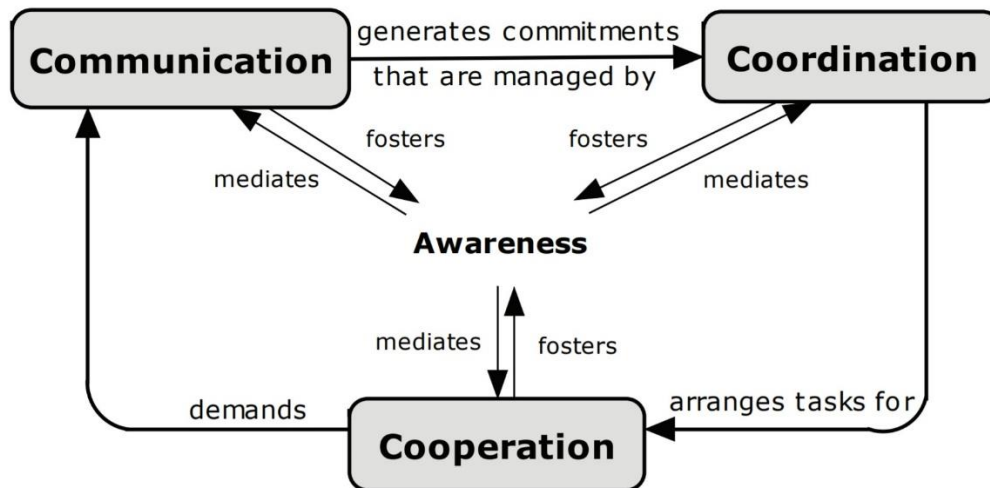


Figure 6.4 (a): 3C Collaboration Model for Groupwork by Fuks et al. (2008)

In accordance with the 3C collaboration model, Podean and Benta (2012) proposed including another component of 'Creativity' as it supports integrated light-weight project and risk management, and flexible content management tools to be implemented. They elaborated that project management is dealing with complexity in a constrained environment whereas project risk management helps to understand, assess and manage uncertainties within a project. The key to successful risk management process is 'proactiveness' which also sources project management procedures. Podean and Benta (2012) proposed that the concept behind the collaboration is creativity. Creativity can be defined as a process of attaining specific goals which are identified distinctly by the shared community. According to Farooq et al. (2005), creativity supports problem-solving and decision-making activities, and helps produce productive results. Assistance for divergent and convergent thinking, the creation of mutual goals and reflexivity are recognised as the main requirements of creativity. Podean and Benta's (2012, p.117) 4C collaboration model is shown in figure 6.4(b).

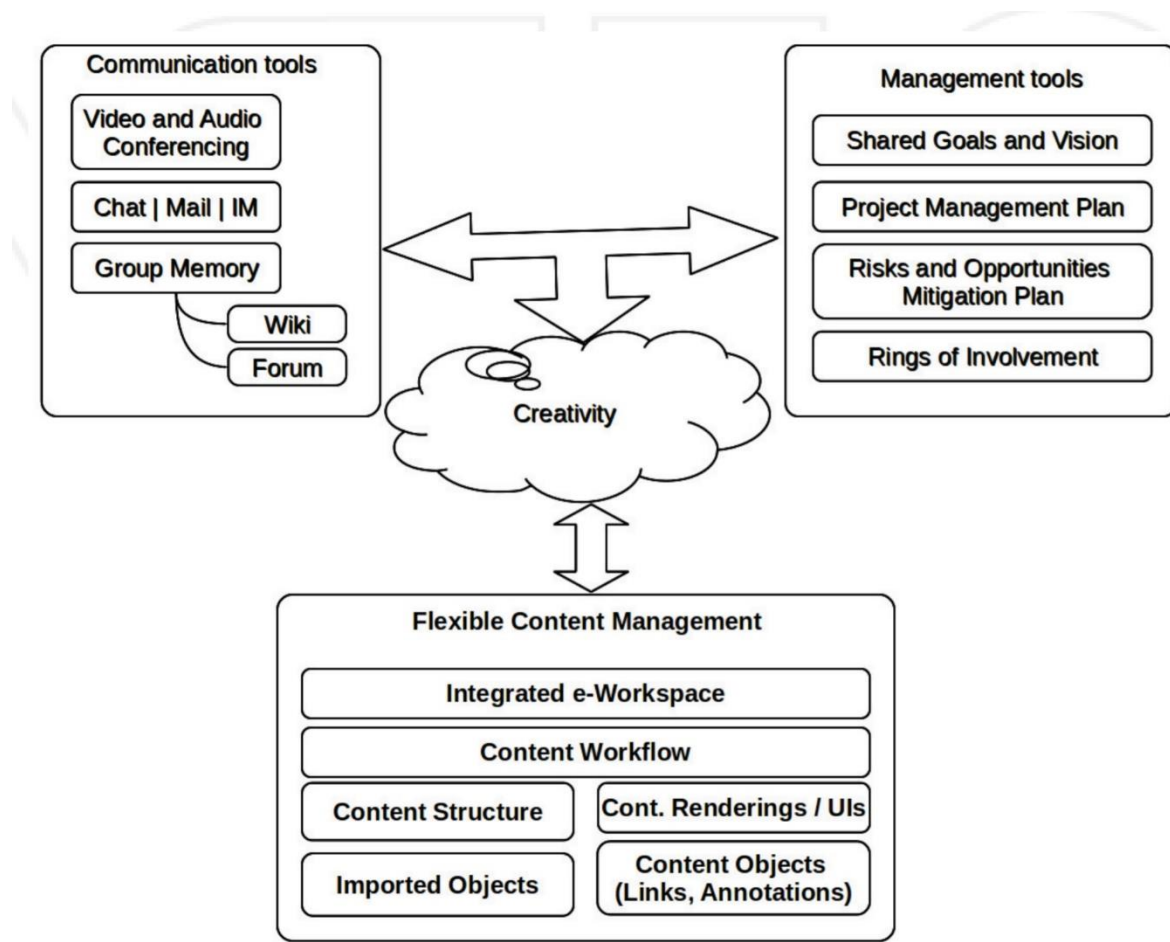


Figure 6.4 (b): 4C Collaboration Model by Podean et al. (2012)

Divergent thinking is the skill to return in response in relation to a challenge or undertaking wide-ranging set of replacements, ideas or viewpoints. On the contrary, convergent thinking is the aptitude to focus down to only one set of replacements and is comparable with agreement building (Podean and Benta, 2012). Podean and Benta (2012) recommend that for a creative flow, understanding of the project objectives is necessary so that it helps all the entities in a system to share a specific knowledge related to the tasks. Similarly, acquiring feedback on tasks and work helps to reflect a shared understanding of the group's objectives. The authors (2012) designate this assumption as a process of reflexivity which is mandatory for creativity to occur. Reflexivity further includes three sub-components:

- Reflection – A sub-process of synthesizing the ideas or viewpoints that would be taken into further account.

- Planning – A sub-process which guides entities to think about their goals and motivates them towards achieving them.
- Adaptation – A sub-process of risk management which encourages group members to adopt changes in accordance with the tasks and objectives. Integrated risk management tools facilitate the recognition, mitigation and define response plan for the uncertainties at a strategic and procedural level to know about the opportunities and threats.

By Adaptation, as one of the sub-components of reflexivity, risk management can be used a strategic tool to respond to the changes in the environment. According to PMI (2013), an efficacious project risk management should comprise of the following factors:

1. Promising attitude and obligation of every individual for ensuring a successful risk management practice
2. A detailed, honest and effective communication. Every team member is supposed to take part in the process and avoid such behaviour that could result in failure of risk management.
3. Risk effort should be scaled to project.
4. Incorporation of project management procedures. Risk management can only be successful when associated with firm project management practices.

Podean and Benta (2012) recommend that the key factor in a successful risk management approach is 'proactiveness'. Project management is a systematic approach to control a complex and uncertain environment whereas risk management helps identifying, assessing and managing uncertainties. Collaboration can be attained by elaborating the understanding of the mutual goals and acquiring knowledge from project management and risks management procedures to enhance the opportunities for reaching project deliverables.

Hilson (2006) also demands an integrated risk management approach which should address strategy and procedures, together with opportunities and threats. The benefits of having such approach are:

- By reduction of the policy and procedures gaps, project deliverables become more prominent with the group's requirements and vision
- Being able to respond to opportunities proactively at both strategic and procedural levels
- Support to decision-makers in resolving uncertain situations
- Reduce time-wastage and enhance productivity and effectiveness by managing uncertainties using the planned responses
- Achieve project objectives by reducing threats and maximising opportunities
- Develop a risk-aware culture which helps realising uncertain situations at all levels and support managing them proactively.

Podean and Benta (2012) further proposed that the elements which hinder collaboration should be properly addressed so that the development of collaboration can be accomplished. To accomplish collaboration, project and risk management processes should be efficient, and this could be attained if project organisations understand the prerequisites and integrate them into the overall strategy.

6.5 Technological Perspective – Diffusion of Innovation

Innovations in technology have led organisations to operate in diverse dimensions. The use of information technology for risk management has facilitated organisations to strategize in order to control disruptions in their business operations. Nowadays, the role of technology in risk management has become vital to provide dynamic solutions and respond proactively to the needs of complex software systems. The need to handle such variations required review of the Diffusion of Innovation Theory. Everett Rogers, who was an American

communication theorist and sociologist, introduced diffusion of innovation theory in 1962. Since its inception, the theory has been published in five different editions. In the most recent edition of diffusion of innovation theory, Rogers (2003) defines diffusion as the process by which innovation is communicated through specific channels over time among the personnel of a social system. Such communication has a special purpose and is meant to develop new ideas. Rogers (2003, p.21) defines communication as

A process in which participants create and share information with one another in order to reach a mutual understanding.

Rogers and Kincaid (1981) designated communication as a two-way process of convergence, a linear act in which one individual contact another individual to attain certain effects. Diffusion is a special communication where distinct notions are transferred. Rogers (2003) acknowledged that diffusion involves a great level of uncertainty. Uncertainty can be regarded as an event in which several substitutions are supposed with respect to the existence of an action/interaction and the relative likelihood of these substitutions. Rogers (2003) proposed that to overcome this lack of predictability, exchange of information can be the core of reducing uncertainties.

The theory of diffusion of innovation analyses that how the social members conceive distinct ideas and how they make a verdict towards it. Rogers (2003) proposed four main elements of diffusion of innovation theory, as follows.

Innovations – An innovation is an idea, practice or object that is perceived as new by an individual. The professed distinction of the new idea determines an individual's reaction to it. If the idea appears to be novel to the individual, it is an innovation. Innovation can be expressed in terms of knowledge, persuasion and decision to adopt it. Rogers (2003) elaborates a link between technological innovation and uncertainty by mentioning that utilization of technological innovation may create uncertainties for the potential adopters

about its consequences. The need for learning new ideas emphasize individuals to learn about the innovations. Such information-seeking activities help reduce uncertainty level for individuals and a decision can be made for adoption or rejection of a new technological innovation. Thus, Rogers (2003, p.28) elaborates this decision-making process as

The innovation-decision process is essentially an information-seeking and information-processing activity in which an individual is motivated to reduce uncertainty about the advantages and disadvantages of the innovation.

Communication Channel – A communication channel is regarded as the means through which information is transferred from one individual to another. Rogers (2003) elaborates that the relationship between individuals helps to choose a particular channel for innovation transfer. Media mass channels are commonly meant for transmitting messages through radio, television, newspapers etc., which enable one or a few individuals to reach an audience of many. Similarly, interpersonal communication channels play a significant role in transmitting innovation between two or more individuals. Rogers (2003) also advocated that due to the advancements in ICTs, interactive communication through the internet has become significant for the diffusion of certain innovations in recent decades. Therefore, diffusion is a social process that requires interpersonal communication relationships.

Time – The third component in the diffusion process is time. Commonly, in behavioural sciences, the factor of time is ignored as people do not consider it as very significant. Rogers (2003) proposed that it takes time to become adapted to the new innovations in a system. Similarly, it takes time for people to get used to new ideas, for example when mobile phones were introduced into the market, it took a certain time for them to become common among people and consequently, it took time for people to get used to them.

Social System – A social system is referred to a set of interconnected units who are engaged in shared problem-solving activity to achieve a mutual goal. Rogers (2003) acknowledges units as the members of the social systems such as individuals, organisations,

groups or subsystems. All the units coordinate to reach the shared solution and this mutual work creates a formation within the system. As diffusion occurs in a social system, several aspects can affect the diffusion of innovations such as the effect of customs on diffusions, the role of leaders or change agents, type of innovation-decisions and the consequences of the innovation. Rogers (2003) further suggests that within a social system there can be three ways in which innovation-decisions are undertaken, as follows.

- ***Optional Innovation decisions***

These decisions link specifically to individuals in which they decide to adopt or reject an innovation. The decisions can be influenced by an individual's norms and interpersonal networks.

- ***Collection Innovation decisions***

Such decisions to adopt or reject are collectively made by the members involved in a system. Once the decisions have been undertaken, the units in the system should comply with them.

- ***Authority Innovation decisions***

Authoritative decisions to adopt or reject the innovations are made by individuals who have the status of power or authority, or are recognised as experts. The individuals have much less or almost no influence in the decision-making process and they should be enforced to undertake the decision once it has been made.

Consequently, Rogers (2003) concluded the mechanism of diffusion of innovation under the following five stages:

- ***Knowledge*** – Due to lack of knowledge or information about the innovation, an individual might not show any interest towards adapting it.
- ***Persuasion*** – The interest of the individual persuades them to get information about the innovation and knowledge.

- **Decision** – In this stage, an individual, based on information and knowledge, decides whether to accept or reject the innovation.
- **Implementation** – The stage where an individual shows some determination about the innovation and comes to know about its benefits and usefulness for the future.
- **Confirmation** – The final stage where an individual decides to conform to their decision and continues to use innovation with full potential.

6.6 Responsiveness in Virtual-Agile Projects – A Critical Evaluation

The concept of Responsiveness evolves from proactiveness and is assumed as a web/network among project entities and stakeholders, who are being conscious and receptive towards developing coordination and collaboration, further supporting risk management procedures. Responsiveness is about how proactively a synchronised system is formed and its readiness is ensured to meet the dynamic challenges. Without having a system in place, organisations cannot reduce and control risk factors in Virtual-Agile projects. Consequently, by looking at numerous aspects of Responsiveness, risks can be avoided or controlled, and software project environments could be harmonised. When dealing with Virtual-Agile IT projects, project teams, sponsors, and clients are based at different geographical locations or operating remotely, where they are unable to interact physically. Risk management in Virtual-Agile projects is not dependent on only traditional methodologies or techniques but the findings suggest that there are several other components which need to be considered and thus have emerged as the critical characteristics for overcoming risks and uncertainties.

6.6.1 Demonstration of Conceptual Framework

The paradigm of 'Responsiveness' has been shown in figure 6.6.1, which tends to reduce risks and uncertainties in Virtual-Agile IT projects. The results of this study are pertinent to the stakeholders who are in decision-making and planning positions, such as organisational

leadership, project managers, senior-level directors and team leaders. In software development projects, several technical issues are expected to occur, but these technical issues and challenges could better be managed if the entities are mindful, knowledgeable and responsive about the situations or proceedings taking place. Such technical issues can be related to coding issues, such as failures in source code for a mobile application, and then looking for solutions to fix it; the requirement of the coding languages such as C++, Visual Studio or Java for development; or the technical issues can be related to integration of two sprints or the failures of software while testing an application after a sprint retrospective. These issues are associated with technical aspects and arise due to the variations in project scope and requirements. The responsible entities such as Scrum Master and Technical team leaders can better grip the situations and suggest solutions by being responsive to such circumstances. Moreover, as this study falls under the subject area of project management, all those factors and practices have discovered which help IT organisations to achieve success and minimise failures. The conceptual model can be seen in figure 6.6.1.

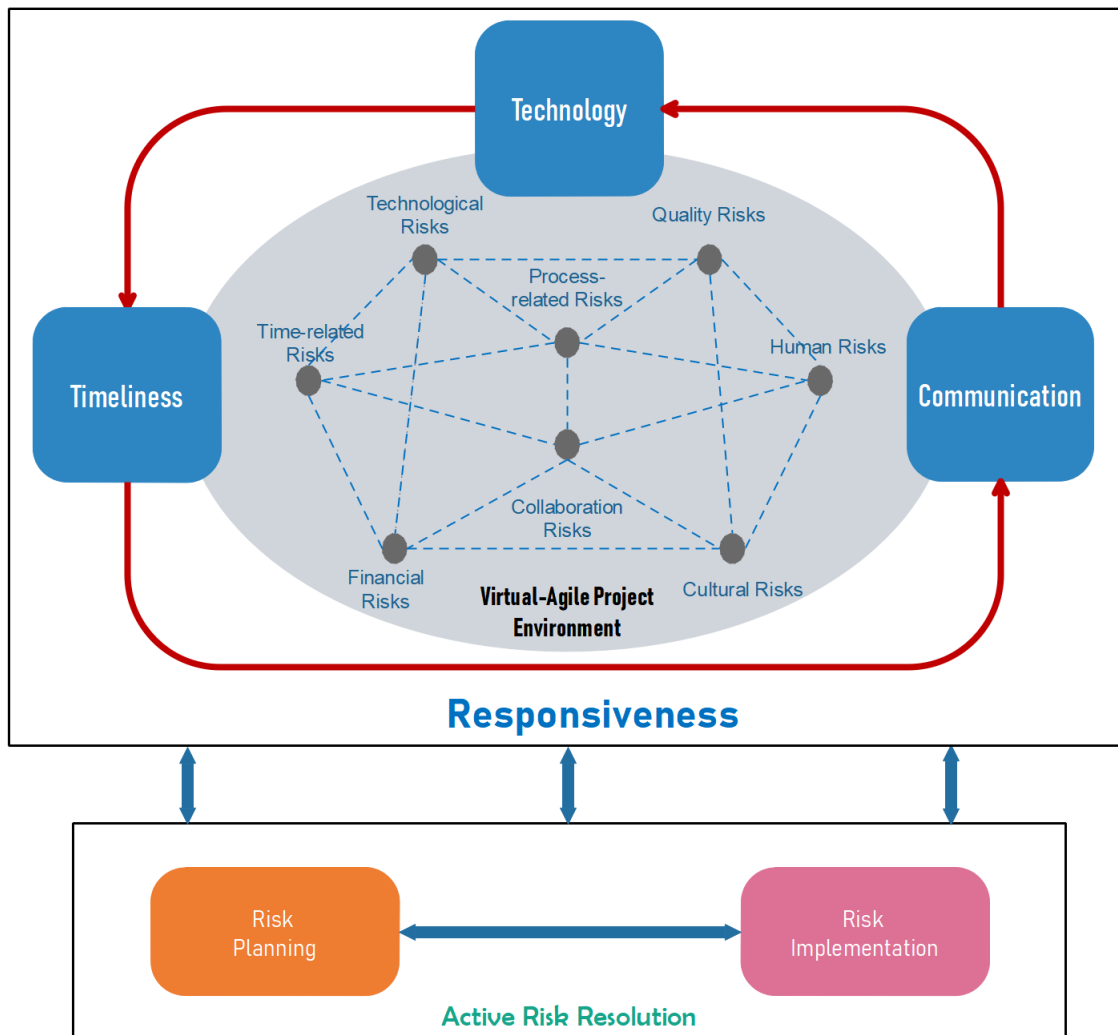


Figure 6.6.1: The Paradigm of Responsiveness

Explanation

The figure above depicts the paradigm of Responsiveness depending upon three major interdependent characteristics of technology, timeliness and communication. A Virtual-Agile Project environment highlighted in the 'grey' area shows presence of various type of risk factors based on table 5.5. These various risk factors affect the project environments globally and disrupt project processes at various locations. Responsiveness which is developed through efficient management of three interdependent components (technology, timeliness and communication) help overcoming evolving uncertainties because of the presence of risk factors (from table 5.5). It has been shown in the model that Responsiveness further supports undertaking formal Risk Resolution strategies in which the

risk planning is performed and then response strategies are designed and implemented. Responsiveness which develops proactiveness in the system help understanding the consequences and circumstances from the presence of diverse risks. The model further elaborates that in Virtual-Agile IT project environments, these risk factors deviate the expected outcome of the project. The developed uncertainties then can be overcome by effectively managing technology, timeliness and communications. Responsiveness helps the distributed team members and stakeholders to collaborate and make efforts to further apply proper risk management planning and design response strategies which can be reviewed and monitored time to time.

In the context of virtual software development projects, a proactive system under Responsiveness is required for responding to dynamic uncertainties and building a robust system. The concept of proactiveness has been discussed in the context of risk management by several authors such as Podean and Benta (2012), Dhlamini et al. (2009) etc in literature, but here the author proposes for a proactiveness system for controlling evolving uncertainties in project environments globally. Proactiveness helps to realise and estimate the forthcoming uncertainties and design an effective risk management process. There are mainly setting differences between two concepts, i.e. in literature proactiveness refers to risk management process only whereas proactiveness as per this research study is a supportive measure to Responsiveness for managing manage uncertainties in overall project environments globally. The reason why proactiveness is associated with Responsiveness is it's support to perceive, reflect and adapt according to the settings of the project environment.

The reasons why Responsiveness is required for such social systems are mainly the constraints of time, cost, quality and alterations in scope, which have also been acknowledged by traditional bodies of knowledge such as APM, PRINCE2, PMBOK etc. As sprints/iterations in Virtual-Agile projects are for a short duration, a proactive system can

facilitate meeting targets and reduce dynamic risks in a project environment. When the projects are initiated, uncertainty is at its peak level. Specifically, in the context of Virtual-Agile project environments (as discussed in Chapter 1), risks become more prominent and are expected to disrupt the project activities vigorously. As risks can be the causes of uncertain events (PMBOK, 2004; 2013), the model shows that Responsiveness is how the distributed entities actually develop an efficient coordination and collaboration and make themselves ready for the future challenges. Taking Miller (1987) conception into consideration (section 2.3) where uncertainties are the causes of individuals' inability to be able to predict and discriminate between irrelevant and relevant data, the researcher deduces that such uncertainties can be reduced when a robust system is in place to distinguish the dynamics of the working environment. The higher the Responsiveness and robustness, the better will be the chances to deal with uncertainties and control risk factors in the project environment.

Responsiveness is not only linked with commissioning vigorous actions for building a system, but it also emphasizes the personal development of every individual working in the projects. Responsiveness is about how the entities involved ensure frequently to be ready for undertaking the projects, the level of personal competency and the level of correlation with stakeholders for coping new challenges. Similarly, it is about how to commence an efficient knowledge transfer process, the need to know about leaders' obligations and the required technical resources; the significance of having a strong integration, and then depending upon such integration to accomplish shared goals. Responsiveness is about how to proactively correspond, plan and schedule, and how to adapt according to the project settings. Until and unless there is a system in place which can work efficiently, the uncertainties and ambiguities cannot be reduced. Hence, the development of Responsiveness is an uncertainty reduction stage where the entities involved in such project

environments come to know about their roles and responsibilities, project rules and the type of involvement and capacity required for a specific project.

Active Risk Resolution is an iterative phase where the entities are in contact back and forth for undertaking risk management measures. If an efficient system is in place using Responsiveness, the better will be the capacity of the system to do risk management planning, and then respond to risk events during the implementation phase. Active risk resolution is about how well the entities use technical resources to get in contact, how effectively they correspond using the parameters of timeliness, and adapt to project settings; and how well the entities communicate to make the decision-making process more efficient. If the entities have the knowledge, correlation, leadership and stakeholder involvement, competency and team satisfaction among themselves, they would be in a better situation to estimate, assess and plan strategies to cope with future risks. Similarly, in case of any unusual activity, the entities can get in contact depending upon the efficient use of technology, timeliness and communication to respond proactively to the risk events. The data suggest the diverse practices of risk management tools and techniques (as per table 6.6.6) where the entities can follow various risk management standards depending on their competency and understanding. The utilization of each method may also depend upon awareness and familiarisation with the knowledge sources. Usually, the risk management in Virtual-Agile projects is completed under two main stages:

1. Planning Phase
2. Implementation Phase.

Risk management planning is performed at various stages of the project, where the team members and stakeholders estimate, assess, plan responses and keep a record of the identified risks. When the project initiates, and occurrence of any risk happens, 'Responsiveness' forces the teams or the stakeholders to get in contact and use the

feedback of the risk management planning phase to analyse the potential risks factors in terms of their influence on the project activities. At this point, team members or stakeholders are in the implementation phase, where consultation is made before acting in an uncertain situation. Assistance is also taken from risk records which include actions/responses that have been made during the risk management planning phase. The assistance is undertaken only for those risks which have been identified with a suitable mitigation response. If any unexpected or surprising risk occurs, Responsiveness helps to analyse the situation and decide upon a strategy that can be applied to cope with a risk event. Further, the implementation phase supports reviewing the actions and results after the submission of a mitigation strategy. Thus, it can be concluded that Active Risk Resolution in Virtual-Agile project environments is heavily dependent upon Responsiveness, which helps to undertake effective risk management measures.

6.6.2 Stipulation of Responsiveness for Virtual-Agile Projects

In his book of managing organisational responsiveness, Jacobs (2003, p.98) defines 'responsiveness' as,

- 1) A process quality experienced by stakeholders in encounters 'with the organization'.
- 2) A socially constructed attribute of an organisation – enacted and reproduced by the stakeholders of an organisation.

Further adding to the argument, Jacobs (2003, p.98) refers responsiveness to:

- Perceptivity, which is an *"ability to identify issues raised by stakeholders"*
- Reflectivity, which is an *"ability to understand and make sense of the issues"*
- Adaptability, which is an *"ability to respond to the issues accordingly"*

Jacob's (2003) perception of responsiveness tends towards building up strong conversational environments in order to meet stakeholder satisfaction. He further acknowledged that

reflective conversations can help enhancing responsiveness and productivity to estimate stakeholder demands. The concept of Responsiveness from this study is quite different to the concept of Jacobs (2003). Although, the responsiveness in terms for this research work on the similar dimensions as of perceptivity, reflectivity and adaptability. Researcher's definition of responsiveness is more about creating awareness and consciousness about the proactive utilization of technology, adhering timeliness and building up communication in order to reduce risks and uncertainties. The researcher focuses more on the proactive element rather waiting for the problems or complication to be occurred. Proactivity according to results of this study is an apprehension to control and avoid dynamic complexities in Virtual-Agile projects by developing a robust system. Similarly, there are contextual differences between the Jacob's (2003) Responsiveness and the paradigm evolved from this study. The differences occur mainly in terms of format i.e. collocation vs virtual. Consequently, the focus of Jacob's responsiveness is to improve quality of conversations in organisations whereas researcher's focus is to synchronise overall project environments and operations during product development.

Referring to the perspective of risk management, it can be deduced that managing risks not only depends upon the application of tools and methods but also requires several factors such as maintaining strong collaboration and communication, managing diverse aspects of a virtual system, building team formation and trust among them etc. The basic definition of risk by PMBOK (2004) which recognises risk as an uncertain event, Miller and Lessard (2001) further suggest that such uncertainties can arise due to weak management procedures or an organisation's internal and external factors. Correspondingly, Barber (2005) designates risks as the factors inherent in the nature of the project work and recommends that they do not arise from the policies, structures, rules, actions, behaviours etc. Similarly, Chapman (2006) suggests uncertainty can be the reason for lack of knowledge or information, or due to lack of predictability about future events.

As Agile methodology is a team-based approach (Lalsing et al., 2012), the data sources also identify that risks and challenges in Virtual-Agile project environments are the consequences of lack of efficient management, which lead to project failures and disasters. Especially, in the context of distributed software development projects which are based on Agile Scrum, XP etc, there is a need to ensure a robust infrastructure or system in place which could deal with the evolving complexities. The data sources also suggest that application of risk management tools and techniques is also being practiced in the industry to a certain extent; this contradicts the viewpoint of Agile only being dependent upon high interaction and collaboration between entities (Cockburn and Highsmith, 2001). Accordingly, some of the participants emphasize the need for application of risk management tools and methods. As depicted from the research problem, Agile in a virtual format brings many uncertainties and challenges for organisations; therefore, in order to reduce such uncertainties and perform better risk management, the researcher assumes that the perception of having 'Responsiveness' can support overcoming uncertain situations under the following two propositions:

- 1) Developing an effective 'collaboration' to support better decision-making, which helps to enhance project performance, thus reducing the uncertainties.
- 2) Introducing risk management practices at every level and involve entities to ensure effectiveness of the process.

From the viewpoint of Fuks et al. (2008) and Podean and Benta (2012), it can be analysed that traditional models available do not completely address the emerging challenges in organisations. For example, the 3C model by Fuks et al. (2008) focuses on sustaining communication, coordination and cooperation for collaboration, whereas the 4C model by Podean and Benta (2012) emphasizes on 'creativity' for effective collaboration. In accordance with the researcher's findings, Podean and Benta's (2012) 4C collaboration model is found more appropriate for the discussion aspect. Fuks et al.'s (2008) 3C model

helps to understand the collaboration but does not emphasize the aspects of utilization of 'technology' and 'timeliness' in particular for the context of Virtual-Agile projects. Similarly, Podean and Benta's (2012) 4C collaboration model focuses on 'creativity', whereas the researcher claims that 'Responsiveness' helps develop collaboration and respond to uncertainties more proactively rather than being only creative. Creativity is also a desired component of the project environments but depending upon it fully doesn't support ensuring a strong collaboration; though several other concerned components have been proposed by Podean and Benta (2012) in Section 6.4. According to Oxford Dictionaries (2017), 'creativity' is *"The use of imagination or original ideas to create something"* whereas the same dictionary recognises 'responsiveness' as *"The quality of reacting quickly and positively"*. Cambridge Dictionaries (2017) defines 'creativity' as *"The ability to produce original and unusual ideas, or to make something new or imaginative"* and 'responsiveness' as *"Used for talking about how quickly and well a person or organisation reacts to something"*. Also, Dictionary.com (2017) recognises 'creativity' as *"The ability to transcend traditional ideas, rules, patterns, relations, or the like, and to create meaning new ideas, forms, methods, interpretations, etc"* whereas it identifies 'responsiveness' as *"The ability of machine or system to adjust quickly to suddenly altered external conditions, as of speed, load, or temperature, and to resume stable operation without undue delay"*.

Considering the propositions of all the three schools of the dictionaries, the researcher believes that 'Responsiveness' has is an appropriate term for the representation of the overall phenomenon for synchronising project environments Responsiveness is derived from 'proactiveness', which according to Oxford Dictionaries (2017) means *"Creating or controlling a situation rather than just responding to it after it has happened"*. As findings suggest that Virtual-Agile projects specifically relate to the software development industry, several authors such as Yong et al. (2006), Bannerman (2008) and Islam (2009) have acknowledged that failure in software development projects is due to weak management

practices, lack of knowledge and ineffective managerial approach. Similarly, specific to the context of Virtual-Agile projects, Lee and Baby (2013), Vijayaraghavan et al. (2014) and Shrivastava and Rathod (2015; 2017) advocate that the presence of risks in such projects is because the interdependent dispersed teams are unable to undertake their jobs properly and they are less uncertain about the proceedings of the environment; this ultimately increases the competitive pressure upon them and affects the overall project environment.

As such environments are following Agile principles, the work is split down into 'sprints' or 'iterations' which require dynamic involvement from every stakeholder of the project. The researcher can, therefore, propose that 'Responsiveness' can support the involved entities to work in a proactive fashion for successful completion of the sprints. Being virtually dispersed across different territories and locations, 'Responsiveness' can help develop an awareness of or attitude to performing the functions in their respective project environments. According to Schwabe (2010), virtual teams require competitiveness and responsiveness to work effectively in the project environment round the clock. Responsiveness requires following three interrelated components:

- Technology
- Timeliness
- Communication.

6.6.3 Utilization of Technology

As the entire basis of Virtual-Agile projects relies on technical resources which serve as the basis of integration and networking between the dispersed stakeholders, the researcher claims that effective utilization of technology is an initial step when undertaking distributed development. The technology comprises of two major sub-components, i.e. standardization of tools and networking. Lee and Baby (2013) have acknowledged that efficient technical resources have an imperative role in developing an effective coordination and collaboration

between global IT project teams. The organisation should be able to standardise the tools for development and conferencing between the interdependent teams. In accordance, Reed and Knight (2010) propose that the use of communication tools should be acknowledged in virtual projects because it helps create high efficiency and reduces ambiguities within the team members for communication. In terms of standardization, following tools should be acknowledged by project organisations for contact and communication.

Use of Synchronous and Asynchronous Conferencing Tools

Findings suggest that the entities in the Virtual-Agile project environments utilize social media platforms such as Microsoft Skype for business, Zoom, Google Hangouts, Facebook for video conferencing, phone calls in general, emails, instant messaging and chat services for making contact with each other.

Similarly, the use of some other mediums has also been endorsed by the respondents in section 5.1.1. Korkala and Abrahamsson (2007) acknowledge that communication medium in distributed Agile developments can be categorised into two main types:

- i. Synchronous* – Runs over real-time and includes video conferencing, phone calls, instant messaging services etc.
- ii. Asynchronous* – Runs irrespective of the real time and includes email as the main application tool.

The respondents mainly rely on the synchronous types of tools such as Microsoft Skype, Google Hangouts, Facebook, Zoom, phone calls and instant messaging services. Likewise, in section 5.1.1, a few participants acknowledged the use of an asynchronous type of communication such as email within the project environments. Green et al. (2010) further considering the use of synchronous and asynchronous communication, determined that synchronous and asynchronous means facilitate Agile development projects under the following four phases:

- **Phase I:** Release Planning – Includes the product planning, requirement descriptions, and stores the data in the form of User Stories
- **Phase II:** Iterations/Sprint Planning – Prioritization of tasks and analysis of User Stories
- **Phase III:** Scrum – Software Design and code, Integration and Test
- **Phase IV:** Product Release and Retrospectives – Document Preparation, Software release planning and demonstrations of the product.

Korkala and Abrahamsson (2007) argue that due to the lack of physical interaction, deciding and choosing the right tools is crucial to productivity. They further proposed that relying upon the asynchronous type increases chances of failures within a project. Schwabe (2010) further commended this viewpoint and suggested that the use of emails in IT projects may not be appropriate for building consensus, evaluating commitment and understanding the content of the specified work. Specifically, from the customer point of view, if the customer does not prefer to communicate actively, the use of any communication type becomes redundant.

Lee and Baby (2013) further attributed the use of updated versions for faster and more reliable communication. Some of the tools which have not been identified from the data are Cisco WebEx Connect IM (instant messaging), Web 2.0 applications like Google Docs and wiki platforms for synchronous and asynchronous communication. Schwabe (2010) recommended the use of Microsoft SharePoint Portals, Google Docs, and wikis for IT projects and suggested that a project manager should not waste their time on using unclear and poor electronic communication means. The reasons the above tools were not identified from the data might be the unavailability and inaccessibility of such tools to all the project stakeholders or to the trends of the particular regions. The tools highlighted such as Microsoft Skype, Google Hangouts, Zoom, Facebook, emails and other instant chat services are easily available in the market and can be downloaded free of cost. Similarly, the reliance

on emails for formal communication can be undertaken where the teams can send notes, documents or attachments. It can be therefore deduced that for the documentation purpose asynchronous type tools such as emails can bring benefits in Virtual-Agile project environments but for active participation, synchronous type tools should be utilized proactively to reduce ambiguities related to project work, enhancing understanding and affiliations between the development teams and client.

Innovative Development Tools

Fowler and Highsmith (2001) demanded the use of effective tools for undertaking development in Agile. The tools which have been emerged from the data sources are Jira, Rally, Innotas, Clarity and some others. The purpose of all these tools is to undertake development using different programming languages and complete software development effectively. One other factor which has been found common in the data and literature is that use of these tools depends upon the project requirements and organisational structure. The arguments of the respondents can be further seen in section 5.1.1.

Lee and Baby (2013) argued that variation of software tools within Virtual-Agile project environments can bring several challenges to the projects. For example, experienced programmers might not prefer to utilize the latest tools and may resist using them. This brings variation and differences in the level of proficiencies between the individuals. Therefore, this can increase the uncertainty and therefore must be avoided. Korkala and Abrahamsson (2007) further proposed that the project manager should be able to globally track the tools which are used for development. He should specify a criterion and guidelines where the specifications and efficiency of one tool can be acknowledged by all the locations. Consequently, Korkala and Abrahamsson (2007) suggested that standardised tools in Agile development help in various phases, i.e. integration of two source codes, pair programming based on XP and launching various versions of an application. Therefore, an agreement

should exist in the distributed project environment for utilization of the type of tools so that it may not hinder the productivity and integration of sprints.

Encouraging Digital Project/Risk Management Tools

Due to the development of ICTs, digital project management tools have been extensively applied by the software industry. For managing projects effectively, a number of project and risk management tools are available in the market. The organization can select the tools based on their requirements and the consensus of the stakeholders. The point here is to equip the latest strengths within the Virtual-Agile environments so that dispersed people can be involved in the process from anywhere around the world. Some of the important project management tools which have emerged from the data are Microsoft SharePoint project management, enterprise risk management software such as Magique and some customised developed tools.

Schwabe (2010) has advocated the use of SharePoint project management tools as they help the dispersed teams to share their work and information and then help to monitor and control the progress of the tasks. Similarly, other respondents in section 5.1.1 have acknowledged the use of some other types of tools which help organisations to achieve project milestones. The reason why the organisations have preferred to use such kinds of tools are mainly the constraints where they have to meet multiple deadlines for delivering the product. The use of such tools helps to keep a track record of the critical points and updates all the locations with relevant alarms so that the teams or individuals can complete their jobs in time, thus reducing the risk of late delivery. The application of enterprise risk management tools is not specifically found in the literature of distributed Agile development (Shrivastava and Rathod, 2014; Lee and Baby, 2013; Vijayaraghavan et al., 2014) but here the researcher suggest that use of such tools can certainly help to undertake formalised project and risk management practices in Virtual-Agile project environments.

Determining Right Communication Channels

In accordance with the dynamic project environments, the use of right communication channels is imperative to support the frequent flow of information. The data suggest that estimating proper communication channels are crucial to sustain a strong network within Virtual-Agile project environments. As the project stakeholders could not interact physically, it becomes then difficult to contact them through multiple channels. They are less certain about the actual means of communication and this causes disruption to the flow of information. The data suggest that deciding upon the right communication channels helps more effective discussion. The channels should be decided mutually between the team members and clients so that the flow of information could be eased. The relevant quotations of the respondents can be seen in section 5.1.2 where they have emphasized learning the use of the right communication channel to reduce ambiguities. Rogers (2003) further acknowledged the use of effective communication channel in his theory of diffusion of innovation while transferring the information from one end to another. Effective and uninterrupted communication channels support the knowledge transfer process more efficiently using telephone calls or the internet medium. Rogers (2003) further elaborates that the relationship between individuals helps to choose a particular channel for an innovation transfer. Vijayaraghavan et al. (2014) also acknowledged in large off-shore and outsourced Agile development that use of a standardised communication channel helps to main strong collaboration between teams. Further, the teams and customer communication should occur using defined channels as it affects knowledge sharing and the trust building process.

Requirement of Higher Bandwidth Connectivity

Due to the required innovation, the data indicates that slower connectivity at customer and teams ends can hinder the process of communication; so, therefore, for sustaining

integration between the teams, the organisation should bring all their resources into consideration and invest in technological infrastructure.

The dependability of the teams on higher internet speed for conferencing and sharing files and the need to ensure quick and reliable connection at all the distributed locations have become necessary for these organisations. Herbsleb and Mockus (2003) further acknowledged that the speed and reliability of the network are necessary for remote working. Correspondingly, Schwabe (2010) suggested that for using project management tools like SharePoint, Google Docs and wikis, the availability of speedy and reliable connection reduces time and frustration between the virtual team members in global IT projects. Due to the advancements in the current era, this issue has been met to a great extent with the availability of high bandwidth connectivity, but the respondents have raised concerns that when sometimes the teams are from a backward location where fast bandwidth is not available, this creates many problems and hinders project activities.

Availability of Backup Sources

The data also indicates that nowadays due to the availability of wireless dongles and tethering devices, individuals have backup sources to connect with their distributed team members. If their primary source such as internet broadband or WAN (Wide Area Network) gets disrupted, they can utilize their personal mobile devices to stay connected.

Being responsive to uncertainties, the participants in section 5.1.2 have acknowledged the use of such personal devices for undertaking video calling or when using IP based (Internet Protocol) calls or sharing files over the internet. They also prefer to utilize them immediately when interruptions occur during meeting sessions. The availability of such backup sources with a quick response helps to control delays where the teams remain connected to each other at various locations. One of the other aspect in terms of availability of backup sources is the availability of repository or database where the teams can share, upload or store their

files after completion of their work. These repositories or databases helps a lot to reduce the risk of losing data.

According to Odzaly et al. (2014), repositories in Agile development is a directory where different file versions, changes in sources codes and risk records are stored. They further acknowledged that repository helps to keep records of the major decisions or planning undertaken during product development. Shrivastava and Date (2010) argued that repository also stores the records of meetings, emails, online discussions and proposals of changes from the clients/customer. It is a sort of database which facilitate every project stakeholder and help proceedings with their responsibilities. Further, the use of repositories helps distributed team members in knowledge sharing process where they can get access to any type of file when required. Hence, the availability and then utilization of backup sources such as portable internet devices, repositories, online database etc play a vital role in creating a strong integration and communication between distributed team members.

6.6.4 Expediency of Timeliness

As Virtual-Agile project environments have primarily the problems of time shifts, 'Timeliness' can reduce such ambiguities and help achieve desired outputs. According to (Ale Ebrahim et al., 2011), the implications of time shifts in virtual projects create new challenges for the organisations. On one side, project leaders have to follow timelines to fulfil commitments and on the other they chase people to get the work done. In accordance with the Virtual-Agile projects, Verner et al. (2014) argued that agile methods bring new challenges when tasks are distributed between entities in different time zones. The need to manage then requires efficiency and clear approach. Cho (2008) further acknowledged that when the sprint backlog is created from main product backlog, team members try to split the tasks as small as possible, so each task could be completed within three days' time. Time management is therefore crucial to achieve productivity and deadlines in Virtual-Agile

project environments. The researcher claims on the bases on data that if the project managers could be able to manage the aspects under timely correspondence, scheduling and planning and adaptation to the project environment; they would be in a better situation to manage the dynamics around time in Virtual-Agile projects. The factor of timeliness can be particularly referred to sorting out the project and individual activities in relation to the time.

Accessibility to Project Stakeholders

It has been inferred from the data that accessibility to especially individuals based in other time zones, customers and concerned project stakeholders is a wide-ranging issue which needs attention. The findings also suggest per section 5.2.1 that inaccessibility can lead to sprint failures and create future uncertainties in the overall project.

Reed and Knight (2010) have acknowledged that time difference is big challenge and leads to several risks in virtual projects such as delay in response, inability to meet deadlines etc. Lee and Baby (2013) suggest that a solution to get accessibility to various stakeholders is to utilize asynchronous means of tools. If not accessible, a message or email can be left with a request to deal with the urgency. Consequently, Lee and Baby (2013) have also proposed to have a resource directory available with all the stakeholders so that in case the primary individual is not available, a second-in-command can be contacted to get help with an uncertain situation. As Agile may include several alterations, the need to correspond with the clients in a timely manner becomes necessary in order to meet the deadlines. The researcher after the review of the literature proposes that the factor of Accessibility has not been highlighted so prominently in the literature; though literature discusses about accessibility to other sites', error handling procedures, documentation and tools in order to proceed with the work in virtual-agile project environments (Hossain et al., 2009). Accessibility, therefore to all the project stakeholders is one of the crucial factors to complete project work in a timely manner.

Promptness in Response

The required level of promptness and reaction in terms of responding is another factor which contributes in timeliness. The data suggest that a proactive response to all the blockers helps to resolve issues early. Lee et al. (2006) have also suggested for quick and prompt response to sensing the uncertainties and challenges in Agile project management. Consequently, participants have highlighted the need to respond to queries and problems on a prompt basis rather than leaving them until the last moment. They further highlighted that the entities in the Virtual-Agile projects are sometimes lazy to respond to their emails and queries which delays work and affect sprint deadlines.

Several authors like Smite and Borzovs (2008), Verner et al. (2013) and Shrivastava and Rathod (2017) have advocated for promptness and rapidness for performing activities and raising issues in order to complete the sprints targets. Consequently, they have argued that correspondence between stakeholders is crucial due to differences in time zones and lack of physical interaction. As project management is all about managing project tasks and working under the constraints of time, scope, cost and quality (PMBOK, 2004), timely correspondence gives a cushion and support to folks in time who get exhausted working on other projects.

Self-Organising Tasks

The data suggests from section 5.2.2 that as the team members are busy on other project assignments, therefore, it becomes difficult for them to complete their work on time. As Agile is a self-organised and team-based approach, Vijayaraghavan et al. (2014) proposed that Agile methodology produces the best results whenever it has a flat organisational structure. In organisations, a flat structure is referred to one where there are very few or no management levels between management and employees. As the role of the person may vary according to the needs of projects, they need to be self-organised. The viewpoint of flat organisational structure has not emerged from the data, but the researcher believes that

this can also be the cause where responsibilities become overlap. Rogers (2003) has further supported this argument by mentioning that when new to the innovations in a social system, it takes time for the people or individuals to get used to them. Virtual-Agile project environments can also be referred to a social system where people and organisations from different groups, regions, races, religions etc are networked through interrelated responsibilities. Entities in the social system must be aware of the proceedings and their job roles when they are bounded by shared responsibilities; this helps them to learn the innovations, proceedings and get used to the working environment.

Necessity for Project/Time Plan

As ideas, notions and tasks vary in project environments, it becomes difficult for the individuals to adopt changes so swiftly, therefore, they may not be able to produce their work or tasks on time. Consequently, meeting deadlines in the sprints or projects using proper scheduling and planning may reduce the probability of risks and control cost overruns. This is one of the potential problems or risks that have been observed in the data numerous times. Boehm (1991), PMBOK (2004), APM (2012) and Schwabe (2010) have proposed that by using project management tools and methods, time can be managed, and deadlines can be met, whereas the researcher believes that together with planning, by developing an attitude of responsiveness and proactiveness, deadlines can be met more effectively. People should be aware about whatever is going-on in the environments; as supported by Rogers (2003). Project and process planning is evolved from the traditional methodologies of project management. PRINCE2 provides several templates for undergoing project planning. Project managers can make efficient Gantt Charts in relation to their timelines, make use of templates from PRINCE2 such as End Stage reports, Daily Logs, Stage Plans and other suitable templates provided in the project planning literature of PRINCE2 (OGC, 2017). Consequently, PMBOK (2013) also provides several templates and guidelines for planning support which can be used by managers. Schwalbe (2014) argues

that the knowledge and comprehension to project management standards must be acknowledged at all levels to ensure effective working of those standards. People in virtual environments do not realise the needs; the difference is not only observed in their practices, but also in their decision-making and adapting power to the required parameters.

Mechanism of Overlapping Hours

As Virtual-Agile projects are based in different time zones, it becomes difficult for the dispersed stakeholders to interact with each other. The problems mainly observed were when the customer and project teams wanted to get in contact. Similarly, for the individuals who are scattered, it is also problematic to get in contact with other people for communication. The solution to these challenges is to change the working routine according to the requirements of the project which are discussed as under.

The data suggests that by using the mechanism of overlapping hours with the customer or product owner, time difference issues can be met to a certain extent. Similarly, overlapping hours with other team members around the globe helps to produce efficient solutions for product. Layman et al. (2006) and Shrivastava and Rathod (2017) have acknowledged the overlapping of hours when interacting with clients/product owner. Shrivastava and Rathod (2017) further acknowledged that overlapping of working hours with clients/product owner helps to highlight issues in a developed source code. The participants have emphasized the use of overlapping hours from section 5.2.3 several times. When getting in contact with a customer or product owner in another time zone, the data suggest for at least two hours overlap when communicating, whereas Vijayaraghavan et al. (2014) have recommended for three hours overlap in the day. This helps to maintain a regular contact with the customer and share the complications and progress with them regularly. Chin (2004) further acknowledge that Agile software development requires a high customer interaction in all the phases of the project lifecycle; whether it is planning; initiation or execution, it is vital to take client on board with all the decisions. Shrivastava and Rathod (2017) further

acknowledged that the issues of time zone difference between individuals can be overcome by using pair programming. Pair programming in Agile development allows the individuals to work on the same workstation even when operating from different locations. This reduces hassles and uncertainties where the developers can share their opinions and ideas even though being dispersed at the same time.

Flexibility in Schedule

The data advises to reduce the effect of time shifts in project environments by having a flexible schedule. Flexibility in working schedule allows the team members to work and respond to an uncertain situation beyond their working routines. The researcher presumes that flexibility and overlapping hours are two different aspects which need to be addressed extensively. Although from a broader perspective they come under same dimensions; overlapping can be regarded as a fixed schedule of working whereas flexibility supports contacting between teams and clients on a random time basis. It has been observed from the section 5.2.3 that entities face many problems contacting other individuals when based in different zones where schedules for holidays are different from the one located in the primary region.

Verner et al. (2013) further endorsed that the project manager in this regard should produce shared time plans so that it may not create uncertainties in the project environment. This viewpoint by Verner et al. (2013) is commendable as it will help to create a common starting and finishing points for individuals. Similarly, the teams and individuals should share their personal contact details in case they are on vacation or based in another time zone where the schedule of holidays is different to the one of the primary location of operations. Therefore, keeping in consideration the opinions of the respondents, it can be deduced that by spreading knowledge of adjusting according to project environments, the issue of time shift can be managed to a great extent. Although there is no alternative to

face-to-face communication, the individuals and stakeholders involved in the project should show flexibility to get into contact with other people or clients.

6.6.5 Comprehending the Dimensions of Communication

According to the data sources, communication is one of the three components which have an imperative role in developing 'Responsiveness'. In accordance with the definition of communication, Roger's (2003) definition provides a viewpoint which is close to the boundaries of Virtual-Agile project environments, where he designates communication as the process of information exchange to reach a shared understanding. Similarly, Fuks et al. (2008) recommend communication as the means of developing an agreement or reaching a mutual understanding about a problem. Both the definitions are pertinent to the context of Virtual-Agile project environments where the project team, including programmers, developers, Scrum masters, and the client/product owner, interact with each other to develop a shared understanding of project-related tasks. In accordance, the data suggest developing a high frequency of knowledge transfer between all the project stakeholders. Reed and Knight (2010) have also advocated the lack of knowledge sharing due to which several complications rise in distributed projects. According to Davenport and Prusak (1998), knowledge transfer is a method that simplifies the process of sharing, distributing, creating, capturing and understanding of a company's knowledge. Keshlaf and Riddle (2010) further recognised knowledge sharing as one of the critical challenges in distributed software development. The data indicates for an efficient knowledge transfer process which needs to be vigilant and varying according to the requirements of the project. The Knowledge Transfer process in Virtual-Agile project environments as emerged from the data mainly depends upon four factors, i.e. feedback, information sharing, progress reporting and scope management.

Closed Feedback Loops

The data from section 5.3.1 suggest that by keeping an effective feedback loop between the distributed stakeholders, several ambiguities related to tasks and work can be efficiently handled. Shrivastava and Rathod (2015) have acknowledged this viewpoint and suggested that frequent feedback in Virtual-Agile projects helps teams and clients help to develop an understanding on various issues and get to know about the causes of failures in the projects. Further, it helps to know about the errors in the source codes and perform improvements by testing the codes at various levels.

Rasmussen and Svedung (2000) emphasize on the need of proactive closed feedback loops in order to resolve queries in a dynamic system. They further elaborate that in close loop communication, meaningful conclusions are made. The data also indicates towards closed feedback loop where the queries of the customers are dealt with straight away in order to maximize opportunities and reduce ambiguities. Further adding to the context, Layman et al. (2006) suggest that active feedback helps to respond to alterations to minimise failures. He also acknowledges that in global software development projects feedback is vital from a customer point of view where they provide the feedback to developers over prototype test runs. Mudumba and Lee (2010) also advocate that feedback from previous iterations/sprints aids in performing the task planning for following sprints. This helps to know about the changes, mistakes and improvements that may be required to be undertaken in a project. Dorairaj et al. (2012) further suggest that the mechanism of feedback helps teams develop an understanding of the common tasks, thus, reducing various obscurities and fears related to project work. Layman et al. (2006) proposed that for dealing with the challenges and issues to the knowledge sharing in teams, a collective code ownership should be introduced which can enhance the knowledge sharing process within the teams. Hence, the evaluation shows that closed feedback loops are important both from the development team and client perspective. Closed feedback loops within teams help highlight evolving complications and

define strategies for future sprints, whereas such loops also help to resolve clients' issues and achieve their satisfaction.

Information and Document Sharing

For sustaining a high frequency of knowledge transfer in Virtual-Agile projects, information sharing has also emerged as another component which contributes constructively to the environments. According to Dorairaj et al. (2012), knowledge sharing between the dispersed teams is significant for the success of Agile development. Information sharing between the teams and customer can increase the level of understanding of tasks. Similarly, the data emphasize the information sharing process by highlighting that the discussion between the teams should be very precise and comprehensive so that the people having different mindsets should be able to understand the ideas and notions of others.

Similarly, Dorairaj et al. (2012) further indicate that the sharing of information and knowledge should occur between team members on a daily basis either in meetings or through emails. As Scrum meetings are for a short duration, Dorairaj et al. (2012) further acknowledge that sharing of information helps to synchronise the daily work and resolve several ambiguities related to project work. Team members discuss their daily routine work which helps to perform the individual task more efficiently. Rogers (2003) further acknowledges that in a social system, knowledge sharing process is crucial as several entities are involved which might restrict their ability to understand the innovations going on in the social system. Therefore, the process of communication should be effective enough to attain the mutual consensus of the people involved in developing issues.

Extensive Progress Reporting

The next aspect which emerged from the section 5.3.1 is progress reporting. Progress reporting is the process of reporting the cases of ambiguities or evolving problems to higher management in Virtual-Agile project environments. Progress reporting in terms of showing

the progress or work to senior management so that they could further guide and provide suggestions to the project team and concerned stakeholders.

Giuffrida and Dittrich (2015) have acknowledged that progress reporting can be referred to as a process of accountability within the global teams where management and key stakeholders require the progress of the work at certain stages to ensure project completion on time. They further propose that reporting to a manager or supervisor on a daily basis helps to get them involved fully in the project and consequently, uncertainties can be reduced to the project work to be undertaken. Progress reporting supports reducing liabilities where the project manager can share the advancements and demarcations of the project to the higher management for getting support. Lee and Baby (2013) further acknowledged that in global IT projects reporting to senior management within time helps to reduce the complications linked within the project processes where different sorts of experts can help management and key stakeholders to resolve the reservations. Thus, progress reporting helps to control evolving risks linked to the delivery of the product or project.

Managing Scope Changes

The data indicates that during the product development, managing scope is crucial as Agile supports flexibility and alternations within a sprint. The data also suggest that sometimes the people involved in the scope change process do not have enough knowledge to communicate between two parties (development team and the client); this leads to new challenges and potential risks in projects.

Korkala and Abrahamsson (2007) further suggested that requirement exchange between the teams and customer should occur accurately as this is one of the most critical processes of software development. Layman et al. (2006) advocated this viewpoint and recommends that a well-scoped project helps to create precise user stories based on the customer

involvement. According to Chin (2004), user stories comprise of the simplified requirements needed by the users in Agile software development. Reed and Knight (2010) further acknowledged that in virtual projects too many scope changes produce numerous difficulties for the development teams. Lee and Baby (2013) also recommended to avoid frequent scope changes as they create several difficulties for the distributed team members; though Agile supports alternations, the scrum master/project manager must take actions to ensure a common understanding among team members and customer at all locations.

Need for Active Participation and Support from Stakeholders

Stakeholders are the entities involved in the project directly or indirectly and are influenced by the outcome of the project (PMBOK, 2013). The data suggest from section 5.3.2 that stakeholders' active participation in the project helps to reduce the uncertainty and enhance project performance. Usually, the product owner primarily from the client and sponsor side must be involved in meetings actively so that this helps completion of sprints successfully. Consequently, Shrivastava and Rathod (2014) acknowledge the researcher's finding that product owner involvement in projects helps to resolve conflicts in the content and helps design prioritization of the tasks to be undertaken. User stories become more precise and straightforward with the active participation of the clients. Team members become vigilant about their tasks and this control future risks. They further recognise that unavailability of the product owner is a big risk to the project progress and should be avoided to achieve maximum output from a sprint.

Due to the dispersed way of working, product owner availability in daily meetings is a big challenge which can lead to scope creep. Vijayaraghavan et al. (2014) acknowledges that the product owner acts as a 'bridge builder' between the customer and the development team. Other stakeholders like Scrum masters, project teams and managers should be actively involved in meetings for supporting and getting consent on the routine tasks.

Another argument which has emerged from the data is the requirement of necessary support from the stakeholder in uncertain times.

The participants further have shown concerns over unavailability of stakeholder where he was not able to get hold of a problem, and therefore, acknowledges that the stakeholder support for managing risks/issues is necessary. In the process of risk management, stakeholders especially the product owner or client play an important role in identification and elimination of risk factors. To avoid blame games at the end, it is mandatory to communicate risks of the project on time and get support from the people concerned. The data also suggest for pre-audit meetings in section 5.3.2 whenever the project has been initiated, where both the internal and external types of stakeholders should get involved to agree on the outcomes before product delivery.

Building of Trust and Social Interaction

It has been found from the section 5.3.3 that strong correlation among the project team members is necessary for the completion of the project. The data indicates that the trust-building process between the team members and clients is problematic as they are anonymous and new to each other.

Correspondingly, if the customer/client is positioned at a different location, he does not trust the project team easily and this may lead to the development of new uncertainties. The data has only identified trust as a crucial factor but does not provide many suggestions to build it. Alzoubi et al. (2015) identify that restriction of the trust building process is mainly due to people differences such as cultural and languages differences, and the differences in their attitude and behaviour. In order to meet such challenges, the organisation should undertake measures to arrange social gatherings where people can meet and develop associations. Data also acknowledges this viewpoint in section 5.3.3. The data also indicate that lack of

trust can be a reason for the deficiency of soft skills within the individuals from diverse backgrounds. A participant acknowledges in this viewpoint that

"What lags behind is the soft element of the project or program that build the relationship and trust within the project."[P7]

Alzoubi et al. (2015) further recommended the use of multiple communication channels to interact, as it helps the frequent flow of information and aids in the building of trust. Dorairaj et al. (2012) endorse the application of communities of practice where individuals can share information, experiences and technical skills on an issue, which helps them to create team formation among them. Similarly, Rogers (2003) recommends that in a social system where new people interact, several new challenges grow; the best way to deal with them is to create formation in the social system through extensive communication.

Equality and Ruling out Discrimination

Empirical evidence from the section 5.3.3 indicates that deep associations or relationships can sometimes be harmful to the distributed stakeholders. A relationship should be developed where people can openly discuss and contact each other for problem-solving using interpersonal communication skills. The data suggest that due to cultural differences between the entities in Virtual-Agile project environments, several uncertainties and ambiguities are expected to occur. These uncertainties grow over time as the people interact and share their experiences. The people who are more in managerial positions should be able to deal with other team members on an equity basis.

The data also indicates that respecting team members and clients supports trust and reduces discrimination. The data does not suggest in detail what the actions should be performed for reducing discrimination but just give a highlight to this factor. The researcher believes that the reason can be the focus of the research study on international culture rather than getting deep insights into each culture. Some of the culture-related issues and

challenges which have emerged are mainly the languages and differences in working practices which can be resolved to a certain extent by standardized training and use of multiple communication channels and tools.

Competency to Manage Workload

In the section 5.3.4, it has been determined that Virtual-Agile project environment requires high competency, experience and knowledge of the Agile principles. Most of the projects fail as people are not able to understand the philosophy behind Agile, therefore lack showing productivity. People involved in such project environments can also be part of other projects as well. The data indicate that such individuals cannot manage their work routine and therefore lag in meeting deadlines.

Lee and Baby (2013) have acknowledged the development of interpersonal skills to ensure the smooth flow of distributed projects. Further, Persson et al. (2009) advocate that in distributed software development projects, interactive skills can help to generate understanding among distributed members in relation to tasks and reaching a mutual consensus. Interactive skills can be attained by training or having previous experiences of working under such dynamic circumstances. Consequently, Mudumba and Lee (2010) argued that in global software development, individuals could not give sufficient time to the working environment due to their busy routines. This gives rise to evolving risks where the gap exists between distributed entities on mutual understanding of the project scope.

Comprehending the Philosophy of Virtual-Agile Projects

The data indicates one of the common issues in Virtual-Agile projects is lack of understanding about the project formats, i.e. the philosophy of working in Agile. People moving from conventional to Virtual-Agile setups are not able to sustain and produce a performance. Team members working in such project environments face difficulties understanding the Agile methodology. Although the application of Agile in industry has been

happening for more than a decade now, people are still unable to work according to the dynamics of Agile. Vijayaraghavan et al. (2014) and Lee and Baby (2013) have acknowledged the fact that Agile in distributed format brings many complications for organisations and project stakeholders. Similarly, entities in the project environment are not able to understand the requirements, alterations or scope of the projects. People have traditional mindsets and practices due to which they are unable to recognize the pace of the Agile methodology. The reasons for failures in such format are mainly due to the misunderstanding of the methodology. This issue can be further resolved by extensive training and hiring of skilled individuals as discussed later.

Requirement of Experience and Creativity

Dorairaj et al. (2012) suggest that in order to reduce the failures, the individuals should have previous experiences and knowledge from a particular field and ability to work under pressure. Similarly, they recommend that the entities involved should know about how to apply the technical resources in project work. Such abilities can help to respond to alterations and developing challenges more positively and thus enhance opportunities for a project. In respect of managing risks, the data specifies that responding to risk events depends upon the natural tendency and ability of each person where they can handle the situations and do not let the project progress be harmed. Another aspect the researcher believes that needs to be acknowledged is the requirement of 'creativity' of the developers or programmers working in Virtual-Agile project environments, as suggested by Podean and Benta (2012), which can help to develop creative solutions for the product. Creativity is a necessary requirement of the virtual-agile projects, as customers/clients' demands are changing, so in order to catch up with the customers' requirement, creativity should exist within an individual. Leenders et al. (2003) supports further by arguing that effective communication is the wellspring of creativity in virtual teams; therefore, the researcher can

deduce that information sharing and interaction among team members help develop creativity and resolve complications within a development code.

Motivation and Fulfilments of Needs

The preceding component of communication which has emerged from the data (section 5.3.5) is motivation which is necessary to attain team satisfaction within the project environment. Moe et al. (2012) have suggested that where the shared decision-making process is under consideration, motivation helps to keep morale high. Similarly, the data suggest that there can also be several personal reasons where individuals do not seem to be willing to correspond or communicate extensively; it becomes a need to motivate them towards their work and socialisation. The factor of motivation has been recognised as imperative in the literature of both organisational and project management.

Powell et al. (2004) propose that in the virtual project as people are distributed, they become isolated from the environment; therefore, the need for restoring their enthusiasm and interest towards project work becomes mandatory to achieve project objectives. Lilian (2014) further suggest that team cohesion and trust can be helping to increase motivation within the virtual team members. Likewise, Reed and Knight (2010) propose that the rise of conflicts between teams can give rise to several misunderstandings between team members; therefore, motivating them towards team cohesion and formation may help achieve project goals more positively.

Consequently, the data also suggest that people in the leading positions should ensure that their teams are well-equipped with all the requirements to undertake the project work. Reed and Knight (2010) further indicate that sometimes the technical resources such as webcam for video conferencing are not available at the individual's end. Similarly, equipment like scanners, printers or software licenses are not available for people from diverse territories. Hence, it becomes the obligation of the project manager to provide such equipment and

tools and ensure that the teams can utilize them in a proper manner. They should ensure that the team members should be present in daily meetings to undertake their work properly. In context, the famous Maslow's Hierarchy of Needs theory (1943) suggests the fulfilment of five factors to motivate and satisfy employees. These are

- Physiological Needs – Needs for survival such as water, shelter, food
- Safety Needs – Needs for personal and financial security, health and wellbeing
- Love/Belonging Needs – Needs for building of relationships and friendships
- Esteem Needs – Needs to feel confident and respected by others
- Self-actualisation Needs – Needs to focus and master oneself in specific tasks.

Although Maslow's theory (1943) follows the traditional style of working, it can be relevant to distributed environments in several aspects. Though the communication norms and means have changed, the researcher can assume that some of the factors such as safety, love/belonging, esteem and self-actualisation are required from the context of individual working and help them to get motivated towards the work. Similarly, Herzberg's (1987) two-factor motivation-hygiene theory informs about the importance of motivation in working environments which leads to satisfaction of the employees. The employees get motivated when they are enjoying their work, feeling recognised and believe they have career progression. The data also indicate that in the Virtual-Agile project environment, the roles and responsibilities given to the people should be concise, and the individuals involved should show an agreement upon the task allocation. Consequently, Shrivastava and Rathod (2014) suggest that getting consent about work helps to reduce uncertainties and thus individuals such as programmers and developers feel more confident and interested in their work.

Signifying Risk Ownership and Tracking of Projects

According to Lalsing et al. (2012), Agile is a people-focused approach, therefore the teams involved in the projects should organise themselves to reach objectives. The data acknowledge this viewpoint but also suggest some necessary obligation which needs to be fulfilled by leadership or management involved in the project. The data indicate the proposition that the project manager is the actual risk owner of the project. According to PMBOK (2004), the Risk Owner is a person who is responsible for undertaking the risk management procedures and they principally finalise the strategies to deal with the uncertain situations.

As in Virtual-Agile project environments, the project manager is an overall responsible person; the data indicates the importance of his responsibilities for undertaking risk management strategies. Consequently, due to geographical differences, the data also indicates that it becomes very problematic for the project manager to monitor and control people and project activities while operating from a different location.

Keshlaf and Riddle (2010) further considering this issue from the perspective of web and software development state that a leader should use proper tracking methods from their experiences for monitoring and controlling the project activities. Experience matters a lot, and then the ways to conduct tracking. Several tools which have already been discussed in section 6.6.3 can be used to monitor the overall progress of the work. Schwabe (2010) further emphasize for the use of latest technological tools such as Microsoft SharePoint, where dispersed teams can share ideas and work, thus helping to monitor and control project affairs more efficiently.

Obligation of Training and Skilled Individuals

Another factor which has emerged from the section 5.3.6 is the lack of skilful individuals in Virtual-Agile projects, who are unable to show productivity. Alzoubi et al. (2015)

acknowledge that leaders' or management's role is to ensure that they hire people having experience, good communication skills and knowledge of working in Virtual-Agile environments. Most of the failures are caused by people in sprints as they fail to run with the promptness of Agile methodology.

The data also indicates that training individuals in this regard is the responsibility of leadership or management. The people who are in a managerial position such as project manager, Scrum masters or team lead development should know the capabilities of each and every person. Similarly, providing them with required work training will enhance the project performance and productivity of every person. Lee and Baby (2013) further acknowledged this viewpoint by mentioning that training such as in terms of using software or development tools or providing live workshops online will give each individual an opportunity to learn and enhance their work capabilities.

6.6.6 Variation of Project and Risk Management Standards in the IT Industry

Data sources suggest that organisations undertaking Virtual-Agile projects utilize various risk management techniques and methods according to their own capacity and understanding. Table 6.6.6 shows the application of various project management standards in the IT industry. The table also shows the variation in utilization of risk management tools and methods. Some of the participants prefer to follow traditional methodologies such as PRINCE2 or PMBOK, whereas some of the participants use the Agile way for managing risks where they depend upon high interaction and collaboration. Similarly, the application of modern process models such as CMMI Model seems to be uncommon in the software development industry until now.

Table 6.6.6: Application of Risk Management Techniques and Methods in the IT Industry

Participant	PRINCE2	PMBOK	CMMI	Agile Way	Digital PM Tools
P1	√				
P2	√				
P3	√			√	
P4		√			
P5	√			√	√
P6					√
P7	√				
P8				√	
P9				√	
P10				√	
P11				√	
P12				√	
P13		√			
P14		√			√
P15				√	
P16		√			
P17			√		
P18		√		√	
P19				√	
P20				√	
P21		√			
P22		√			
P23				√	
P24		√		√	
P25				√	

6.6.7 Influence of Responsiveness in Risk-Management Planning and Implementation Phases

Responsiveness supports undertaking of formal risk management procedures under the planning phase and then responding to risks proactively in the implementation phase. Dhlamini et al. (2009) also emphasize the requirement of 'proactiveness' of risk management procedures rather than following 'Reactive' approaches of the traditional project management which are meant to manage the complexity of projects. Software development projects are complex by nature; therefore, a proactive risk management helps

to control and reduce the effects of unexpected events on the project objectives. In relation to the management of evolving risk factors, Nelson et al. (2008) proposed several strategies to deal with the risks such as prioritising the tasks at the beginning of the iterations helps to manage risks effectively. It helps to reduce the possibility of risks associated with the tasks, and consequently, risks can be resolved as soon as it occurs, where sequential actions can be undertaken. Following figure demonstrate the influence of Responsiveness on the Risk management planning and implementation stages.

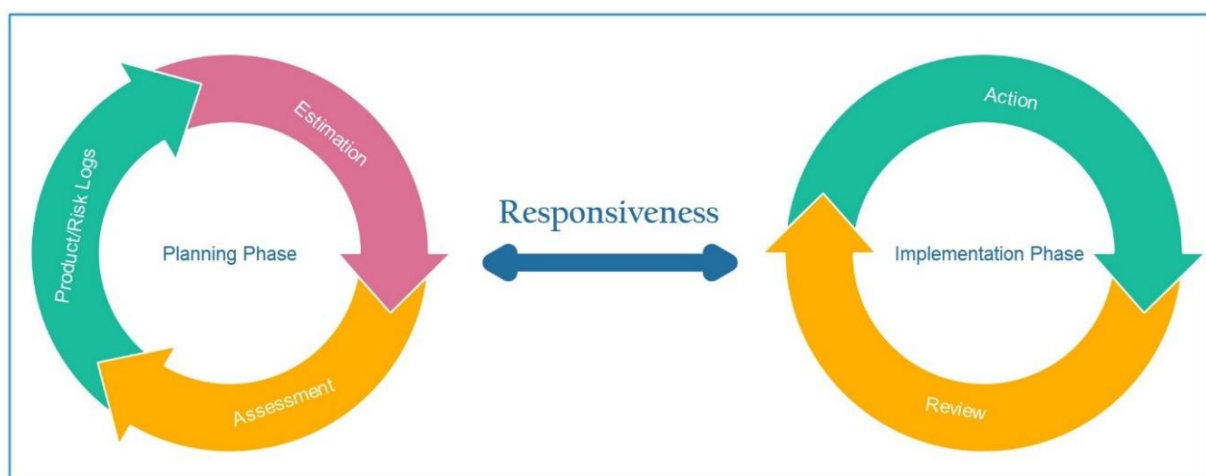


Figure 6.6.7(a): Responsiveness in Planning and Implementation Phases

Brainstorming Sessions, Delphi Technique and Gap Analysis

Responsiveness supports undertaking risk management planning during daily Scrum meetings. Consequently, risk management planning is also undertaken at various stages of the projects such as when creating backlogs, during sprint planning, sprint retrospectives, etc. The data suggest undertaking brainstorming sessions and gap analysis to identify the risk factors. According to Dinu (2012), an effective brainstorming session requires creativity and collaboration among the team members. As discussed in section 6.6.5, competency which helps to undertake work efficiently and create awareness about the project environment, the researcher proposes that creativity can play an important role in the

brainstorming sessions. Brainstorming is considered as a creative problem-solving skill which supports in defining a solution to a problem (Al-Khatib, 2012).

Another method which has evolved from the data is the gap analysis for the identification of a problem. According to Murray (2000), gap analysis is a tool which is preferred in IT management to identify and correct the gaps between current and desired levels of performance. As per findings, one participant suggested that gap analysis may help to recognise the differences between the desired objectives and actual understanding of the scope. Gap analysis helps to reach a consensus on the procedures and practices to be undertaken which is a useful activity for estimation of the risks. Similarly, in the literature, several techniques have been suggested for risk identification. According to Garrido et al. (2011), Delphi Technique, Influence Diagram, Expert Judgement, Check List and Flowcharts are some of the useful techniques to identify risks in a project. The data also acknowledges the Delphi technique and Expert Judgement that is practiced by participants in the distributed environments. The researcher can assume that due to the distributed environments, it is difficult to undertake techniques such as influence diagrams, checklists or flowcharts as the teams are distributed and can interact using technology only where they may not prefer to share hand-written material. Hence, it can be suggested that Expert Judgement and Delphi Techniques are some of the useful activities which the distributed teams should undertake from time to time. According to Morano et al. (2006), Delphi technique is undertaken to get a view from experts and get a consensus to resolve an issue, whereas expert judgement is a set of unstructured, semi-structured or structured interviews undertaken individually or jointly with experienced project specialists or stakeholders to reach a solution in regard to problem. The researcher believes that both the activities can be undertaken under the support Responsiveness, i.e. if the teams and project stakeholders are well aware of the consequences they would be in a better situation to estimate the risks

arising. Therefore, it can be proposed that estimation of risks is specifically related to the competency, creativity and involvement of stakeholders.

Root Cause Analysis and Probability vs Impact Analysis

Consequently, some of the methods and techniques such as root cause analysis and likelihood vs impact analysis are being practiced assessing the identified risk factors. This step is the next level of estimation where the participants who have already identified risks use brainstorming, the Delphi technique and Expert Judgement for analysing the effect of each risk factor. According to PMBOK (2013), risk analysis can be undertaken using qualitative and quantitative approaches. Qualitative risk analysis is based on judgment and experience, whereas quantitative risk analysis is based on statistical calculations of the probabilities and impacts of the identified risk factors. The data suggest the application of qualitative risk management techniques in distributed environments as team members and project stakeholders can discuss and evaluate the likelihood or impact of the risk according to their understanding and experience. This is one of the common methods that has been proposed by various project management standards such as PMBOK, PRINCE2, CMMI etc. The template for the qualitative analysis in terms of Probability vs Impact method is shown in figure 6.6.7(b) (PMBOK, 2013).

Impact	Very High					
	High					
	Medium					
	Low					
	Very Low					
		Very Low	Low	Medium	High	Very High
Probability						

Figure 6.6.7(b): Probability vs Impact Analysis adapted from PMBOK (2013)

The ranges from 'Very Low' to 'Very High' along the X and Y axes show the probability of occurrence and impact of the identified risk on the project outcome, respectively. Using the Delphi, expert judgment and brainstorming techniques, all the stakeholders can assess the identified risks using a variety of tools. Similarly, root cause analysis is another tool which is used to identify the cause of the problem or risk. The data does not suggest any particular type of root cause analysis technique, but according to Garrido et al. (2011), root cause analysis consists of four steps, i.e. data collection, causal factor charting, root cause identification, and recommendation generation and implementation. It is a graphical process used to investigate and categorise the causes of the occurred risk. Further, Garrido et al. (2011) elaborate that root cause analysis is used to find out when, how and why a particular risk event has occurred. The researcher believes that this method may help the distributed team members, especially in the implementation phase to estimate the causes of a risk event.

Diary to Store Risk Responses

The next stage of the planning phase is where the project stakeholders maintain a record of estimated and assessed risks. The data identifies the application of both the Product Backlogs and Risk Registers in the software development industry. Product backlog is specially used for Scrum methodology and is a prioritised list of activities with short descriptions to achieve project objectives (Cockburn and Highsmith, 2001). While following the Agile way of managing risks, participants acknowledged the use of a product backlog list for maintaining records of the identified risks. Identified risks are stored against each prioritized task which helps to know about alarming points of the projects. Similarly, people who have traditional qualifications or mindsets utilize risk registers to store assessed risks with planned responses when they are expected to occur in the implementation phase; which is more like a conventional tool for storing the record of risks.

Action and Review of Responses

The implementation phase becomes active when any estimated or surprising risk event occurs. Depending on the Responsiveness, the team and project stakeholders get into contact and make efforts to resolve the uncertain situations. Here, the researcher claims that competency, stakeholder involvement and leadership function are greatly worthwhile when responding to a risk event. Timeliness is the key to get control of risks in time by proactively responding to them. The conception is based around Responsiveness as to how proactively the project stakeholders get into communication to resolve issues. The realisation, creativity and collaboration between the team members help them to analyse the situation. They may prefer to undertake Delphi technique, Expert Judgement or root cause analysis to find out the causes of the problem and then design a response accordingly.

After responding to risks, they review the results in sprint retrospective meetings or at a suitable point and then create awareness about the problems for the upcoming sprints. The data imply that Responsiveness is a facilitating factor that helps individuals to recognise and assess the risks events for future projects as well, which reduces uncertainty and ambiguity levels among them. Table 6.6.6 shows the variations in risk management practices in the software development industry. On the other side, the data also acknowledge the fact that people in Virtual-Agile project environments are still using the Agile way of managing risks which is dependent upon daily discussions, not utilization of conventional procedures or techniques. The researcher can thus conclude that formal risk management procedures especially Delphi technique, Expert Judgement, Brainstorming sessions and qualitative analysis techniques should be applied by the entities in Virtual-Agile project environments for undertaking risk management.

6.7 Relevance of Evolved Paradigm in Virtual-Agile Project Environments

Virtual-Agile IT projects operate on the principles of Agile methodologies where the project is divided into several achievable parts, for which a specific duration of two to four weeks is allocated known as a 'sprint' or 'iteration'. The concept of 'sprint' is more appropriate when discussing the Scrum and Extreme Programming (XP) sub-methodologies, as depicted from the data and confirmed by literature. Scrum and XP both are used extensively in the software development industry for completing complex IT projects but differ in principles and practices. Similarly, KANBAN is another type of Agile methodology which is more pertinent to co-located projects. KANBAN is purposely used in Virtual-Agile formats as it is based on visualizing and improving the flow of work.

The evaluation of the findings has highlighted various dimensions and their applicability in dynamic project environments. The findings have also manifested the applicability of Scrum methods in virtual project environments together with the application of XP methods. Scrum and XP methods both run side by side as sprints (iterations), but the differences are mainly: Scrum does not favour amendments within a sprint whereas XP supports alterations in the scope of a sprint. Scrum duration is normally two to four weeks, whereas XP duration is maximum one to two weeks. When it comes to Virtual-Agile format, the utilization of Scrum methodology methods is found to be the most common practice in the IT industry. The reasons for Scrum implementation as per respondents are its compatibility and suitability with the distributed format, which allows multiple individuals to work together and share their tasks under strict timelines. While discussing the appropriateness of Scrum methods in distributed software development, some of the participants mentioned that:

"Scrum provides a combination and a team which is strong enough for carrying out Agile practices and different other software techniques."[P9]

"Scrum is something that I have been using because it has more defined events like I standard grooming planning, team size different roles so it is supportive here especially in my current organisation."[P11]

"The clients do not know what they actually want from your team unless they see something. You know it's there in the software industry, that is the main reason for the adding Agile so less documentation obviously, you know giving them shorter-term research, not reading for three-six months. We are delivering them in two weeks, implementing every sprint after every two weeks, and then showing them then they {clients} come with the changes. That's the best thing that we have achieved from the Agile Scrum."[P17]

Consequently, taking into consideration figure 1.6, the applicability of Responsiveness for a particular Agile type and the virtual environment is shown in table 6.7. The table has been drafted using the empirical evidence which informed about the respondents' methodology and their involvement with the type of virtual working environment.

Table 6.7: Applicability of Paradigm of Responsiveness for Specific Virtual-Agile Formats

Participant	Primary Location	Teams Location	Client Location	Application of Agile Method	Virtual Environment Type
P1	UK	UK	EU/UK	Lean, XP	Geographically Distributed
P2	UK	UK	UK	Lean, XP	Geographically Distributed
P3	UK	UK	UK	Scrum	Geographically Distributed
P4	Germany	India	Germany	Scrum	Off-shore Development
P5	UK	UK-India	UK	Scrum	Geographically Distributed/Off-shore Development
P6	Germany	India	EU	Scrum	Geographically Distributed/Off-shore Development
P7	UK	UK	UK	Scrum	Geographically Distributed

P8	Pakistan	Pakistan-India-USA	USA	Scrum, XP	Geographically Distributed/ Global Inter-organisational
P9	Pakistan	Pakistan-India	Canada	Scrum, XP	Geographically Distributed/ Global Inter-organisational
P10	Pakistan	Pakistan-USA	Canada	Scrum, XP	Geographically Distributed/ Global Inter-organisational
P11	Pakistan	Pakistan-India	USA	Scrum, XP	Geographically Distributed/ Global Inter-organisational
P12	Pakistan	Pakistan-UAE	USA	Scrum	Geographically Distributed/ Global Inter-organisational
P13	Pakistan	Pakistan	Pakistan	Scrum	Geographically Distributed
P14	UAE	UAE-Bahrain	Middle East	Lean, Scrum	Geographically Distributed/ Global Inter-organisational
P15	Kuwait	Kuwait-India	Middle East	Scrum	Geographically Distributed/Off-shore Development
P16	USA	USA-Canada-India	USA	Scrum	Off-shore Development/ Geographically Distributed
P17	Pakistan	Pakistan	France	Scrum, XP, KANBAN	Geographically Distributed
P18	Pakistan	Pakistan-India	France	Scrum	Geographically Distributed
P19	UAE	UAE-Bahrain	Middle East	Lean, Scrum	Geographically Distributed
P20	Pakistan	Pakistan-India	USA	Scrum	Geographically Distributed/ Global Inter-organisational
P21	Romania	Romania-EU	UK	Scrum	Geographically Distributed/ Global Inter-organisational
P22	Pakistan	Pakistan-India	Italy	Scrum	Geographically Distributed/ Global Inter-organisational
P23	Pakistan	Pakistan-UAE	USA	Scrum	Geographically Distributed/ Global Inter-organisational
P24	UAE	UAE-Middle East	UAE	Scrum	Geographically Distributed/ Global Inter-organisational
P25	Pakistan	Pakistan-USA-	USA	Scrum, KANBAN	Geographically Distributed/ Global Inter-

		Germany			organisational
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Where,

- Geographically Distributed is a virtual format where individuals or teams are operating from different locations or regions whether inside or outside the base location of a country to meet common goals or objectives.
- Global Inter-organisational is the format where entities being a part of distinct organisations or joint alliances are operating from different geographical territories.
- Off-shore development is a setup hired or undertaken by organisations in other countries/different geographical regions in contrast to their main operating location to provide business services to their own customers.

Therefore, with the support of empirical evidence, the researcher using table 6.7 has determined the appropriateness of Responsiveness in the following types of Virtual-Agile formats as shown in figure 6.7.

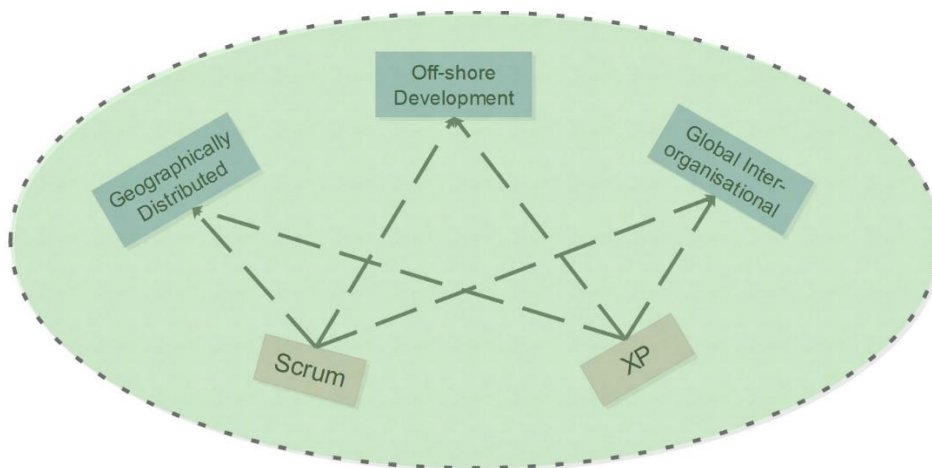


Figure 6.7: Appropriateness of Responsiveness in Virtual-Agile Projects

The 'Green' highlighted area above corresponds to the area of this research as per figure 1.8; where now after the data collection and analysis it has been revealed that Scrum and XP methods are the most appropriate to virtual formats such as geographically distributed, off-shore development or global inter-organisational. The adoption and applicability of other

Agile methods such as DSDM, KANBAN, Lean and FDD seem to be limited or almost non-existent in virtual environments as they seem to work better in collocated or in-house development projects. Therefore, it can be deduced that the findings of this study are most relevant to Scrum and XP methods of Agile in virtual formats. Sutherland et al. (2007), Paasivaara et al. (2009) and Shrivastava and Date (2010) have also recognised the suitability and appropriateness of Scrum and XP methods in distributed formats and determined that use of the customised versions of these two methods is now becoming a common practice in the software industry. Responsiveness does not limit its boundaries only to the Virtual-Agile format, but it can also be useful for the collocated or in-house development as both formats share several characteristics; though the required coordination and intensity level of technology, timeliness and communication are relatively high and frequently changing.

6.8 Actions for Ensuring Trustworthiness in Research

One of the most common critiques qualitative researchers face is to demonstrate the trustworthiness in the study conducted. Positivist researchers normally question this issue to judge the reliability and validity of the study undertaken by qualitative researchers (Silverman, 2001). Guba (1981), while demonstrating trustworthiness, elaborated four criteria under which a qualitative study can be judged. These four criteria are as follows.

6.8.1 Credibility

According to Lincoln and Guba (1985), credibility is the most significant characteristic in establishing the trustworthiness of qualitative research. There have been several criteria defined previously to judge the credibility of such research. Some of the following parameters have been considered by the researcher to address credibility for this study.

a. Member checking

Lincoln and Guba (1985) consider member checking as the unique characteristic to strengthen a study's credibility. Member checking depends upon two criteria: checks relate to the accuracy of the data and verification of the emerging findings. In regard to checking accuracy of the data or captured articulations, the verbatim transcriptions as per recorded audio were sent to the participants for their verification to ensure that their speech or words have been accurately apprehended and have not been misunderstood. In this regard, the response from the participants' side was found to be unsatisfactory. The researcher after discussion with the supervisory team decided to send two reminders to each participant for responding and confirming back. In this regard, a suitable deadline was provided to each participant and if by that time, they were unable to respond, the transcript was considered as accurate and used for further analysis. Similarly, a section was provided at the end for each participant to confirm their agreeability towards the transcribed data.

Another feature of member checking is the validation of the emerging concepts and the interpretations after it has been developed (Lincoln and Guba, 1985). This strategy has also been suggested by Brewer and Hunter (1989) and Miles and Huberman (1994) for carrying out member checks. In such type of credibility check, the researchers after developing initial findings go back to the respondents and gets a formative feedback to evaluate the interpretations of their findings. This provides a formal opportunity to previous respondents to assess the results of the study. It is an additive feature which proves or disproves the investigator's assumptions about a phenomenon which has been examined.

According to Strauss and Corbin (1990; 1998; 2008), grounded theory methodology itself consists of the principles of data validation. Constant comparison help comparing different emerging concepts which are then confirmed when enquiring about those concepts in the following themes. Various authors such as Parry (1998), Glaser (1978; 1992; 1998) and Charmaz (2006) have acknowledged that data validation procedures are incorporated within

principles of grounded theory methodology. Grounded theory methodology is based on the principles of abduction in which the researcher collects the data, analyses it and then on the bases of the emerging concepts further goes in the field and this process continues until saturation is observed.

As the researcher has mentioned in the section 4.4.3 that some of the qualitative principles were introduced in this study to fulfil academic requirements, therefore member checking criteria included going back to the participants, getting formative feedback and validating the findings. Participants were randomly approached again, and the aim was to allow a maximum number of participants to respond so that the member checking process could be performed comprehensively. Three participants agreed to have a Skype meeting while one of the participants who was based in the UK preferred to have a face-to-face meeting. Similarly, another method implemented was sending an abstract of the findings including some structured questions to participants so that whoever did not have time for a live meeting might be able to give formal comments about the work produced. This strategy was also used keeping the supervisory team into confidence. The researcher, in order to avoid bias, contacted several participants from various regions to get diverse feedback. Table 6.8.1 shows the details of the participants who responded and supported addressing the credibility issue.

Table 6.8.1: Participant Details for Member Checking

Participants	Method	Region	Means
Participant 7	Interview	UK	Face-to-Face
Participant 8	Interview	Pakistan	Skype
Participant 17	Interview	Pakistan	Skype
Participant 24	Interview	UAE	Skype
Participant 16	Feedback Form	USA	Email
Participant 20	Feedback Form	Pakistan	Email
Participant 25	Feedback Form	Pakistan	Email
Participant 10	Feedback Form	Pakistan	Email

On returning back to participants for verification, the participants acknowledged the overall effort of the researcher and regarded it as most suitable to the context of Virtual-Agile projects. The discussion time for all four interviews was 25–35 minutes. A structured type interview was used so that feedback could be attained on every aspect (concepts and categories). For the Skype meetings, the researcher's personal computer screen was shared with the respondents so that they could read, understand and go through the results in detail. The researcher showed his final framework and described about the working concept of the phenomenon of the Responsiveness. Similarly, in the face-to-face meeting with a UK participant, a brief summary of the findings was given to the respondent beforehand to read, and when ready, a formal session of discussion was initiated. All the four live meetings were recorded as evidence. During all of these four meetings, most of the respondents fully agreed with the findings of the study. Consequently, with the help of feedback the researcher came to know about the productivity of this work. However, some of the respondents critiqued and provided minor suggestions to be included in a few categories.

While discussing about the overall results of the study, a few participants mentioned the following points:

- 1) *"Responsiveness is one of the key factors in any kind of project management especially in Agile when you are delivering projects with virtual team members I really find it very interesting and obviously very useful, you have had almost everything covered. The very good thing about your findings basically is that it is truly based on practical findings not exactly theory based or something like that, so that was really good and interesting. I do not think there is any drawbacks but would like to see it in final draft."*[P17]
- 2) *"I am impressed by the work and detail which has been shared with me. It is a very different way of looking at the operating risks Having read the information, obviously it is very detailed. Findings seems to be complete in terms of couple of three pages I have reviewed. I think it shows a lot of hard work, a lot of focus in the correct area."*[P7]
- 3) *"Responsiveness is quite interesting as it encapsulates the communication, the timeliness and the technology within the Responsive cube {box} or deep paradigm... As we are talking about this iterative process in these findings and evaluation document, so it helps to see how critical are these three dimensions, and together how they come to form a Responsive Matrix."*[P8]
- 4) *"Yes, I definitely agree with the proposition of Responsiveness. It's an attribute of an organization that refers to the perceptive, reflective and adaptive capacity of the team. In planning stages, we can use the experience of stakeholders to identify the issues, and to understand and make sense of those issues, before finally diving into responding to the issues."*[P25]

Similarly, some of the participants gave a few suggestions or contradicted or partially agreed with some of the findings. Participant 24 advised that particularly for Progress Reporting

under Knowledge Transfer, an appropriate person and communication channel should be defined so that information does not get lost. He gave an example by mentioning that if a CEO or senior-level director receives hundreds of emails on a daily basis, then they might not be able to respond to those. Similarly, participant 20 while giving the feedback regarding the timeliness factor of Responsiveness mentioned that

"Partially agree, Timeliness is important to deliver on time, but in some cases, it is not the crucial part."[P20]

Overall, the verification of the results has added credibility to this study. The researcher has welcomed the criticism over a few aspects and finally after discussion with the supervisory team, as they were minor in nature it was decided to overlook these points at this stage due to the time constraint.

b. Tactics to help ensure honesty of informants

Another factor which helps to attain credibility in qualitative research is to ensure honesty in the informants' attitude. Every participant who was approached has been given an opportunity to express their consent for participation in the study to ensure that the participant genuinely wanted to participate in the study without any restrictions. In this regard, all the 25 participants selected were sent a Consent and Information sheet via email before the data collection sessions. This allowed storing records of each participant with their original signatures, both electronic and handwritten. Additionally, before the proceedings of the interview sessions, the researcher highlighted the terms and conditions, mainly getting their willingness to participate and informing them of their right to withdraw at any stage of the interview or research project. Similarly, it was also mentioned that the data shared will be kept highly confidential and would be shared with examiners or the supervisory team if needed. This provided each participant a secure and free environment to

talk, providing them maximum opportunities to express their thoughts and experiences about the phenomenon.

c. Peer scrutiny of the research project

During the course of the research study, the researcher has always welcomed feedback from his colleagues and alumni who were studying at the same level. Regular discussions have been undertaken to discuss several aspects of the projects. This helped to attain critical reviews of other Ph.D. scholars which supported in highlighting critical points of the research. For example, during the first year of the study, the researcher consulted a few individuals who have used grounded theory as their methodology for research. Similarly, for discussions related to analysis and findings were also carried out to brainstorm and get diverse viewpoints time to time. Some of the other activities which were carried out during the research study period were participation in academic conferences and publishing in a journal. Details are already available on the introductory pages of this thesis.

d. Frequent debriefing sessions

During the 39 months of this research study, frequent meetings were held with the supervisory team to discuss every decision and action before implementation. The support of the supervisory team helped a lot to learn the methodology and coding procedures. Consequently, during these 39 months of the study, meetings were held as required; sometimes once or twice a month or even weekly. Minutes were recorded for each meeting and uploaded to the supervisory meeting records on the university's website. Similarly, records in the form of MS Word files were kept and shared with all the supervisors within three to five working days of the meeting. Similarly, the data interpretations and emerging ideas were discussed with the supervisory team from time to time so that it helped to avoid biases and the researcher's own preferences about developed framework. Several times the opinions of the supervisory team were considered to ensure that the data interpretations

represent originality. Amendments were made as per recommendations with empirical evidence which helped to achieve the goal of this study. The researcher apart from his supervisory team has attained extensive support from the expert research fellows in the university. Similarly, a few of the fellow Ph.D. colleagues who were applying qualitative methods or grounded theory methodology were brought into consideration to look at the coding procedures and express their thoughts about the interpretations of the data. These were some of the strategies used to build up credibility of this research study.

6.8.2 Transferability

The second aspect to assess the trustworthiness in qualitative studies is to address the subject of transferability. According to Merriam (1998), transferability, which is like external validity, is the range to which the results of the research can be applied or transferred to other contexts or settings. Lincoln and Guba (1985, p.16) further elaborates transferability as

It is, in summary, not the naturalist's task to provide an index of transferability, it is his or her responsibility to provide the data base that makes transferability judgments possible on the part of potential appliers.

Lincoln and Guba (1985) further recommend providing thick descriptions of the phenomenon. Thick description in qualitative research is a method of assessment where the researchers provides robust and detailed account of their experiences during data collection process. Thick description includes researcher's experiences during interaction with the cultural and social contexts. This also includes highlighting several aspects of the social world providing a detailed and richer understanding of the research setting. The researcher believes that the issue of transferability has been presented constructively in this thesis. In Chapter 4, specifically in the Sections between 4.4 – 4.11, the researcher has discussed and highlighted various aspects of the data collection process, and his interaction details with the

respondents during interviews. These sections provide readers with authentic and rigorous information from the very beginning to end of the data collection process.

6.8.3 Dependability

According to Shenton (2004), dependability is to ensure that if the work is repeated using the same procedures, methods, participants and context, the output would come out the same as the original study. Fidel (1993) argued that qualitative studies always face problems of showing dependability due to the changing nature of the phenomenon under study. Shenton (2004) further explained that the research design should be elaborative enough to demonstrate the procedures so that a future researcher may use the same kind of methods to generate similar results. The issue of dependability has been dealt with in detail in Chapter 4 and Chapter 5 where the process of data collection and analysis are discussed. Chapter 4 includes a description of decisions and steps undertaken to initiate the study, e.g. enhancing theoretical sensitivity, reflexivity, defining the unit of analysis and the major sources of data collection. Similarly, Chapter 5 comprises all of the descriptions related to participant selection criteria, sampling techniques, interview questions and version types, and then discussion of each emerging category with a few examples related to the emergence of various concepts. The memo-database also represents the thoughts and ideas which were recorded against every sub- and main category during the analysis which later helped to generate the theoretical framework. Similarly, the open, axial and selective coding procedures have been discussed in detail to show when and where the categories evolved and how they emerged from the data to take the form of a model. Hence, the researcher can claim that by following the procedures in Chapters 4 and 5, the work can be repeated, but variations are expected due to the investigator's own experience and interpretations of the original data.

6.8.4 Confirmability

According to Miles and Huberman (1994), confirmability is the extent to which an investigator accepts their own biases during the research study. The researcher must be able to demonstrate that the results produced are the opinions and ideas of the original respondents, rather than their own preferences or interpretations. Shenton (2004) further added that it is crucial to address this issue to demonstrate an audit trail which gives the reader an opportunity to review the decisions made step by step during the investigation. For this research study, the issue of confirmability has been addressed extensively by the researcher in Chapter 4 where he showed evidence against the emergence of various concepts, categories and core category. Chapter 5 also includes detailed information and evidence from the data for each concept and category shown with original participant quotations. The critical evaluation of the findings in Chapter 6 has also helped to attain confirmability in the generated concepts and categories. Discussion over various aspects of the paradigm with the help of other authors' views helped to signify the researcher's interpretations and understanding of the phenomenon. Without any personal bias, evaluation of the findings was undertaken to highlight both the strengths and weaknesses. The themes or concepts which have not been discussed in the literature were highlighted and a few of the concepts which did not emerge from this study were considered and acknowledgement was made accordingly at every point. The researcher has tried his best to limit biases in the study but accepts due to some limitations and constraints that he took some decisions which could have restricted him from capturing rich information as there was no other option than to accept the developing circumstances.

During the initial phases of the study, it was decided by the supervisory team that all the respondents should be anonymous to avoid bias in the selection of participants. This action will help the readers to assess that the selected participants were genuine and not influenced by any personal bias. As most of the time theoretical sampling technique was

applied, the researcher would like to acknowledge that participants# 7, 17, 19 and 20 were from his professional circle. By professional circle, the researcher means to say that there was hardly any contact with those participants after completion of undergraduate and postgraduate studies. All the participants were from researcher's previous educational institutes and they were approached through LinkedIn platform to participate in the research study. According to Qu and Dumay (2011), qualitative interviewing may involve collecting data from the participants who could have a relationship with the researcher. Qu and Dumay (2011) further acknowledged that there is no harm in gathering data from such participants as long as they fulfil the ethical requirements and specification criterion. An example of this can be taken of Adams's et al. (2002) research when they conducted in-depth interview with their family doctors to explore the reasons why doctors limit the number of elderly people for whom they provide care. DiCicco-Bloom and Crabtree (2006) further specified that conducting interviews with closest relationship participants sometimes help to acquire sensitive information which cannot be gathered from anonymous people. They further highlighted that interviewing with such people also supports to attain rich and rigorous information which helps developing desired conclusion. Consequently, the researcher didn't omit the options for using other methods such as observations or focus-groups as specified in section 4.6.1. The main reasons for selecting participants those participants were their ability to contribute in the research study and recording useful insights of their experiences. All the participants were well-informed and well-experienced, and fulfilled the criterion defined in Chapter 4 for selecting the participants. They all were leading projects, well-experienced in their fields and had sufficient experiences to share. Keeping in view the ethical considerations, the research decided to approach the participants from his professional circle and attained several useful insights as mentioned in the Chapter 5 and 6.

Another aspect to show confirmability is the ability to demonstrate an audit trail. For this study, the researcher has maintained and secured all the records which can be asked for review at the examination stage. This includes all the records of meetings with supervisors and decisions undertaken, all the interview audio recordings, transcriptions, contacts with participants through emails and social networking websites, records of memos and field notes, records of open, axial and selective coding procedures, records of how the process of constant comparison was performed, records of journal databases, records of participation in academic conferences and presentations, records of validation in the form of audio recordings and feedback forms, signed consent forms pre- and post-findings: all the material has been secured for evidence, and the researcher will be pleased to provide any of them to the examiners of this study. The following figure the activities over the period of 39 months taken step by step by the researcher.

Table 6.8.4: Research Plan Over 39 Months Study Period

Activities	2014		2015												2016												2017												2018							
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb						
Pre & Post Literature Review																																														
Methodology Review																																														
Write-up of PP1 Document																																														
Points Progression 1 Submission & Viva																																														
Changes in PP1 Document (From viva)																																														
Approval of Research Ethics																																														
Interviews Conducted																																														
Transcription and Analysis of Interviews																																														
Participation in UoB Annual Conference 2016																																														
Data Collection Tour Pakistan & Middle East																																														
Write-up of PP2 Document																																														
Points Progression 2 Submission & Viva																																														
Changes in PP2 Document (from viva)																																														
Working on conference papers																																														
Submission to BAM conference																																														
Submission to IJIMT Journal																																														
Submission to MIC Conference																																														
Visit to Italy for conference																																														
Visit to Warwick for conference																																														
Write-up of the Final Thesis																																														
Submission of Thesis Drafts to Supervisors																																														
Submission to Journal of Risk and Uncertainty																																														
Post Theory validation																																														
Submission of Final Thesis																																														

6.9 Summary

This chapter has elaborated the post-findings actions that were undertaken to review the literature again and help develop the conceptual framework. The chapter highlighted various conventional and software approaches to risk management previously elaborated by the well-known authors and various body of knowledges. Critical evaluation of the concepts and categories have been undertaken in detail to demonstrate the strength and weaknesses of the developed paradigm. The chapter also has demonstrated the appropriateness of the findings in relation to numerous contexts of Virtual-Agile projects which further helps to understand the applicability of the developed paradigm. The chapter also in the last showed actions undertaken for ensuring the trustworthiness in the study and provided a detailed overview how the actions were undertaken to ensure credibility, transferability, dependability and confirmability of this research study. The chapter thus provides readers a detailed outline of the findings evolved after conducting this study.

CHAPTER 7: CONCLUSION

At the end of this study, the researcher would like to highlight a brief summary of what has been achieved, the key outcomes, limitations and constraints, and some of the recommendations for future research. The chapter will also provide readers an outline of where the developed paradigm stands, and how well it addresses the research aim and objectives.

7.1 Overview of the Study

This research study was based on exploration of strategies/practices which could help overcome risks and uncertainties in Virtual-Agile project environments. The main goal of the study was to develop a substantive-level theory by getting involved with experienced participants and professionals who had been extensively involved in the management of such project environments. A total of 25 interviews was conducted in different regions, namely, the United Kingdom, Germany, Pakistan, the UAE, the USA, Kuwait and Romania to get multiple insights into the phenomenon. The research methods used were primary dependent upon qualitative methods combined with the application of grounded theory methodology. Grounded theory methodology allowed a more systematic approach and helped to collect and analyse data simultaneously, depending upon the principles of theoretical sampling and constant comparison. The benefits which grounded theory brought to this study were mainly an in-depth analysis of the empirical evidence, where the data was examined using word-by-word and line-by-line reading of the transcripts. The data was arranged and re-arranged several times during open, axial and selective coding stages to determine links between each emergent concept and category. Further, the process of analysis helped to identify the central phenomenon of Responsiveness which has been found to be the basis to overcome risks and uncertainties in Virtual-Agile project environments.

Responsiveness which is dependent upon three interrelated components of Technology, Timeliness and Communication, supports the development of a proactive system where the project entities can create a strong web among them being dispersed at various locations. Responsiveness influences formal risk resolution practices in which the entities can undertake risk management planning and respond to risk events in the implementation phase; depending upon efficient utilization of technology, timeliness and communication. Consequently, the three interdependent components have a central role in the reduction of such evolving uncertainties. All the activities, happenings and events evolve around these three components and therefore must be efficiently managed by managers and organisations to control potential risks. Thus, the results of this study were found imperative and simplified after the evaluation, which led to the development of the paradigm of Responsiveness.

7.2 Referring to Research Problem/Gaps and Objectives

After the evaluation of the findings, the researcher can deduce that various characteristics emerged which have not been discussed extensively in the literature. The use of grounded theory methodology provided an opportunity to the researcher to think from a broader perspective and bring all the real-life practices into consideration rather depending upon pre-assumptions or pre-conceptualizations. Consequently, the researcher has discovered various concepts and categories which elaborate the phenomenon of Responsiveness more explicitly.

Referring to the research problems, where 1) Agile methodology brought several challenges to organisations in virtual format and 2) the existing risk management approaches were dissimilar from the ones essentially practiced in the software development industry, the researcher can claim that the conceptual model generated has well addressed the research problem by highlighting various dimensions of the risk management practices of software

development projects. The findings thus highlight that the risks can be reduced, controlled or eliminated when organisations have a Responsive or proactive system in place which could better understand the events, happenings or proceedings of Virtual-Agile project environments.

Being distributed from their base location and working under the constraints of time, cost and quality, as per every basic project, the intensity and frequency of remaining proactive towards the project environment are actually a solution to reduce uncertainty level, thus, eliminating the chances of risks. Similarly, the software industry at the moment does not primarily emphasize the risk management procedures, rather they have taken predetermined measures to eliminate and reduce risks when they normally occur. It cannot be said that they totally ignore such practices, but they give less emphasis to formal tools and methods. They undertake risk management planning during meetings at various levels, where they estimate, assess and plan responses, and respond and review results in relation to a risk event; but the point is they mainly depend upon effective management of the three components of Responsiveness. Technology, Timeliness and Communication play an active role throughout the project lifecycle, which ultimately supports undertaking of every activity proficiently. Being distributed and isolated at several locations, the tendency to understand the situation and then act upon it is actually the explanation to deal with evolving issues and risks. The participants have emphasized several times that there are no particular formal practices or tools which are to be applied; rather they focus on creating Responsiveness in the project environments. The stakeholders of the project can utilise methods from the various project management standards but still, it requires awareness and mindfulness about a current or forthcoming problem. The researcher to the best of his knowledge can also deduce that the findings provided in this thesis are actually grounded in the data and represent participants' viewpoints, that were compiled during the data collection and analysis process.

There were three objectives defined as per the section 1.6 for this study. Those were,

- 1) To explore the most critical risk areas/factors which disrupts the Virtual-Agile IT project environments
- 2) To explore strategies and practises which could help to overcome risks and uncertainties in Virtual-Agile project environments.
- 3) To propose a framework which could guide project managers and organisational leadership and further contribute in the literature of risk management.

Referring to the **objective#1**, several risk factors have been explored (as in Table 5.5) which demonstrate the existing complexities and potential issues for the IT organisations when undertaking Virtual-Agile IT projects. These risk factors also provide direction to the organizational leadership, planners and board of directors to consider various dimensions when undertaking multiple projects. As the Virtual-Agile IT projects are a collaboration and interaction of various environments, individuals and cultures, there are expected challenges and issues which can disrupt the desired outcomes. The risk factors thus help the project manager to undergo the project planning keeping these complexities under consideration. The risk factors explored also provide contemplation to the issues which are not paid considerable attention in the co-located projects.

Referring to the **objective#2**, it has been examined that project managers from various regions and organizations are giving certain attention to the aspects identified as 'codes' and 'concepts' from the data (Table 4.16). It has been found that organisations and project managers should improve their practices and develop strategies to managing technological aspects, adhering to timeliness and improving communication for overcoming risks and uncertainties in Virtual-Agile project environments. If project managers and organisational leadership can effectively manage the technological aspect and timeliness and understand the dimensions of communications, there will be less chances of occurrence of risks, and

even if there are some possibilities, Responsiveness helps undertaking risk management procedures depending upon team or project stakeholders' experience, understanding and awareness of the situations; where they can predict, analyse and propose an action to upcoming complications.

Referring to the **objective#3**, which was related to the development of a framework has been achieved successfully by representing the findings in the form of the conceptual framework as shown in figure 6.6.1; where a system depending upon technology, timeliness and communication is shown and further its influences on the formal risk management procedures have been demonstrated. The framework has been emerged in the form of paradigm recognised as 'Responsiveness' which is the core of dealing with risk and uncertainties. Responsiveness depending upon three interdependent characteristics overcomes unexpected problems, and then further depending upon these three components supports the project entities to do risk management planning and act upon any uncertain situation during the risk management implementation phase. Thus, the exploratory nature of the study helped to create a paradigm of Responsiveness, elaborating various dimensions and guiding organisational leadership of the potential issues and challenges.

7.3 Main Contributions of the Study

The emerged phenomenon has contributed to the literature in several ways. These contributions will help determine future prospects and areas of research for the current scholars and researchers in academia. The researcher can claim that the results of this study are more pertinent to the project stakeholders who are in decision-making and planning positions, such as organisational leadership, project managers, senior-level directors and team leaders. The attained contributions according to their nature are categorized into following classifications.

- **Theoretical Contributions**

The theoretical contributions of this study are discussed as follows.

- 1) Firstly, the development of the paradigm has helped to demonstrate the actual industrial practices undertaken in the software industry which helped to address the major gap identified by Keshlaf and Riddle (2010). Similarly, the call for in-depth research in the similar area by Hossain et al. (2009) and Vijayaraghavan et al. (2014) has helped to explore more effective strategies to support the use of Scrum methods in global software development and look for better risk management practices in largely closed-couple distributed Agile projects, respectively.
- 2) One of the major contributions of this study is the introduction of the term 'Virtual-Agile' which focuses on different variations of the Virtual-Agile contexts (discussed in section 6.7). Previously, in the literature different variations of such contexts have not been highlighted or discussed extensively. Previous authors have focused only on the distributed teams rather considering their relationship with the organisations and particular regions. The researcher, therefore, can claim that this is the major contribution from a theoretical perspective.
- 3) Similarly, the developed paradigm can benefit researchers and scholars from academia who further want to test the developed framework in different settings or regions. Such types of future research will help estimate the applicability of the findings in different contexts.

- **Practical Contributions**

The practical contributions of this study are demonstrated on the basis of post-findings validation where the respondents have shown keen interest to apply the developed paradigm into their organisations to reduce risks and uncertainties. As the findings cover diverse aspects of such environments, the researcher on these bases can claim its application in Virtual-Agile projects. The framework presented in Chapter 6 is a contribution that can be

used as a practical tool to guide managers, decision-makers and senior project stakeholders while undertaking Virtual-Agile projects. The explanations in Chapter 5 will help them to know the risk areas and responses that could be implemented. The study will also support novice project team members and individuals building their knowledge level, and understanding their required pattern of work, and abilities necessary to achieve project targets.

7.4 Limitations and Constraints

Limitations and constraints are always the part of a research project. The researcher after achieving the scope of this study accepts some of the limitations and constraints that were involved during the research process as discussed here.

Limitations

- As the research study was mainly conducted in different regions of the world, finding and getting access to participants was difficult as the researcher could not travel to different time zones for data collection. Communication with them by video conferencing tools and telephone was a somewhat problematic as well, as most of the respondents were entirely unknown to the researcher. The researcher accepts that in a few interviews due to interruptions or breakdown of line, the capturing of information while writing field notes might have been affected. Similarly, the disruption sometimes caused a distraction or infrequent flow of information between the interviewer and respondent.

Constraints

- Grounded Theory study requires a lot of time to collect and analyse data. This was due to the fact that at several stages the researcher was unable to follow his time plan and therefore has to put extra effort to meet the deadlines. As all the

transcriptions were done by the researcher himself, the researcher believes that hiring an external expert or specialist could have helped to overcome this limitation.

- Managing finance was also another major constraint together with the time. The researcher could have travelled to different countries for conducting face-to-face interviews but as his study was self-sponsored, he could not pay for travelling expenses and therefore had to conduct interviews using computer-mediated communication.

7.5 Future Recommendations

After conducting this research, the researcher believes that this study has highlighted some new in-depth perspectives that could be used for future research. As most of the previous literature focused on the application of tools and methods for managing risks, the researcher has presented a distinct concept of Responsiveness in the form of conceptual model. The researcher proposes that Responsiveness can help in avoiding, controlling and mitigating the risk factors by improving practices in dynamic project environments. Consequently, this study has opened new doors for future research and therefore some of the recommendations from the researcher have been compiled here:

- There is a limited number of studies in the context where risk and uncertainties are considered as two different aspects in a project environment. Future studies can be conducted to explore further about these two terminologies; study the contextual differences between these two concepts and the level of disruption they cause in the project processes.
- Comparative case study analysis can be undertaken to apply the proposed strategies from this study and the strategies already highlighted in the literature. This would help the researchers to compare and develop a stronger understanding of the consequences and required strategies.

- Future research can be undertaken to test the developed paradigm into different contexts, settings or organisations, and assess its applicability (quantitative studies).
- Future studies can be conducted to investigate the interdependency or influence of each sub-category (table 4.16) onto the main category, for example, the influence of Competency, Correlation or Team Satisfaction onto Timeliness or for some other categories etc can be studied using a more mixed-type approach.
- The literature available on risk management is mostly dependent on primitive and traditional theories. There is a sufficient gap available which requires researchers' attention to be filled with latest pragmatic approaches to managing risks in IT sector.
- Consequently, future research prospects can be to show the required variation of developed paradigm with respect to region, culture or type of project undertaken in Virtual-Agile environments. This will help to explore more insights and dimensions of the required level of Responsiveness in different contexts.

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APPENDIX – I: Consent Form, Information Sheet & Ethics Approval

PARTICIPANT INFORMATION SHEET

Research Study Title:

‘RISK MANAGEMENT IN VIRTUAL - AGILE PROJECTS’

INTRODUCTION

I am Hassan Amar, a PhD student at University of Bedfordshire. This information sheet is mandatory part before the interview proceeds. You are being invited to take part in this study. Before you agree to do so, it is important that you must understand the purpose and nature of the research, and the type of participation required wholly depending upon your consent. Please read the following information carefully, and please do ask if anything is not clear, or if you want more information about anything. Contact details are given at the end of this information sheet.

WHAT IS THE PURPOSE OF THE STUDY?

You are being interviewed as a result to explore appropriate approaches or practises required to control risk factors in virtual-agile projects. The purpose of the study is to explore appropriate practises or strategies which could help reducing risks and uncertainties in virtual-agile projects. The research is conducted in purpose to build a substantive-level theory which could highlight various practises when overcoming risks and uncertainties in virtual-agile project environments. Please have a look onto the following information,

WHY HAVE I (THE PARTICIPANT) BEEN INVITED TO TAKE PART?

As you have been working under virtual-agile project settings or have experience of managing projects and teams or providing consultancy or having a good knowhow about the working of virtual-agile projects, you have been chosen to help out in this research. Your experience and previous background is worth contributing in this study.

DOES TAKING THE PART IN THIS STUDY MANDATORY?

Participation is entirely voluntary. It is completely up to you to decide whether to take part or not. If you do agree to take part, you are required to sign a consent form. If you agree to take part and want to withdraw at any time before or after the interview, any information or data collected will not be used at all in the study.

WHAT WILL TAKING PART INVOLVE?

You may need to discuss about your relevant experiences and knowledge for managing virtual-agile projects efficiently. You will be asked to express your thoughts for managing risks, challenges and the type of techniques or methods or practises you prefer to utilize during the projects. The questions will be open-ended in nature which will provide you opportunity to express your thoughts and experiences extensively. You may add valuable comments, suggestions or highlights from original experiences to help data researcher getting rich data.

WILL MY PARTICIPATION BE CONFIDENTIAL?

All information collected during the study will be kept strictly confidential and stored in accordance with the Data Protection Act. The only people who will know information collection would be the researcher himself, director of studies, supervisory team or the examiners. All the data, whether electronic or paper or in any other form will be destroyed after the successful completion of my PhD Studies

WHAT HAPPENS NEXT?

Thank you for reading this information sheet. If you agree to take part, the consent form will be sent to you before meeting via email, so that you read and understand the terms and conditions of the participation. You are kindly required to sign the form and submit before the interview initiates. Please,

Note 1: *You will be given a copy of the consent form to keep.*

Note 2: *If you wish to complain about any aspect of how you have been approached or treated in respect of this research study, please contact:*

1) Dr Yanqing Duan (Director of Studies), **BMRI** (yanqing.duan@beds.ac.uk)

2) Research Graduate School (rgsoffice@beds.ac.uk)

University of Bedfordshire, Luton

CONTACT FOR FURTHER INFORMATION

If you are not sure about anything related to this meeting, or if you want more information, please do not hesitate to contact:

HASSAN AMAR

Mobile: +447456092543

Email: hassan.amar@study.beds.ac.uk/hazzankhan@msn.com

PARTICIPANT CONSENT FORM

RESEARCH STUDY TITLE:

'RISK MANAGEMENT IN VIRTUAL – AGILE PROJECTS'

Name of Researcher: HASSAN AMAR

Please tick the boxes to confirm each statement

I confirm that I have read and understood the Information Sheet dated [<i>date</i>] for the above study. If I have asked for clarification or for more information, I have had satisfactory responses.	<input type="checkbox"/>
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason.	<input type="checkbox"/>
I understand that relevant sections of the data collected from me during the study may be looked at by the researcher, director of studies and examiners	<input type="checkbox"/>

I agree to take part in the above study

Name of Participant	Signature	Date
---------------------	-----------	------

Name of Researcher	Signature	Date
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ETHICS APPROVAL

UNIVERSITY OF BEDFORDSHIRE

Research Ethics Scrutiny (Postgraduate Research Students)

When completing this form please ensure that you read and comply with the following:

Researchers must demonstrate clear understanding of an engagement with the following:

1. *Integrity* - The research has been carried out in a rigorous and professional manner and due credit has been attributed to all parties involved.
2. *Plagiarism* - Proper acknowledgement has been given to the authorship of data and ideas.
3. *Conflicts of Interest* - All financial and professional conflicts of interest have been properly identified and declared.
4. *Data Handling* - The research draws upon effective record keeping, proper storage of data in line with confidentiality, statute and University policy.
5. *Ethical Procedures* - Proper consideration has been given to all ethical issues and appropriate approval sought and received from all relevant stakeholders. In addition the research should conform to professional codes of conduct where appropriate.
6. *Supervision* - Effective management and supervision of staff and student for whom the researcher(s) is/are responsible
7. *Health and Safety* - Proper training on health and safety issues has been received and completed by all involved parties. Health and safety issues have been identified and appropriate assessment and action have been undertaken.

The **Research Institutes** are responsible for ensuring that all researchers abide by the above. It is anticipated that ethical approval will be granted by each Research Institute. Each Research Institute will give guidance and approval on ethical procedures and ensure they conform to the requirements of relevant professional bodies. As such Research Institutes are required to provide the University Research Ethics Committee with details of their procedures for ensuring adherence to relevant ethical requirements. This applies to any research whether it be, or not, likely to raise ethical issues. Research proposals involving vulnerable groups; sensitive topics; groups requiring gatekeeper permission; deception or without full informed consent; use of personal/confidential information; subjects in stress, anxiety, humiliation or intrusive interventions must be referred to the University Research Ethics Committee.

Research projects involving participants in the NHS will be submitted through the NHS National Research Ethics Service (NRES). The University Research Ethics Committee will normally accept the judgement of NRES (it will never approve a proposal that has been rejected by NRES), however NRES approval will need to be verified before research can commence and the nature of the research will need to be verified.

Where work is conducted in collaboration with other institutions ethical approval by the University and the collaborating partner(s) will be required.

The **University Research Ethics Committee** is a sub-committee of the Academic Board and is chaired by a member of the Vice Chancellor's Executive Group, appointed by the Vice-Chancellor and includes members external to the University

Research Misconduct: Allegations of Research Misconduct against staff or post graduate (non-taught) research students should be made to the Director of Research Development.

UNIVERSITY OF BEDFORDSHIRE

Research Ethics Scrutiny (Annex to RS1 form)

SECTION A To be completed by the candidate

Registration No: **1220710**

Candidate: **HASSAN AMAR**

Degree of: **Doctor of Philosophy (PhD)**

Research Institute: **BMRI**

Research Topic: **Development of strategic theory for Virtual Agile Risk Management (VARM)**

External Funding:

The candidate is required to summarise in the box below the ethical issues involved in the research proposal and how they will be addressed. In any proposal involving human participants the following should be provided:

- clear explanation of how informed consent will be obtained,
- how will confidentiality and anonymity be observed,
- how will the nature of the research, its purpose and the means of dissemination of the outcomes be communicated to participants,
- how personal data will be stored and secured

- if participants are being placed under any form of stress (physical or mental) identify what steps are being taken to minimise risk

If protocols are being used that have already received University Research Ethics Committee (UREC) ethical approval then please specify. Roles of any collaborating institutions should be clearly identified. Reference should be made to the appropriate professional body code of practice.

•	The informed consent will be obtained by having pre-data collection meetings (over telephone/skype/face-to-face) with participants in which the researcher will elaborate all those parameters written in the information sheet of the consent form. The terms and conditions plus all important information will be duly agreed by the participant and researcher. Additionally, the consent form will be presented to participants and read before the start of data collection meeting which will be recorded in the audio/video storage tape. Upon confirmation of participant and signing of the consent form, the questions will then be asked to participants.
•	(Answer to 2 & 4) All information about collected during the study will be kept strictly confidential and stored with password protections in usb drives or any form of multimedia accordance with the Data Protection Act. The only people who will know will be the researcher himself, director of studies and examiners. All data, whether electronic or paper written or in any other form will be destroyed after the successful completion of my PhD Studies
•	A pre-data collection meeting will define the aims and objectives of this research, its significance and their type of participation required for this study. Additionally, the outcomes and results of this research will be sent to them via email for validating the information.
•	If the participants are facing any type of ambiguity during any phase of the research process, they are allowed to leave and their information will not be used in the research at any time. The main steps involved to reduce the risks element will be 1) Ask time-to-time to participants during the data collection meeting and research journey that if they are happy to proceed. 2) To ensure that participant is not under any form of stress (work or personal) before the start of the meeting 3) if the participants leaves the meeting, ask them if they are happy to continue later on or want to withdraw 4) give time to participants to contact back within one or two weeks; if they do not send them email 5) all the problems predicted or occurred, discuss them with supervisor at all times 6) finding a substitute for data collection 7) finding and making contacts with concerned individuals

Answer the following question by deleting as appropriate:

1. Does the study involve vulnerable participants or those unable to give informed consent (e.g. children, people with learning disabilities, your own students)?

Yes **No**

If **YES**: Have/will Researchers be DBS checked?

Yes **No**

2. Will the study require permission of a gatekeeper for access to participants (e.g. schools, self-help groups, residential homes)?

Yes **No**

3. Will it be necessary for participants to be involved without consent (e.g. covert observation in non-public places)?

Yes **No**

4. Will the study involve sensitive topics (e.g. sexual activity, substance abuse)?

Yes No

5. Will blood or tissue samples be taken from participants?

Yes No

Will the research involve intrusive interventions (e.g. drugs, hypnosis,
6. physical

exercise)? Yes No

Will financial or other inducements be offered to participants (except
7. reasonable

expenses)? Yes No

8. Will the research investigate any aspect of illegal activity?

Yes No

9. Will participants be stressed beyond what is normal for them?

Yes No

10. Will the study involve participants from the NHS (e.g. patients) or participants
who fall
under the requirements of the Mental Capacity Act 2005?

Yes* No

If you have answered yes to any of the above questions or if you consider that
there are other significant ethical issues then details should be included in your
summary above. If you have answered yes to Question 1 then a clear
justification for the importance of the research must be provided.

*Please note if the answer to Question 10 is yes then the proposal should be
submitted through **NHS research ethics approval procedures** to the appropriate
NRES. The UREC should be informed of the outcome.

Checklist of documents which should be included:

Project proposal (with details of methodology) & source of funding	
Documentation seeking informed consent (if appropriate)	
Information sheet for participants (if appropriate)	
Questionnaire (if appropriate)	

(Tick as appropriate)

SECTION B To be completed by the Research Institute Ethics Committee:

Comments:

The BMRI Research Ethics Committee has considered your application for Ethics approval for your research project, and is satisfied that you have taken adequate care of ethical requirements. Therefore, I am happy to provide ethics clearance for this project in my capacity as the Chair of the BMRI Ethics Committee. While executing your project, please ensure that you adhere to the ethics principles of the University

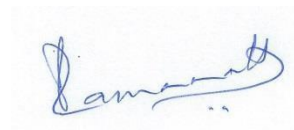
(<https://www.beds.ac.uk/research/rgs/research-ethics>) at all times.

Please note that if there is substantial change in your research project, you may have to seek ethical approval again.

The BMRI Research Ethics Committee wishes you success on your interesting research project.

Since this project is not externally funded, this clearance is not forwarded to the University Research Ethics Committee for further approval.

Approved.

A handwritten signature in blue ink, appearing to read 'D. L. Smith', is written over a light blue grid background.

Signature Chair of Research Institute Ethics Committee:

Date: 01 September 2015

This form should then be filed on the student's record

If in the judgement of the committee there are significant ethical issues for which there is not agreed practice then further ethical consideration is required before approval can be given and the proposal with the committees comments should be forwarded to the secretary of the UREC for consideration.

There are significant ethical issues which require further guidance

Signature Chair of Research Institute Ethics Committee:

Date:

This form together with the recommendation and a copy of the research proposal should then be submitted to the University Research Ethics Committee

APPENDIX-II: Interview Questions

Semi-Structure Style: Basic Interview Questions

- 1) Can you tell us about your experience in relation to virtual-agile projects?
- 2) What are the challenges and issues you face in those projects?
- 3) How you use to manage those issues or challenges?
- 4) What are the other challenges or issues you face in agile projects?
- 5) How you managed them?
- 6) What is the impact of agile methods in virtual projects?
- 7) Out of the issue identified, what issues or challenges can be recognised as potential risks?
- 8) What methods or tools you use for risk management?
- 9) How does the risk management process work in virtual-agile projects?
- 10) How the risk management can be made more effective?

APPENDIX – III: Transcript Sample

Interview # 25

Interviewer

Hello this is Hassan Amar. Today is 26th of August 2017. I am a student of University of Bedfordshire and today with me is Mr. Participant # 25 who is a project manager in one of the leading software industries in Pakistan. So, before starting with the interview, I would like to highlight the terms and conditions of the interview. This interview will only be used for the research purpose and shall only be shared with the examiners and the reviewers. If any point Mr. Participant # 25 wants to leave, so it is not mandatory for him to continue till the end of the interview. So, Mr. Participant # 25, first of all I would like to thank you for lending me some time. So, can we please know about your experiences in relation to the virtual-agile project environments?

Participant

Ok, currently I am working at two different places and then we are following agile methodology and then we both have sprints and KANBAN going on. Before then I have been working for during under the same methodology for about 4-5 years now. We do have virtual teams, currently, we have teams in Germany and USA, plus in Pakistan. So, we do collaborate you know virtually, or you know over the phones or skype is one of the medium we use and then we have Google hangouts we have Zoom. So, that's how we communicate in and between the teams.

Interviewer

Ok and what sort of projects you have actually dealt in virtual agile project environments?

Participant

They are mostly related to IT and software. Fewer projects that I am taking over, I mean looking for towards right now is: one is related to educational one is the educational software, other is health management and the third one is mostly related to software industry covering the websites, analytics and then OCRs, like where you can read the documents using the OCR (Optical character recognition).

Interviewer

Ok, so you mentioned that you are dealing with some of the IT and the software projects; so, can you give us a brief detail. I know that some of the things are you know confidential and data protected, but if you would like to give us a brief highlight of those projects?

Participant

Sure, so starting off with the first one; the first is OCR related, in this we are building an app which would read the documents and also have the 2D 3D object recognition. So, you will turn on the camera of your cell phone and then if you point to a document it will tell you if it's a hand written or if it's a document type using a type front. If it's an object, it will take you to the second option which is a 2D or 3D object and you will recognise what objects you are pointing the camera towards to. And then further links in the camera we can use the same thing too. It's also, been used in postal services right now, where they can get the addresses from the envelopes and they can automatically do the sorting of that; it's also being used staples America or for back to school things where students are handed over let's say of book or the stationary list, and then people in staples company they use their devices, they just scan and then everything gets purchased pretty much online or just it's just pretty much quick. You don't have to go through every section and pick up things from there. If let's say, I need a marker and if the document say markers, then it will tell you

different types of marker available online. You can just click one and then order from there right away.

The second project that I am dealing with is health management. It is related to basically: it has management system which includes OPD and clinic apps which includes test, profiles. Anything basically end to end, checking, walking in customers, getting their check-ups done, getting their test done and then in the very end getting them signed from the doctor; getting the prescriptions to the pharmacy directly and in the very end picking up the medicine from the pharmacy. So, that is the system we are building right now. And in the third is the education related system in which we have basically the whole school system includes scheduling, classrooms, examinations, library, payroll, fees, attendance; that's a pretty much big portal for students, faculty members, parents as well so they all have one stop shop for everything where they can communicate collaborate through.

Interviewer

Ok, that's great Mr. Participant. So, can you also tell us who are the you know teams which were actually involved in these kinds of projects. Where they were based? Can you please tell us more?

Participant

Ok, so right, so we have offices in US as I mentioned earlier

Interviewer

Ok

Participant

There is an office in Germany as well and then the development office. The technology office is mostly based in Pakistan. So, the whole development team let' say designers, developers, databases, network, infrastructure, securities, servers; all those tech people are

setting in Pakistan 90%. There are some people who are in US and then there are some people who are in Germany. So people in US and Germany are mostly clients focused. Sales and marketing people, account managers, people who broaden the market, do the demos and do the market analysis and all these sort of people. So, they get the requirements from the clients, from the customers and they let us know what the new trends in the market are? What are the things required by the clients? Clients ask about the current software and this is something we would like to see in our product or project or application that you are using.

Interviewer

Ok, Mr. Participant you have been dealing with off course two or three offices worldwide, so, can you tell me what are the major challenges or issues you normally face during these projects?

Participant

Right so, one of the really basic challenges we face every day especially these days communication with the clients that are not in the same time zone or the people or say teams who are not in the same time zone. A lot of people in Pakistan, they have reservations that we cannot come in or we cannot come out let's say for a meeting at 9'o clock or 9:30, which is the day time in US or somewhere around the evening time in Germany, so we need basically I need. I am the person who is actually the scrum master or the agile coach. I am the person who is acting bridge between all this.

Sometimes, people are skipping the meeting, I am the one to take meeting notes, get them uploaded to server. Then from there people who missed it, I usually do a follow up with them. Have on one on one with them next day. Just to be sure that they know what's required. Plus I also have a strong communication things going on with the teams in Germany and US as well. I do collaborate with them pretty much in everyday basis. We

have one on ones every day or every other day. My main job is basically to communicate and collaborate things. We have stand ups every day. So, we try to you know have on a time where maximum people can attend. So normally, we have two standards. One is the 10'o clock in Pakistan time 10 in the morning 10 A.M. and then we have another 9'o clock P.M. Pakistan time. So, that's the one in which US people joins and the Germany people joins as well.

Interviewer

Ok and how apart from these two or three challenges, what sort of other challenges or issues normally face which you say ok, they occur after a quite you know long time but they have got a little importance in these types of projects?

Participant

We do have infrastructure issues at times. For example, you know recently we had the internet break down of the optical fibre under the sea you know that broke down and then we were sort of we had a data packet lost and then 50% of internet connectivity was low. So, in situations like this we sort of get cut from our virtual offices in Germany and America. So, we usually just get to have a meetings like written in type over the internet. We cannot have a voice or video call and then specially if there are servers that are based per host in Pakistan, and then people in US were trying to access it, so, we do have downtime for that. So, you know power and then culturally we say we have things going on and they normally casual about work schedules. They commit to something and they do not deliver, so you know there are all these chances. You know there are all these challenges we face especially while you know we here.

Interviewer

Ok, so Mr. Participant how do normally manage these issues and who are the people involved in management of such sort of process management?

Participant

We normally have one scrum master per team. So, let's say if you have three or four different projects going on so, we do have one scrum master looking over on all those things, plus they are all heading this as well. So, we normally have two to three people per team who are really active in communication and collaboration. Who are really on the toes when it comes to keep an eye on emails, alarms and triggers on the servers if they are going down? Or if we have any performance issue on the live website. So, when you have few people who are special accesses and then you know who can look at the emails and triggers if something bad happens.

Interviewer

Ok, as you know that agile was like initially developed for the in-house projects. So, what difficulties do you find you know when you know you are undertaking the agile projects in the dispersed way or virtual way?

Participant

My primary concern is always being about the communication because people are there, especially in Pakistan's office, they normally try not to communicate too well especially when it comes to the projects when it comes to raising the flags, when it comes to raising the risks. They normally send out of the very end day of the sprint and then say that this is not being completed. So, you know I see lacks a lot of times and then what I do solve them is I keep asking them keep communicating them with them on everyday basis. I have my one on ones you know pretty much everyday with the whole team. I make sure that I get to participate in the stand ups to make sure that they are communicating and communicating

well with everybody. So, that everybody stays in the same page. Nobody stress on the information. They transmit, and they pass it on if there is something.

Interviewer

Ok and you know of course you have been going through virtual-agile environment, so, what do you think that what is the impact of the agile methodology onto that you know virtual bit, or you know distributed type of projects?

Participant

in what sense?

Interviewer

Whether are there any benefits or limitations if you want to highlight any of them?

Participant

Right so, what happened to the lot of the times that, let's say there are teams sitting in different offices you normally do not know what's happening in the other office. If there is a power failure. If there is something else going on in other office. If I require something from a person in US. May be that person is off and I have been waiting for let's say design from his end and then again that person off for two days. So, so we do have limitations then there is nobody in the US office that can cover those things and then strange ends you know on a very fixed day. So, we normally have sprint failures in these cases where things are not delivered on time and then we do discuss those things in retrospective. For example, we had server issues or designs were late or if we have any you know wrong estimations and planning. If we had any story or task extra time as what we suppose and planned it be for so, all those sorts of things are kept in mind and discussed in retrospective as well, that these were the limitation and these should not be happening again, so, the process where

we keep you know improving the things from our end and whatever the limitations we try that if it happens once we should not try to have it again.

Interviewer

Ok, so, do you think that in the virtual-agile type of projects process you need a higher level of interaction or communication?

Participant

I would say yes. I mean it's sort of a backbone. I mean if the teams are not communicating especially if they are working together on a project in a sprint, they probably may not be able to deliver what they had planned for. Right now, we do have dependencies that the designs will be coming from the US people since they are customer facing and client facing. They normally interact with them, get the design made and get the design approved from the client. So, if that's getting late we do have issues from our sprints when they get delayed. So, I think communication is a key, at times we do have issues with power, with internet, resource availability or resource utilisations. So, we do get some limitations when we come to the lab.

Interviewer

Ok, now let's move to the next part of our questions which is you know linked with the proper risk management. So, what type of risk management strategies or methods do you use in your projects?

Participant

We normally do not have any formularised risk management techniques but we do while we doing the grooming and climbing meeting specifically, we do discuss all these things if we

have any holidays coming up, any persons going on vacations, anything that is in the pipe line that can delay things and then we also have process gone definition of ready. So, we normally do not plan up or pull up a task unless it's fine with the definition of ready. So, we have sort of organised things in a way that we do have things ready before we pull them or before we commit to them. Then we also do try that we do raise the risk to the management as soon as they occur. For example, if we have issues that a resource had an emergency or had an accident or something. So, we normally raise them at the very same time to the management, then plus we normally keep a cushion for such things like ambiguities; let's say a person being sick or you know network failures or things like that you know we normally keep a little cushion for that; so, if something like that happens, we do have team to back that person.

Interviewer

So, as you said that normally when risk occurs, so you prefer to interact. So, do you only interact internally with your management or do you also prefer interacting with your external project stakeholders?

Participant

We try to handle these things internally first, I mean it's better if we pull up a resource from another project that sort of have a low priority and then we can you know put that person into this one which has the higher priority. Or you know if you are a person sitting on bench then you utilise the person in that project and the management where we have the risk or something which has come up, but if things are definitely falling out of hand, it's better to know the clients if it is better to know the product owner of the things and then let them know of the situation but the first stop would definitely be to handle things on our own which we normally try to do. I mean we normally have let's say if we think that a person can sit can sit for four extra hours to do that. This thing we would probably request the person

to do that and I know it sort of violates the scrum and sprint principles that you cannot extend the time box but if putting an extra effort from someone can do this, we normally get it done.

Interviewer

Ok, so, Mr. Participant please tell as you mentioned that there is no particular methodology or format you normally apply for risk management. So, you know when any risk occurs as you discussed, and you go back to the management to discuss, so what sort of different strategy if you can give us examples? if something happened in your past or currently, can you discuss with us that how you normally do that with an example?

Participant

It happened this past Eid when we were doing the planning or let's say we were developing road map of that, we did not basically consider that there will be holidays coming in. So, I mean you know when we were into that sprint or release, cycle some of the resources we had to push; after the discussion with the management that we can sort of make them work a little extra, get their efforts recognised in some other way but do get the work done. So, you know we do discuss these things in generally, we come up with a plan, we do work in a reactive way I would say, but as far as being concerned we do consider these things in mind. If the person is a little slacker, if there are things coming up, if you know our office would place be moving to some other place or something like this. We keep those things in mind but if there is something happens we do discuss, and we act accordingly that what can be done, you know to utilise the resources in the best possible way that we have right now. Before putting it on towards the client.

Interviewer

Ok, so, normally, when you discuss with your clients and your management who are actually let's suppose they are distributed, so, what are the methods you normally use for the communication?

Participant

Ok, so what I would do is to send out an email to all the key folks. We would set up a time for a meeting let's say when I know everyone would be available sitting on everybody's calendar. So, we would let's say at X PM, we would all set, I would explain everything in email first, so they would know what's going on. And then when we meet we will discuss background of the problem and then we will try to come up with a solution that would can be done now to overcome that problem. And then also you know learn from the mistakes. So that we make sure you know that if such thing happens again, we have a backup plan for this as well. Do, let's say there is power failure we can have a backup generator. In case of an internet failure we know we all can be using our internet devices that we have. we know we have been given from the office. So, you know things like these we do have a plan and we do sort of do things on run time basis.

Interviewer

Ok, so you tell us what is the importance of time factor in managing risks?

Participant

Its, pretty important. I mean everything is time based. Everything is bound, if we have some deadline left. Let's say we have to deliver project on 31st august, so we cannot exceed that. So, so let's say if it's just the last weekend we can put an extra and get things done by that date. I think we can just give a little push in and just do it. Time definitely is an important factor and we have done this thing in past as well during my projects, the teams have to work on an extra Saturday to get things done; we have done that things in the past.

Interviewer

Ok, ok, now how would you analyse you know the issues that you have identified above you know in the previous section? how can you know consider them or some of them as potential risk factor? So, what type of risks do you think can occur?

Participant

I think the problems I mention earlier, those were pretty much being the ones that we face on every day basis especially when it comes to work requirements were not there. We didn't get to hear back from the client in US. We didn't get to hear from someone who was stopped in let's say Germany office and they couldn't reply to us, or infrastructure issues, So, we do have a solution to, we are trying to cover up as many things as we can right now. Initially, we were having a shortage of internet devices and now we have given the internet devices, laptops to pretty much everyone. So, if there is a situation that they cannot come to the office, they can work from home. They have internet, they have a laptop, so gradually we are getting there. That you know whatever situations that we had in the past they should not be happening in the future.

Interviewer

Ok one more thing I want to ask, what do you believe that what is the difference in managing risks when you are working completely in-house and when you are working in a distributed way?

Participant

I think in house you know things can be done internally and it would not be any loss from the customer side. You wouldn't be having any angry customer. You wouldn't be having any clients that would run away but when the same thing is something when you are doing for the client or they serve no client you have to be really careful in what you commit. What you

can and what you deliver. Things have to be should be pretty perfect you know on time and then you have to utilise all the best possible resources that you have to deliver what you commit for. But if something internal like let's say if you have an internal website for the company, I think you can discuss with the local manager and you can discuss those internally within the team or your tech director. And then plus that thing may be a week away. If something for external you may lose the client, so you have to be on toes when it comes to the external things.

Interviewer

Ok, so, what is the significance of your client when normally any risk happens. So, what do you think that what is the significant of the client in that risk you know in risk management of that particular risk, if it happens?

Participant

Like informing them or informing them before it happens.

Interviewer

Yes, like before or after. So, what do you think that if you consider some of the risk which can occur in the future, then how or what is the actual procedures of conveying them, so what is the significance of a client actually in this risk management process?

Participant

Ok, the first part is how we communicate. We normally have all these things written in the contract. And then normally have those things uploaded to a base camp or somewhere if you are using Jira. We have it in the conference page of that project that you know these are the deadlines, these are the road maps and these are the risks. So, we have all of things written somewhere in black and white in form of emails in form of communications or in the form of documents somewhere. Now the second part, it does have the effect on the client.

If they know there are lot of risks, they can run away. But then the also but the good thing is once you tell them about the risk they feel confident and then they trust you more because they would know that we know our risks. And then would definitely have a mitigation plan to that as well.

Interviewer

Ok, that's excellent. So, Mr. Participant in the end I would like to know about the importance of the risk management. So, how would you make the risk management process more effective in the virtual-agile projects?

Participant

I think as long as all the risks are communicated, as long as they are raised right they when they happen, or if I know something which a potential risk could be later on, it's my responsibility, then it's sort of my ownership to raise it right away and instead of you know waiting for the things to actually happen. We normally commit to a team, we tell them that ok if there is any risk that you know, please raise it right away. You know it could be done at the start of the project or the start of the sprint, that ok if there is anything that you could think of, that could be a potential risk in not getting the work done just raise it right now.

Interviewer

Ok, Mr Participant, thank you so much. With this I would like to finish this interview and stop recording.

APPENDIX – IV: Memo Examples

Concepts	Memos (Open Coding)	Sub-Categories	Memos (Axial Coding)	Main Categories
Conferencing Tools	The need for conferencing tools in Virtual-Agile project environments becomes necessary when the teams and the individuals are dispersed. Without deciding and agreeing on the medium of communication, it is difficult for the people around the world to contact with each other. Especially when in need in an uncertain situation, right means of communication helps a lot. Nowadays, several tools are available in the market but the needs for coordination between teams should be there to acknowledge the right tools for themselves. By doing so, they can reduce distances to a great extent.	Standardisation of Tools	Technology in terms of resources needs to be addressed by organisation as they directly impact the strength of the projects. Individuals working in such project environments need to ensure that they utilize appropriate tools for development, conferencing and managing projects/risks. Choosing the right tools and get them available in time depends help to reduce uncertainties for the projects. Standardization of the tools helps to work in an orthodox approach where the teams and individuals could communicate with each other using common tools.	<i>Technology</i>
Project Management Tools	Efficient ways to manage projects nowadays becomes comprehensive with the use of latest tools of the project management. Team members and individuals who have come together to work for the shared goal, it must be ensured that the teams and individuals are trained and knowledgeable about the certain tools which can help them out in doing their project management. Usually, people from the technical side do not care much about their issues and later face challenges to meet deadlines. These tools can provide a great support in managing timelines and controlling risks. Risk management can be done using and sharing different templates and a diary can be maintained to store the records of risks. Several tools are available in the market, but the organisations need to specify the right tools for all the locations so that ambiguities can be reduced.			
Right communication channel	Right means of communication are required to keep integration with the team members around the world. People in the Virtual-Agile environment should know which type of communication tool they should be using to contact each other while undergoing development or in case of an urgency. It has been observed that during the vacation period or holidays in one part of the world, work can be disrupted if there is no assistance from their other folks during this period. Even people do not prefer to leave their contact details which ultimately effects the progress work. The right channels of communication should be elaborated together with their means. Normally people do not know which mean to use for communication with their folks in other parts of the world. This can create more problems where progress could be disrupted.	Networking	Technology helps to create a network or a web between teams using different communication channels. There is a need that to choose right communication channel for interaction so that Virtual-Agile teams should collaborate with each other on a common platform. Arranging the contingent sources helps to sustain a network in case of disruption/interruption in a primary network. The organisation should ensure that their distributed teams should be able to get contacted throughout the working hours. They should provide the distributed or remote team member with multiple	

High Bandwidth connectivity	The requirement of high bandwidth is compulsory when the team is connected to the internet. It helps them to undergo their work efficiently and they can upload it anywhere on the repository so that the other team member can see the work already being done. Similarly, high bandwidth is required when the teams get into contact with each other via conferencing. All the people have less time due to which their work routine gets disturbed if proper procedures are undertaken to ensure a strong infrastructure		sources to stay connected throughout the working hours	
Accessibility	When the teams are working in different parts of the world, contacting other team members becomes difficult as the teams may not be available at that particular time to respond. Similarly, during the vacations of holidays or in case of uncertain situations, it becomes difficult for the PM to get hold of the individuals from different time zones. In this case, the people should share their other contact details in case of need so that the work may not get disrupted. If the person is accessible, then it helps a lot to timely correspond to the queries.	Timely Correspondence	Timely correspondence when you are working in another part of the world is a crucial factor to achieve. It has been observed that people do not respond to the queries and emails which then give rise to evolving risk factors. Time management is always a bottleneck in Virtual-Agile projects, therefore the teams and client should both agree on a specific duration of getting in touch with each other so that the work progress couldn't get affected.	<i>Timeliness</i>
Promptness in Response	Team members and other project stakeholders should be able to respond in a given time duration. Normally it has been observed that the client doesn't respond to the emails of the development teams which ultimately leads to the sprint delays and affect project deadlines. Similarly, in case of an uncertain situation, all the folks should be able to help each other so that the process of work should get an effect from the evolving uncertainties.			
Efficient Feedback loops	Feedback helps to improve the work and supports in minimising errors. Feedback contributes to making knowledge transfer process effective as individuals are based in different locations and are expecting that their work be reviewed and sent back to them at a definite time. Efficient feedback loops help to identify the problems and errors in the source codes, development codes and provide assistance to team members during all the phases of the projects	Knowledge Transfer	Knowledge transfer has a significant role in building up a high communication level. When the teams are distributed, they should adopt customs of sharing their work and helping each other in difficult times as they purpose to achieve a mutual goal. Similarly, when a problem occurs, if the teams or individuals do not have the knowledge of the type of complication and its impact on the projects, the actions would not be viable. Communicating other team members or stakeholders about the situation and circumstances helps to reduce and control the effect of the situation. Communication in terms of	<i>Communication</i>

Information Sharing	Information sharing is a crucial factor which contributes to an efficient knowledge transfer process. Information sharing in Virtual-Agile projects is limited. This can be the reason that the project teams are not enough efficient to determine the useful practices of project success. This needs a certain attention by project manager or organisation who is managing the project. As the project success is heavily dependent on extensive communication and information sharing, extensive knowledge transfer helps teams and stakeholder to understand the objectives of the project. Project manager needs to be aware of the situation where the information sharing between the teams and stakeholders are limited.		providing appropriate information is important so that they could estimate the level of uncertainties. Similarly, team members working on the projects should be able to understand the scope, purpose, and objectives of the project so that they help their other team members with the information sharing and document sharing. Without having a high level of communication, knowledge transfer process cannot be effective in Virtual-Agile project environments.	
Building of Trust	Trust plays an important role in relationship building process of Virtual-Agile teams. In the beginning, as everyone is anonymous to each other lack trust is reflected as people do not prefer to speak openly and hesitate while undergoing work. It also creates hurdles in the relationship building process as people from diverse backgrounds do not prefer to talk or trust other team members in few interactions. It takes time for the team to build a level of trust which is crucial. Especially, the clients do not trust project team easy and it might take long to achieve trust of each other. Trust can be built through fulfilling commitments, respecting and helping out each other in difficult times.	Correlation	Communication depends upon strong relationships between the teams or stakeholders. A strong relationship is developed either during the project cycle; or if the people have worked previously together in a similar environment. The strong relationship between the teams can help to control uncertain situations. Team members can also assist each other in difficult times because having a strong relationship. High level of communication helps to build trust among the scattered team members in Virtual-Agile project environments. Similarly, discrimination is expected anywhere when a diverse group of people is working together. This can be due to previous relationship or affiliations between team members or stakeholders. Keeping a high level of communication helps to build the factor of trust and promotes social interaction, which can formalise the team to respond to risks more prominently.	
Reducing Discrimination	As diverse ethnicities are part of projects, eliminating discrimination helps to keep the work environment optimistic. Maybe some of the individuals have worked together previously or are from same organisations, they may support each other in several aspects. Discrimination can be in several meanings, it can relate to working activities, it can be in the sense not treating other communities equally, it can be not responding properly to the queries of specific persons, it can be between different cultures. Ruling out discrimination factor helps relationship building as it builds a dynamic, respectful and enthusiastic between the project stakeholders			
Managing Work Load	Managing workload in Virtual-Agile project environments is difficult for the individuals as they are busy on other assignments. In this regard, it becomes difficult for the all the team members to put their skills into every work and this is one of the reasons of 'dirty code' which has been emerged from the data. Team members should know about their strengths and capabilities and then should get involve into each of the assignments.	Competency	Communication for managing risks in Virtual-Agile projects environments depends upon the performance capabilities of the team members and project manager. Team member or project manager if they were a part of such type of projects in past, they would know the process and importance of managing such risks. Similarly, it depends upon the	

Previous Experience/Knowledge	Previous knowledge and experiences of working in the Virtual-Agile projects helps a lot to undergo the development work efficiently. Most of the project fails as people are not able to understand the format of working. They cannot estimate the dynamics of working and therefore are not able to compete with the pace of the working environment. Similarly, people from more traditional way of working utilize hybrid approach which is a threat to the Virtual-Agile way of working. People working in the environment should know what they are doing and should follow a specific approach.		natural tendency of the individuals as well while being able to communicate the risks within team or senior authority. Managing workload helps better to communicate as the individual is not stressed out. Completing the work at an appropriate time helps him to observe the other events or happenings taking place in the project environment.	
Motivation	Motivating team and keeping their morale up is a useful ingredient of getting success. Motivation helps to achieve team satisfaction, contributes to achieving goals more prominently; team members become pleased and confident about their jobs and then project environment is found more optimistic. Similarly, motivation is required when there is a need to boost up the efficiency of team members where they have to perform tasks in limited time, meet deadlines or deliver the product to the clients. There is also a need to motivate team members when they are not able to achieve their goals or alternations are demanded by the product owners in short time. Motivation enhances team satisfaction level. Scrum master or project manager plays an important role in motivating team members.			
Estimation of needs	The effects of team members' satisfaction level start to come when the project initiates. Where the team is working virtually, providing them with necessities, understanding their needs helps to increase the satisfaction level. As Virtual-Agile environments demand a high level of interaction and work, sometimes due to unavailability of team members the project may get stuck somewhere. It may be due to personal reasons which agile does not allow as you have to achieve targets on daily basis. As the teams are not visible, the project manager cannot properly estimate the needs of participants; what their actual desires are. May be some individuals require more time to understand the project environment and working phenomenon, some may require more time to settle down, some may do not prefer to interact more often just they want to focus on work, some may not happy with the tools, machine or software provided. So, achieving team satisfaction level is crucial as diverse people are part of this project environment.	Team Satisfaction	Team satisfaction helps to build up strong communication level between the distributed team members around the world. If the teams are motivated, their needs are fulfilled they would be happier to work and it will certainly increase their level of performance in the project work. Before giving the work to the people, PM should ensure that the teams or individuals know about the work they are doing so that the standard of the working environments couldn't be affected.	
Estimation of Risks	Identification of the risk is performed through various techniques where different stakeholders interact and estimate the possibilities of the risks. Estimation is performed using the experiences and understanding of the	Risk Management Planning	The need for active risk resolution is mandatory as the teams are not able to interact physically. They more generalise the things and then act upon to any	<i>Active Risk Resolution</i>

	project's environment. PM can involve several specialists or experts to help out estimation of risk. Estimation of the risk factors is a necessary factor of the risk management planning phase from which the people around the world comes to know about the potential risks which could create hurdles in project processes.		uncertain situation. The identification of risks is performed generally in daily scrum meetings where the stakeholders interact and recognise the possibilities of the uncertain situations. They look for the probability and influence of each risk that may occur during the projects. In this regard, risks are then assessed on the basis of qualitative or quantitative analysis. They may apply different tools and techniques as per their understanding and consensus. After the assessment, they store the record of risks in the form of Product log or Risk registers. They plan the response that how they should be able to manage risks. During the implementation phase, they implement the responses from risk registers. If any of the risk that is not assumed previously, project stakeholders get into contact and decide on the mitigation strategies of the risks and then implement in time. For reviewing the results of the implemented strategy, they hold review meetings and try to monitor and control the situation for future events.	
Assessment of Risks	Assessment is the next phase where the distributed team members and stakeholders analyse the probabilities and influence of each identified risk factor using multiple techniques identified from the data such as root cause analysis, probability vs impact analysis etc. This stage of risk management planning helps to know about the situation or circumstances which could be developed when any sort of risk occurs.			
Action	People in the Virtual-Agile project environments act to an uncertain situation using the responses from the risk management planning phase. If the responses are not stored in the planning phase, they get in contact to estimate and analyse the situation and then design the mitigation strategies to control them. Responding to any uncertain situation on time becomes viable as the team is remotely operating. Getting into contact on time and then acting upon is crucial to achieving in virtual agile projects.			
Review	After the implementation of the response, project stakeholders review the results that the strategy they have implemented has helped to control the situation or not. They review the situations and come back into contact again and again to analyse the situation. This reviewing of the results becomes active when any risk has occurred. Usually, the team and PM review the implemented strategy in after the completion of the sprints in Retrospective meetings or is the risk in common, they can discuss it in daily scrum meetings.	Risk Management Implementation		